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# Factors Affecting The Adoption Of Telemedicine: A Three-Country Empirical Investigation

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FACTORS AFFECTING THE ADOPTION OF TELEMEDICINE: A THREE-  
COUNTRY EMPIRICAL INVESTIGATION

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## **Dedication**

To my husband and parents, in appreciation of their support, encouragement, and patience during the dissertation process.

FACTORS AFFECTING THE ADOPTION OF TELEMEDICINE: A THREE-  
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by

PARAND MANSOURI-RAD

DISSERTATION

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## **Abstract**

Telemedicine improves access to information and healthcare services. Not only more cost effective and more efficient method of providing health care than the traditional methods, telemedicine is the most convenient method of delivering healthcare. However, the adoption of telemedicine has been challenging. The purpose of this dissertation is to find the barriers to adoption of telemedicine. Using data from Brazil, Taiwan, and the United States, the present research investigates the influence of culture on telemedicine adoption and patient information privacy, security, and policy. It also examines the impact of information security, privacy, and policy on telemedicine adoption. Using Structural Equation Modeling, I find support for most of my hypotheses.

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## **Chapter 1: Introduction**

### **1.1 Problem Statement**

In the past, simple devices such as flags, signs, and bells were commonly used to communicate the presence of diseases (Carey, 2000). Recently, a new model of communicating health information and providing healthcare has emerged which blends the delivery of medicine with Information and Telecommunication Technologies (ICT). An ongoing and increasing demand for healthcare services is accentuated by an acute shortage of healthcare professionals and hospital facilities especially in rural areas. The development of this new model of distance healthcare, also known as telemedicine, has increased significantly over the last few years as manifested by a fast growing number of programs (Peredina and Allen, 1994; U.S. Department of Commerce, 2001). It has been estimated that the market for telemedicine services will go beyond \$1.8 billion by the end of 2013.

Despite the bright future of telemedicine, its adoption has been problematic. Many studies investigate the reason behind the slow adoption of telemedicine. Adam (2001) and Bashshur, Shannon, and Sapci (2005) argue that the lack of telemedicine adoption is due to the lack of availability of ICT. Anderson (2000) and Varghese and Scott (2004) blame it on regulation obstacles. Hu, Chau, and Sheng (2000), Gagnon, Godin, Gagne, Fortin, Lamothe, and Reinharz (2003), Gaggioli, Carlo, Mantovani, Castelnuevo, and Riva (2005), Kifle, Mbarika, and Payton (2005), and Topacan (2009) cite human factors to be responsible for lack of telemedicine adoption. Others, such as Hofstede (2001), Straub, Loch, Evaristo, and Karahanna (2002), and Bangert and Doktor (2003), perceive cultural barriers as problem in telemedicine adoption. Most studies concentrate on the impact of ICT factors on telemedicine adoption (e.g. Adam (2001) and Bashshur et al. (2005)). Hu et al. (2000), and Kifle, Mbarika, and Brandy (2006) report that

human and cultural factors have significant impact on telemedicine especially in developed countries such as Taiwan and the U.S.

Vaast (2007) and Luethi and Knolmayer (2009) address the lack of health information security as a barrier in implementing telemedicine. Akram (2006), Terry and Francis (2007), and Angst and Agarwal (2009) emphasize the importance of privacy in adopting electronic health records. Checchi, Sevic, and Lock (2002), Murray and Evans (2003), Jennett, Scott, and Affleck (2004), and Omary, Mtenzi, and Wu (2009) stress the role of regulations in the diffusion and adoption of telemedicine.

The aforementioned studies are not thorough in investigating the lack of telemedicine adoption. Most of them lack an empirical research examining the impact of information security, privacy, policy, and culture on technology adoption. In order to help improve the practice of telemedicine there is a need for a comprehensive research to overcome the limitations.

## **1.2 Purpose of the Study**

Previous studies in the area, as discussed above, are not thorough in probing the lack of telemedicine adoption. Most of them are limited in scope and focus only on one antecedent. As such, these studies do not conduct an in-depth analysis of the adoption of telemedicine. The objective of the present research is to conduct a comprehensive study on telemedicine adoption. More specifically, the present research investigates whether culture plays an important role in telemedicine adoption and whether this role is positive and significant. It also scrutinizes whether culture indirectly influences telemedicine adoption through information security, information privacy, and information policy. It also examines whether information security, privacy, and policy directly impact telemedicine adoption.

### **1.3 Contributions**

The literature demonstrates that culture is a significant factor in telemedicine adoption. This research contributes to the literature by using a new theory-based comprehensive model to explain factors affecting telemedicine adoption. The model is developed by combining relevant constructs from Protection Motivation Theory (PMT), Rational Deterrence Theory (RDT), Hofstede's Theory on Culture (TOC), and Moor's Control Access Theory (CAT). Findings obtained from this study will be useful to health practitioners who want to use empirically validated and theoretically-grounded information on providing distance healthcare to patients, especially in rural areas, in a secure manner without violating government regulations and patient privacy (Mansouri-Rad, Mahmood, and Hall, 2009).

The dissertation empirically validates the research model using data collected from three countries: Brazil, Taiwan, and the United States. The study also contributes to the constant debate on the ability of telemedicine to allow access and to reduce costs. A research paper on this subject was presented at the 2009 Decision Sciences Institute Conference (Mansouri-Rad, Mahmood, and Hall, 2009).

### **1.4 Dissertation Outlines**

The remainder of this dissertation is structured as follows. Chapter 2 provides the literature review which describes the impact of culture on telemedicine adoption, the literature of information security and information privacy in the adoption of telemedicine and the impact of information policy in telemedicine adoption. Chapter 3 discusses the theoretical framework includes Protection Motivation Theory (PMT), Rational Deterrence Theory (RDT), Hofstede's Theory on Culture (TOC), and Moor's Control Access Theory (CAT). Chapter 4 provides the research model and hypotheses development. Chapter 5 presents the proposed research method

and data collection procedure. Chapter 6 describes the fit and model reliability. Chapter 7 provides the results. Chapter 8 presents discussion and recent research. Chapter 9 provides conclusions, limitations and future research.

## **Chapter 2: Literature Review**

Previous research on telemedicine adoption, as stated earlier, is limited in scope. While these studies expand the understanding of telemedicine adoption from various perspectives, only a few studies consider culture as a construct. No comprehensive study on the implementation and adoption of telemedicine has been conducted yet. This research seeks to provide a remedy to the situation by focusing on constructs (e.g. culture, patient information security, patient information privacy, and patient information policy) that previous studies suggest play a major role in implementing and adopting telemedicine. This study uses these constructs and sets them in the form of a comprehensive model. In the next section, a literature review to support each construct is provided. Section 2.1, more specifically, describes the literature on culture in telemedicine. This section is followed by section 2.2 which provides the literature on information security, privacy, and policy.

### **2.1 Literature on Culture in Telemedicine**

As stated earlier, a few studies consider culture as a construct in adopting telemedicine and other areas of adoption of technology. In the studies mentioned below, culture is considered as an antecedent of successful telemedicine adoption. A brief summary of these studies is provided below.

Using the Technology Acceptance Model (TAM) model, Hu et al. (2000) empirically investigate telemedicine adoption among physicians in Hong Kong. The authors examine the effect of perception of both ease of use and usefulness on telemedicine technology adoption. The authors believe that the degree to which telemedicine technology is easy to use affects both physicians' perception of usefulness of technology and their attitude towards using this technology in general. Hu et al. (2000) argue that attitude is affected by the level of technology's



usefulness, as perceived by physicians. Finally, the authors state that the extent to which physicians intend to use technology can be explained by their attitude towards the use of technology and the perceived usefulness of technology. In order to investigate the model empirically, the authors conduct a survey of 400 physicians in Hong Kong. The authors use Factor Analysis (FA) and Structural Equation Modeling (SEM) to analyze the data. The results demonstrate that intention is mostly determined by perceived usefulness. The findings also show that perceived ease of use of technology does not influence the adoption of telemedicine. Results reveal that, in order to make decisions about telemedicine adoption, physicians consider usefulness of technology. In addition, attitude also has an impact on physicians' intention to use technology. However, the authors do not find any significant relationship between the ease of use and attitude. Overall, the authors find that the collective attitude of medical staff and the perceived service risks are the two most significant factors in the implementation of telemedicine.

Meyer and Goes (1988) empirically investigate what impacts the process of adopting and implementing new technologies such as CAT scanners, ultra sonic imaging, laser surgery, and fiber optic in healthcare organization. The authors use 25 hospitals on the process of decision making to adopt new technologies. The authors examine different types of variables, such as environmental (population density and income growth), organizational (size and structural complexity), leadership (leaders' impact on their organizations), innovation (level of risk of injury, degree of training required, and result visibility to organizational members), and innovation related decision variables on new technology adoption in hospitals. The authors collect data using interviews and questionnaire. Interviews are conducted between 1976 and 1980 with two-hundred-and-six physicians, seventy administrators, forty-six board members, and

thirty-three nurses. The authors use a 9-point Guttman–type scale to create a dependent variable. They perform hierarchical multiple regression and find that only 11% of the variance is attributable to organization structural variables and about 50% of the variance in adoption decision belongs to environmental and cultural variables. The results show that healthcare organizations with welcoming cultural environment are more likely to try new technologies and implement them.

Kifle et al. (2006) empirically explore the effect of Hofstede's (2001) culture on telemedicine adoption in Sub-Saharan Africa (SSA). Hofstede identifies four culture dimensions: Power Distance (PD), Uncertainty Avoidance (UA), Individualism (IDV), and Masculinity (MAS). PD refers to the degree to which equality distribution of power is accepted in a culture. UA personifies the level of tolerance for uncertainty and ambiguity in a culture. IDV refers to the degree to which individual or collective relationships are reinforced in a culture. Finally, MAS is the degree to which the traditional masculine values are reinforced in a culture. Kifle et al. (2006) investigate the influence of PD and UA on telemedicine capabilities to improve accessing and delivering healthcare. The authors survey 194 physicians and telemedicine experts in SSA. They use PLS to analyze collected responses. Most respondents were from Ethiopia, Tanzania, and other SSA countries. The results do not show any relationship between UA and telemedicine capabilities. However, the authors find a positive relationship between PD and telemedicine capabilities.

Trimmer, Cellucci, Wiggins, and Woodhouse (2009) empirically investigate the physician residents' attitude and perceived norm toward Electronic Medical Records (EMR) using the Unified Theory of Acceptance Use of Technology (UTAUT) and the impact of culture on EMR. The authors use open ended face-to-face interviews of 7 residents in a family medicine

clinic in the U.S. The clinic has implemented EMR systems and all data are available through a secure wireless network. Four of these residents had no experience with paper or electronic health records but two had worked with EMR. In regards to performance expectancy (usefulness) the result of interviews shows that residents favor having an EMR system since the patients' data is available at all times. Regarding effort expectancy (ease of use), residents believe that there is a need for additional effort and time to enter the data into the system and to navigate and work through patient's information. Social influences have an impact on the decision to use EMR since peers are encouraging each other. Since using EMR is mandatory, voluntariness of use has no importance in this study. The results show that organizational culture exists in this hospital and has a positive and effective influence on strategic implementation.

Whittaker and Soicher (2011) empirically examine the reasons for failed adoption of mobile handheld devices in a hospital in South Africa. They examine the cultural impact on nurses' intention to use electronic health. In this case, the hospital adopts devices to enable nurses to charge for medicines, record bed and room transfers, and discharge patients at their bedside (Whittaker and Soicher, 2011). The authors find that nurses discontinue the usage in two years due to disappointment with device benefits. The authors propose a model to investigate the reasons for this failure. The model considers individuals' characteristics, such as their culture among other factors, affecting technology usage process and adoption outcome. The authors conduct open-ended interviews with 29 users in IT departments and top managers in a hospital. Twenty-one of the interviewees are nurses. The analysis is done using pattern matching, comparing the result from empirically based pattern with a predicted one (Whittaker and Soicher, 2011). The results show that devices have negative impact on nurses' confidence, because nurses could not check what they have charged and felt a loss of control. Nurses' culture plays an

important role in this case. Most of the nurses believe that the system makes them look as bad caregivers since the system is used for charging at the patients' bedside. Moreover, the patients do not see any benefit from the system. Since they do not think charging a patient at their bedside is a good idea, the nurses refuse to use the system completely or partially. This study finds a direct relationship between a culture and hospitals' adoption of technology.

Harris, Rettie, and Kwan (2005) examine m-commerce usage in Hong Kong and the United Kingdom (UK). The authors investigate the impact of culture on adopting m-commerce in these two countries. To accomplish their goal, they use Hofstede's (2001) collectivism and power distance cultural dimensions. The authors survey 200 young students between eighteen and thirty years old in both countries. The authors find major differences in usage and intention to adopt m-commerce between these two countries. The results show that the adoption rate in Hong Kong is low compared to UK. The authors find that Hong Kong residents consider m-commerce less useful and more expensive than UK residents. Compared to UK, the Mobile Internet usage is found to be low in Hong Kong. Results show that Hong Kong residents consider voice services and video calls more beneficial than UK residents. The authors suggest that the higher level of collectivism in Hong Kong caused the difference. According to the authors, as a result, mobile communication services (e.g., video calls and voice services) are more popular in collectivist cultures than in individualist cultures. They also find that the hedonic m-commerce services are more desirable in high power distance cultures than in low power distance cultures.

Bangert and Doktor (2003) empirically examine the association between Hofstede's national cultural dimension of uncertainty avoidance (e.g., how comfortable do citizens feel towards ambiguity?) and the culture of the organization in which telemedicine is implemented in

five countries. The authors find that national cultures with high uncertainty avoidance (e.g. France and Japan) favor a highly mechanistic implementation of telemedicine. Mechanistic organizations have high complexity, formality, and centralization. They punish mistakes and avoid diversity. On the other hand, cultures with low uncertainty avoidance (e.g., USA and UK) favor an organic organizational form of telemedicine adoption. Organic organizations welcome questions and participation, learn new things, diversity, and ambiguity (Dibella and Nevis, 1998).

An empirical study by Nwabueze, Meso, Mbarika, Kifle, Okoli, and Chustz (2009), considers the effect of Hofstede's cultural dimensions on behavioral intention to use telemedicine in underserved countries (a region that has a relative or absolute deficiency of health care resources such as beds, equipment, or medical personnel). The survey is adopted from Hofstede (1984) and Vakantash, Moris, David, and Davis (2003). Nwabueze et al. (2009) collect data from 196 physicians. The authors examine two groups: prospective users (123 physicians are interested to use) and actual users (73 physicians are currently using). The results show that UA has a powerful impact on prospective users' behavioral intention to use telemedicine but not on actual users. However, the authors find that PD has a weaker effect on prospective users' behavioral intention to use telemedicine. No significant relationship is found between IDV and MAS on prospective users' intention to use telemedicine. The authors also discover that none of Hofstede's cultural dimensions have an effect on actual users' intention to use telemedicine.

Standing and Gururajan (2011) examine the factors that impact the knowledge management in telehealth projects and investigate the challenges in managing expertise in the telehealth area theoretically. The paper studies the impact of organizational culture on expertise

management among other factors. After reviewing and analyzing online academic journals, the authors discover that collaborative culture is one of the most important elements in sharing expertise in telehealth. The study reveals that sharing the same beliefs, regulations, and values will help innovation and can be one of the reasons for success of telehealth projects. The authors believe that cultures that value trust and are open to a variety of opinions can help telehealth to succeed the most. However, the above research needs to be validated through an empirical investigation.

Peng and Kurnia (2010) conduct a case study to investigate the factors affecting Hospital Information Systems (HIS) in China. The authors consider organizational size, slack resources, executive commitment, computer skills, cost justification, and perceived usefulness as main factors affecting the HIS adoption. They conduct semi-structured interviews with 5 individuals (a hospital director, an IT manager, an administration manager, a head nurse, and a physician) to collect data. The results from these interviews show that culture underlies HIS adoption experience in China. All interviewees mention collectivism, obedience to managerial orders, and the enthusiasm to save face as important cultural values in hospitals. Based on the results from interviews, the authors create a new model for HIS adoption in China. This model considers culture as a base for all other factors in adopting HIS. According to this model, culture has an impact on adoption related decision making, system implementation, and system assimilation. The study shows that knowledge about the country's culture can help overcome users' resistance to IT adoption in hospitals. The authors believe that hospitals should emphasize the development of collective thinking and community membership more when dealing with collectivism. Since workers perceive themselves as a part of the whole, they are more likely to overcome challenges

in accepting new technology. Although this study introduces a new framework for adopting HIS, it is weak in testing the framework empirically.

Thatcher, Strite, Stepina, and Liu (2003) empirically examine the impact of Hofstede's (1991) UA, PD, IDV and MAS on personal innovativeness with IT. The authors survey 100 southeastern U.S. University students. They use Partial Least Square (PLS) regression to analyze the data. The results show that a negative and significant relationship exists between UA and personal innovativeness with IT; however, no relationship is found between PD, IDV, and MAS and personal innovativeness with IT. Nevertheless Thatcher et al. (2003) find that work environment mediates the impact of UA and power distance on personal innovativeness with IT. Although the study is helpful in identifying the relationship between culture and intention to use new technology, it does have some limitations. A sample for this study is limited to students of only one country and, therefore, the findings obtained from this study cannot be generalized to non-student subjects and subjects from other countries.

## **2.2 Literature on Information Security, Privacy and Policies in Telemedicine**

Threats related to information security are a major concern for many organizations since threats may increase their liability and decrease their credibility (Cavusoglu, Cavusoglu, and Raghunathan, 2004). The main difference between telemedicine and traditional healthcare is the use of the internet and, therefore, online patient information security, privacy, and policy are of paramount concern. These issues are discussed in the following sections.

### **2.2.1 Literature on Patient Information Security in Telemedicine**

Security objectives for communicating information over the internet mainly include authentication, non-repudiation, and access control. Applying these procedures in telemedicine is not, however, as straightforward. Although authentication and authorization procedures may

keep patient information safe and secure concurrently, they may impose boundaries on productivity and efficiency of healthcare professionals (Luethi and Knolmayer, 2009). In this area, the current literature finds models, procedures, and techniques provided by a number of studies such as Janczewski and Xinli Shi (2002); Vaast (2007); Khoumbati, Themistocleous, Irani, and Mantzana (2008); Nicholson, Grimaila, and Strouble (2008); Fernando and Dawson (2009); Luethi and Knolmayer (2009); Burkhard, Schooley, Dawson, and Horan (2010); and Dhukaram, Baber, Elloumi, Beijnum, and Stefanis (2011).

Dhukaram et al. (2011) empirically examines patient's and healthcare provider's perception toward pervasive healthcare technology. The purpose of the study is to find the benefits and risks associated with using a pervasive healthcare system. The authors interview thirty four individuals in England to find their views on the BRAVEHEALTH project. In the BRAVEHEALTH system, physicians use the internet to monitor and consult the patients. Participants are divided into five focus groups and given an introduction about using the system. At the end of the session, twenty six participants consider security a major concern. Even though the individuals show supportive attitude toward using the system, they refuse to adopt the system for security reasons.

Burkhard et al. (2010) empirically examine the factors that influence employee perception and concerns about security of electronic Personal Health Records (PHR). The authors investigate privacy and security of personal health record data in Employer-Sponsored PHRs (ESPHR). The authors propose a model to show the impact of perceived privacy and security of personal health data in ESPHR on confidence in using ESPHR for health decisions. The data is collected from a large Fortune 500 firm in the U.S. The firm provides free ESPHR to all employees. In ESPHR, employees are able to provide their (and their families') past and



present health conditions, medications, and health status. Data are collected through a web based survey of 268 employees. One-hundred-and-thirty-two employees have completed the survey. The results show that users of ESPHR consider privacy and security of ESPHR data very important. The results also show that perceived importance of ESPHR's privacy and security positively affects the confidence in the use of ESPHRs for decision making. The study shows the importance of employees' concern for their privacy and security when using ESPHR.

Fernando and Dawson (2009) empirically investigate how clinicians use Health Information System (HIS) privacy and security at public hospitals. They interview twenty-six clinicians in three Australian hospitals using open-ended questionnaire. Results show that to protect security of a patient's information, clinicians lower their voices when consulting the patient, avoid asking non-relevant questions, and display confidential patient information in public places. The paper introduces a conceptual framework regarding factors influencing patient's health information privacy and security. The model divides these factors into beyond control and within control categories. Beyond control factors include confusing and contradictory privacy and security laws, independent health information system privacy and security technical standards, hospital budget, and information technology resource demands. These factors are beyond clinicians' control and can impact patient's health information privacy and security. The second category includes factors that are within the clinicians' control, such as right training, local health information system privacy and security implementations, and shared clinical workspace privacy and security of patients. The problems in this category are in clinicians' control and can be solved easily.

Nicholson et al. (2008) theoretically discuss the importance of EMR security system. They argue that even though it is necessary to convert a pencil and paper approach to an

electronic system, this conversion brings a lot of issues regarding privacy and security of a patients' information. The authors emphasize the need to change management strategy and system administration to guarantee security and privacy of patients' information. The authors discuss some information security goals in Canada and the U.S. They believe that only authorized security personnel should use the system and that there is a need to log the users' actions. The paper emphasizes the need to protect the security functions against unauthorized modification and deletion. The authors recommend the availability of data when it is needed and using the system in a safe manner. They stress that storing information in one location is not recommended especially if security requirements are not applied. The authors suggest using smart devices to defend the system against sophisticated hackers. The authors recommend hiring knowledgeable professionals to EMRs against attacks.

A model suggested by Luethi and Knolmayer (2009) in a case study reveals the relationship between clinical and administrative healthcare information systems' adoption in an organization and information technology capabilities of the organization. The authors consider factors related to market, policies, institutions, and technical capabilities. The authors study two academic medical centers and two hospital groups in Switzerland and the U.S. They find significant differences between Switzerland and the U.S. groups in the areas of security requirements, audit considerations, and equipment accountability. In general, the results show that more control is needed in hospitals regarding healthcare information security. The results further indicate that the size of hospital, IT infusion, and regulations impact healthcare information security.

Vaast (2007) suggests the use of a social representation perspective to investigate information security in healthcare. The author performs a case study to understand how different

members of different communities working in the same hospital understand healthcare information security. Semi-structured interviews with 39 individuals employed in different healthcare occupations (physicians, registered nurses, medical residents, technicians, clerks, administrative associates, and IS professionals) are conducted. The study shows that, in regards to patient information security, these communities do not have the same understanding of security. This study shows that to understand the importance of security in healthcare organizations, it is important to know that different members of the community have different views on security. The research also reveals that it is important to understand and maintain security from different perspectives in healthcare organizations.

Janczewski and Xinli Shi (2002) conduct a case study on the development of electronic medical records, networked clinical systems, and related privacy and security policies. The authors, using a comprehensive questionnaire, interview healthcare professionals. Based on these interviews, the authors develop an information security framework baseline. The authors define the security baseline as a minimal set of laws, rules, and practices that are vital in protecting organizational information. In the proposed framework, the authors make a number of recommendations, including making employees aware of security concepts and assigning them responsibilities for maintaining security, examining the differences between existing security routines and established baselines, performing risk analysis and making decisions based on this analysis, monitoring and reviewing security measures, and setting up a mechanism for conducting continuous reporting and documentation, and providing feedback and recommending possible changes, if needed.

Khoumbati et al. (2008) conduct research on health care information systems and factors that affect Enterprise Application Integration (EAI) adoption in healthcare organizations'

information systems. The authors examine the impact of IT infrastructure barriers, IT support, IT sophistication, patient satisfaction, physician and administrator relationships, organization size, and external pressures on adoption of EAI in healthcare organizations. The authors use an exploratory case study to examine their model. In order to perform their case study, the authors conduct multiple structured and semi-structured interviews with twelve mid-level and low-level management personnel to collect data. The research is done in one of the UK's oldest hospitals. The results show security and confidentiality affect EAI adoption. The authors conclude that a patient's information need is an additional level of security and that there is a need for a national level guidance about information security.

### **2.2.2 Literature on Information Privacy in Telemedicine**

Health care providers are increasingly using telemedicine for monitoring patients' health (Wall Street Journal, 2006). Transferring personal health information between patients and provider, however, raises the issue of potential privacy violations of confidential patient information. The American Recovery and Reinvestment Act of 2009 imposed new privacy and security requirements on the old HIPPA (1997) law. Healthcare information privacy, therefore, deserves serious consideration during any decision on adopting telemedicine. A number of researchers have addressed this issue in the past. Recent studies by Akram (2006), Ludwicka and Doucettea (2008), Angst and Agarwal (2009), Hewitt (2009), Perera, Holbrook, Thabane, Foster and Willison (2011), Liu, May, Caelli, and Crol (2008), Zhou (2011), Menachemi, Yeager, Bilello, Harle, Sullivan, and Siler (2011) and Zaidan and Zaidan (2011) are relevant to the present study and are addressed further.

Menachemi et al. (2011) empirically examines the intention of Florida Physicians to apply for Electronic Health Record (HER) funding. The purpose of this study is to determine if

non-users will adopt Electronic Health Records (EHR) and use it in secure and private manner. The study also examines if the current users will apply for funding. About 8000 surveys are mailed to physicians who accept Medicaid and 2386 responses are received. The result of surveys reveals that about 60 percent will apply for EHR funding. The other 40 percent have a variety of reasons not to adopt EHR. For example 68 percent believe it is costly, 41 percent need more information, 29 percent are concerned about privacy issues. Privacy issues are one of the reasons that some physicians refuse the funding, and policymakers should be aware of those issues while implementing the EMR.

In an empirical study on healthcare privacy, Akram (2006) studies patients' concerns with regard to their electronic privacy. Using a previously developed information privacy instrument, the author investigates four dimensions of patient privacy concerns (e.g., improper collection of patient information, unauthorized secondary use of this information, improper access to this information, and errors in this information) and finds these to be of great concern to patients. The author provides insights toward evaluating these factors in order to reduce potential liabilities for healthcare organizations.

Angst and Agarwal (2009) empirically examine the impact of privacy on adopting EHR. The authors investigate the likelihood of adoption (LOA) considering the degree to which the patients would approve to have their medical information digitized and shared with appropriate individuals. The authors survey 336 individuals attending a conference called Toward an Electronic Patient Record (TEPR). The data are analyzed using the structural equation modeling technique. The results show that a majority of respondents have a positive attitude towards EHR adoption. These results demonstrate that even though privacy concerns are significant obstacles, they are not sufficient to stop the acceptance of electronic health records.

Perera et al. (2011) empirically examine patients' and physicians' opinions about the privacy, benefits, and harms in using electronic health data for patient care and secondary purposes. The study has been done in a hospital in Ontario, Canada. Five-hundred-fifty-seven patients and physicians are surveyed using Health Information Privacy Questionnaire (HIPQ). The results show that the majority of physicians and patients are not concerned about privacy loss and see more benefit in using electronic health records than paper based records. The study shows that privacy of electronic health records is not impacting the physicians' decision to adopt this technology.

Hewitt (2009) investigates the impact of privacy on adopting EHR systems in a pilot study. The author uses the TAM model to investigate why the adoption of this type of technology is slow in organizations. The author divides privacy into three categories: single sign-on, biometric authentication, and multiple systems access and investigates the impact of these three factors on the ease of use of electronic health records. Even though the author expects significant impact of the aforementioned privacy types on adoption of EHR, the results do not support that. The individuals do not think these technologies are important for maintaining patient privacy.

Zaidan and Zaidan (2011) conduct an empirical study on the impact of data privacy and confidentiality on telemedicine adoption. Using survey research, the authors poll the participants asking them whether they are willing to make their data publicly available. One hundred twenty eight out of 130 people who participate in the survey say they would mind. This shows, according to the authors, the importance of patient information privacy in telemedicine. Based on these results, the authors find designing and implementing secure algorithms using hybrid

passwords with token or graphic passwords to be most useful. They also recommend for Congress to pass a universal health law to protect the rights of patients.

Zhou (2011) empirically examines the impact of privacy concerns through perceived risk and trust on the usage intention of location based services (LBS). LBS contain mobile navigation, location-based advertisements, emergency evacuation systems, and check-in services of mobile social networks. Since user location is needed for using LBS, they can feel that their privacy is violated. The author uses four factors to measure privacy: collection, improper access, error, and secondary use. The proposed model tests the impact of collection, improper access, error, and secondary use on usage intention through perceived risk and trust. The author surveys 210 individual in a university in China. The individuals are randomly picked and asked to fill out the survey. Using SEM, the results show that collection and secondary usage are the most important factors impacting perceived risk, whereas errors have the major impact on trust. This study not only shows how trust influences perceived risk, it also determines usage intention.

Liu et al. (2008) discuss the importance of privacy in e-health systems. The purpose of this theoretical paper is to find ways to gain the patient trust by improving the privacy of their information. The authors suggest a limited level of privacy in health care systems. They compare manual information systems with electronic information systems and state that the paper based system are more trustworthy and try to find ways to transfer this trust to electronic information systems. The authors believe that security is the means to achieve privacy and that it is people's right to be protected from hackers gaining access to their health information. The authors recommend choosing a safe operating system for health care organizations. The authors also recommend applying the highest security levels for privacy of information systems in healthcare organization. They suggest upgrading a present general purpose operating system. The authors

further recommend the system designers and Chief Information Officers to be chosen very carefully and be highly experienced in using high level security systems.

Ludwicka and Doucettea (2008) review literature to explore the health information systems adoption in primary care. The authors' objective is to find the factors that impact health information systems adoption. Using eighty-six articles, the authors find that feature functionality, project management, procurement, and users' previous experience influence health information systems adoption. Reviewing the articles reveals that the adopters consider privacy, patient safety, connection between provider and patient, employees concerns, time, quality of care, cost, efficiency, and liability as important factors affecting adoption of health information systems. However, the results show that factors such as techniques and training have no impact on implementation outcome. Furthermore, patient safety and connection between provider and patient had no influence on adoption.

### **2.2.3 Literature on Information Policies in Telemedicine**

Regulations play a major role in decisions to implement distance healthcare. In the United States, the Health Insurance Portability and Accountability Act (HIPPA) of 1996 requires health care organizations to "be protected with reasonable administrative, technical, and physical safeguards to ensure its confidentiality, integrity, and availability and to prevent unauthorized or inappropriate access, use, or disclosure" (The HIPAA Privacy Rule and Electronic Health Information Exchange in a Networked Environment, p.1). In addition to HIPPA, the Model Emergency Health Power Act of 2001 allows states to upgrade their legal, technical, and public policy infrastructure to minimize the impacts of bioterrorism (Bayer and Colgrove, 2002). A number of studies explore the impact of policies on telemedicine adoption. A few of them cover policy problems of the past such as Kifle, Mbarika, Tsuma, Wilkerson, and Tan (2008); Miller



and Tucker (2009); Omary, Zanifa, Mtenzi, and Wu (2009); Peng and Kurnia (2010); Schlachta-Fairchild, Varghese, Deickman, and Castelli (2010); Kodukula and Nazvia (2011); Mir (2011); Omowunmi, Willie, and T.O. (2011); and Alvarez, Chanda, and Smith (2011). These papers are discussed below.

Alvarez et al. (2011), for example, empirically examine the trading of telemedicine between the UK and India. The authors examine the outcome of bilateral trading when India exports telemedicine services to the UK. For their purpose, the authors conduct nineteen interviews among India and UK investors. The purpose of the interview is to clear the barriers, benefits, and risks in their operations. Most interviews are conducted face to face. After reviewing and coding the answers, different obstacles are identified such as policy issues and regulation. One of the major concerns is how to keep standards while diagnosing the patients between two countries. Another issue is how governments maintain infrastructure with same standard, speed, and reliability in both countries. Most participants believe that policies are needed to resolve the obstacles. The sample size of this research is very small and therefore, it is difficult to generalize the outcome.

Kifle et al. (2008) empirically investigate the relationship between e-health policies and telemedicine capabilities. The authors collect data from two hundred and twenty physicians and medical specialists. Kifle et al., (2008) find that a strong relationship exists between security policies and telemedicine adoption. The authors suggest that getting help from the government increases the quality of communication among healthcare professionals. The results show that e-health policies, however, do not affect the successful adoption of telemedicine. Further research is required to examine the relationship between e-health policies and telemedicine adoption.

Mir (2011) empirically examines the influence of HIPAA privacy laws on protecting the privacy of medical records. According to the author, a survey of 2100 patients conducted by the California Healthcare Foundation shows that 2/3<sup>rd</sup> of the surveyed patients are concerned about privacy of their records. The results show that patients do not have knowledge about their own privacy rights and are willing to trade their information to gain some benefits. In addition, the findings show that 45 percent of physicians believe that privacy violation of medical records is not a serious problem. However, 25 percent physicians consider this violation a problem. Furthermore, the results demonstrate that only 22 percent of physicians consider HIPAA regulations useful in maintaining the patient medical record confidentiality.

Omowunmi et al. (2011) empirically examine the impact of information technology policy on the Nigerian health sector. The authors investigate the issues in health policy, adoption of policy goals in health areas, and policy implementation. The authors conduct interviews with individuals working at nine different hospitals in four states of Nigeria. The results show that although the adoption of IT in health system is high in the country, most individuals are not familiar with the IT policy. The authors find that the use of policy at health institutions is at a primary phase. In addition, most respondents reveal that the government does not provide IT infrastructure and training. Furthermore, the authors believe that the government and its policies can be barriers in the management of hospital information systems.

Kodukula and Nazvia (2011) empirically investigate the success factors for telemedicine implementation in Maldives. The purpose of their study is to find the barriers in adoption of telemedicine. The authors perform Individual-depth Interviews and Focus Group Discussion in hospitals where telemedicine projects have failed previously. The respondents include Policymaker (Manager Group), Clinician Group, Technical (Support Staff Group), and People

(End-user Group). The results reveal that supporting government regulations, policies, and political support are some of the main critical success factors needed in implementing telemedicine. The authors believe that commitment from political authorities is also needed to keep present policies in health sector active. The authors suggest that governmental support and policies can help in proper implementation of telemedicine projects.

Omary et al. (2009), in a theoretical study emphasize on the impact of policies on the adoption of EHR. The authors believe that the benefits of EHR adoption are not clear to government since Return on Investment (ROI) of adopting e-health cannot be measured for a short period of time and, therefore, the government would resist the adoption of EHR adoption. The authors state that most governments lack developed roadmaps for e-health and some who have the developed roadmaps are behind in the absence of vision and political determination. Furthermore, the authors argue that physicians' political views have a direct influence on e-healthcare adoption. The authors believe that physicians usually support political parties for their own benefits since each political party has its own principles regarding healthcare. For example, the Democratic Party favors public health and wealthier physicians favor the Republican Party. The authors believe that policies affect the adoption of e-healthcare.

Schlachta-Fairchild et al. (2010) examine the impact of policies on telenursing in a theoretical study. The purpose of their study is to propose a useful policy for telenursing that is particularly useful for advanced practice nurses. The authors believe that a number of barriers exist in dealing with policies. These barriers include technology selection and implementation principles, interstate licensure, malpractice, and telehealth reimbursement. Furthermore, the authors argue that state-based licensure system is a barrier in using the telenursing system due to lack of geographical boundaries. The authors suggest that the existence of a multi-state,

licensure, or uniform model of interstate regulation can help solve this problem. The authors believe that policy has an important role in telenursing and suggest that the risk of failing the telenursing system can be lowered with understanding of standards, core guidelines, and nursing.

Miller and Tucker (2009) examine the impact of privacy regulations on the diffusion of EMR in a case study. The authors compare the states with and without privacy policies for hospitals. They examine the rate of adoption in each state. The authors conclude that state privacy regulations are slowing the EMR adoption by 24 percent. In addition, they find that, in states with no privacy regulations, the EMR adoption rate is increasing by 7 percent. Their results show that privacy regulations on patients' information reduce the adoption of EMR.

Peng and Kurnia (2010) conduct a case study to examine the adoption of Hospital Information Systems (HIS) in China. The authors investigate the major factors that affect the main stages of HIS adoption in China. These stages include decision, implementation, and assimilation. The authors conduct semi-structured face-to-face interviews with five individuals, including a hospital director, an IT manager, an administration manager, a head nurse, and a physician. The results show that the support or command of China's communist government is found to be the most significant factor in adopting HIS. In addition, national IT standards and relevant regulations are found to be other important factors in the adoption of HIS. Results show that standards and legislations in Chinese hospitals are outdated. The authors believe that more recent legislative is needed to successfully implementing HIS.

In summary, the aforementioned research studies examine the impact of culture, privacy, policy, and security on telemedicine adoption. The results, however, obtained from these studies are contradictory. Kiffle et al. (2006), for example, find no relationship between UA and the adoption of telemedicine, whereas Thatcher et al. (2003) believe that UA influences IT

innovation. Furthermore, Thatcher et al. (2003) and Nwabueze et al. (2009) find no relationship between PD, IDV, MAS, and IT innovation, whereas Kiffle et al. (2006) find a positive relationship between PD and the adoption of telemedicine. Standing and Gururajan (2011) and Trimmer et al. (2009) believe that culture plays an important role in telehealth success, whereas, Doktor et al. (2005) find no significant relationship between IDV and MAS on perspective user's intention to use telemedicine.

Regarding security factors, all studies agree on the importance of security in adopting technology and its use. Bukharard et al. (2010), for example, believe that security is essential and affects confidence in using PHR. Khoubati et al. (2008) emphasize the need for national level security guidance and more security of patients. Moreover, Luethi and Knolmayer (2009) stress that security is necessary to maintain HIS adoption for hospitals in the U.S. and Switzerland. However, most of these studies lack empirical investigation. Among those with empirical research there is none in the telemedicine area. In order to fill the gap found in the literature, it is necessary to empirically investigate the effect of information security on telemedicine.

The studies that consider privacy address the importance of information privacy on adopting new technology. Findings obtained from most of these studies suggest that existence of privacy is important in adopting technology. Liu et al. (2008), for example, consider privacy very important in e- health. Even though the authors state that paper-based system is more trustworthy, they still recommend EHR when privacy is provided. Terry and Francis (2007) also believe that privacy and confidentiality impacts telemedicine adoption. However, Ludwicka and Doucettea (2008), Angst and Agarwal (2009), Hewitt (2009), and Perera et al. (2011) believe that although privacy of information is important, but it is not necessary to adopt technology. Therefore, there is a need to investigate this matter further.

The studies in the policy area also mixed. Omary et al. (2009), Peng and Kurnia (2009), Schlachta et al. (2010), and Kodukula and Nazvia (2011), for example, believe that existence of policies is important and has a positive impact on healthcare technology adoption, whereas Kifle et al. (2008) and Miller and Tucker (2009) find that policies either lower the adoption of technology or have no impact at all. Due to these contradictory findings, it is important to further investigate the impact of information privacy policies on adopting telemedicine.

Overall, the studies discussed above attempt to examine the influence of culture, security, and privacy on technology adoption. There is, however, no clear consensus on how these factors affect telemedicine adoption. Some find positive and some find no relationship between the aforementioned factors and the adoption of telemedicine. Therefore, there is a need for further research to investigate the impact of these factors on telemedicine adoption. This dissertation, therefore, explores the effect of culture on security, privacy, policy, and the adoption of telemedicine. In the next section, the theoretical framework for the study is presented.

### **Chapter 3: Theoretical Framework**

Most of the studies on telemedicine adoption use either Theory of Planned Behavior (TPB) or the Technology Acceptance Model (TAM). Therefore, a comprehensive and integrated model is needed to measure healthcare professionals' intention to adopt telemedicine. This model should integrate culture, patient information security, privacy, and policy toward successful implementation of telemedicine (see Figure 4.1). The proposed research model is grounded using the Protection Motivation Theory (PMT), Rational Deterrence Theory (RDT), Hofstede's Theory on Culture (TOC), and Moor's Control Access Theory (CAT). Combining different theories, as done in this study, is called theory integration. Theory integration is intended to fuse different theories, so that the integrated model provides more explanatory power than a model derived from a single theory (Akers and Sellers 1994). The next section discusses PMT, RDT, TOC, and CAT, and illustrates why these theories are used and which constructs of these theories are utilized to create the proposed model.

The Protection Motivation Theory (PMT), which originated in health sciences, aims at motivating people to avoid unhealthy behavior through fear appeals (Rogers, 1975; Rogers, 1983). PMT is divided into two parts: threat appraisal and coping appraisal. Threat appraisal evaluates how a person responds when he/she is faced with a threatening situation (e.g., a physician may be threatened by potential legal and financial ramifications and a decrease in credibility if, upon adoption, security breaches take place in electronic patients records). Coping appraisal consists of two dimensions: self-efficacy and response efficacy. Self-efficacy refers to a person's evaluation of his/her capability to deal with and avoid possible damage or loss that a threat may cause. Regarding telemedicine adoption, self-efficacy is the healthcare professional's confidence in his/her ability to be able to use telemedicine. Response efficacy, on the other hand,

suggests the effectiveness of a proposed action. Response efficacy, in the context of the present research, refers to a healthcare professionals' confidence about whether telemedicine security measures can prevent potential hackers from breaking into telemedicine databases and stealing patients' health records. Based on PMT, current research hypothesizes that security measures such as confidentiality, authorization, authentication, and access control toward protecting electronic patient records will encourage healthcare professionals to adopt telemedicine.

Through his CAT (1997), Moor argues that if a person is protected from interference, intrusion, and information access by other people, a person is said to have privacy. Moor (1997) further discusses that this right allows us to build relationships with individuals which are hard to build in public. The author describes privacy as the core value of security and suggested that each individual needs it to survive. Moor also suggests that the greater the amount of information, the more the need for protection against unauthorized access and use of this information. Based on CAT, current research hypothesizes that privacy and protection of patient records will facilitate healthcare professionals toward telemedicine adoption. Furthermore, if patients feel comfortable about telemedicine being able to keep their health information private, they will feel comfortable about physicians adopting and using telemedicine.

Rational Deterrence Theory (RDT) describes the behavior of an individual to control or prevent punishment or retribution. There are two groups of Deterrence: general and specific. General deterrence focuses on policies. The person does not have to change his/her behavior, but will be punished in public if he/she violates such policies. Specific deterrence emphasizes the person making an effort to change his/her actions, if necessary, to avoid punishment. Beccaria (1963) believes that deterrent is beneficial considering certainty of sanction and severity of sanction. According to this theory, criminals would avoid unlawful behavior if the chance of



getting penalized is high. Current research believes that information privacy and security policies can have an impact on crime prevention if these policies are robust enough. Thus, they can prevent criminals from violating a patient's privacy. Based on RDT, current research hypothesizes that adequate organizational policies and procedures will deter hackers from violating a patient's privacy and security which, in turn, will encourage healthcare professionals to adopt telemedicine.

Hofstede's Theory on Culture (TOC) is very insightful when it comes to investigating the adoption of telemedicine. Hofstede states clearly and emphatically that organizational systems work best when their values and culture are consistent with the underlying values and culture of the society in which they are implemented. Hofstede identifies four culture dimensions as previously discussed.

## Chapter 4: Research Model and Hypotheses

Based on the previous discussion, the current research posits the following conceptual model (see Figure 4.1). The model offers an overview of the main constructs for telemedicine adoption and the relationships among these constructs.

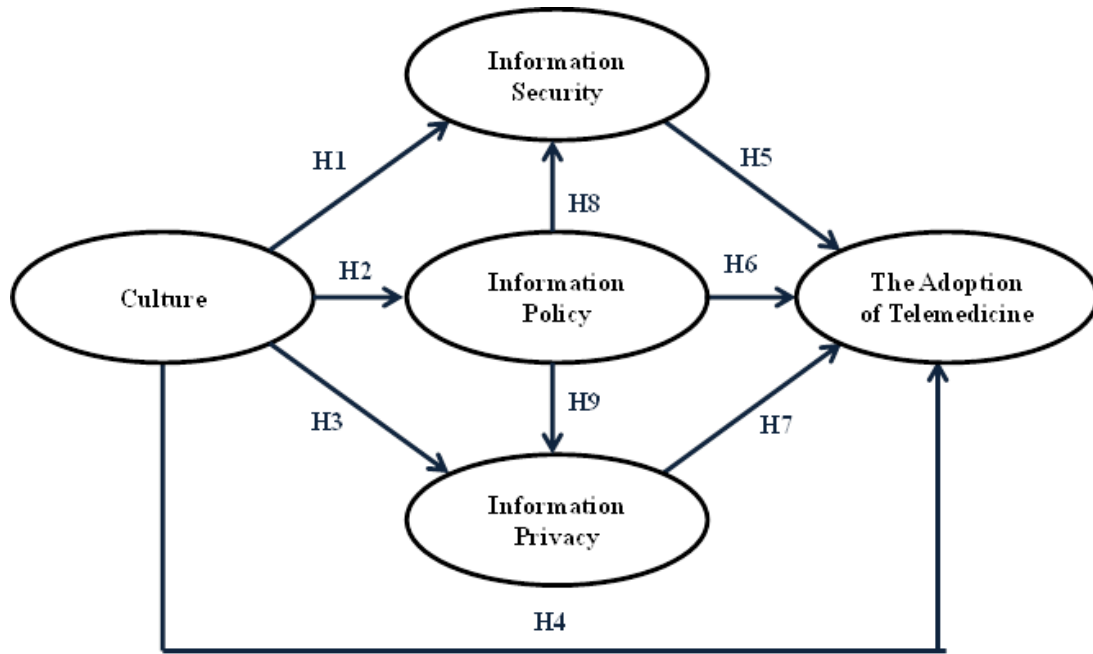


Figure 4.1: Hypothesized Model

### 4.1 Hypotheses

The following section describes the hypotheses used in the present research and provides the literature support for each hypothesis. Vroom and Solms (2004) believe that the human factor has an impact on maintaining security. The authors report that even though 17% of security breaches are intentional, 35% are not. This shows that human factor has an impact on maintaining security. According to Vroom and Solms (2004), the organizational culture can help individuals to become aware of security rules and policies to encourage the adoption of such policies. Glaser (2009) examines the impact of national culture on information security. The author finds that China has less secure system compared to the other countries while the cultures

of Germany and the U.S. support information security the most. The author also finds that the uncertainty avoidance part of the culture influences information security. It seems the impact is, however, positive in some cultures and negative in the others. Ifinedo (2008), for example, finds no significant differences between a national culture and individuals' perception of IT security in global financial services institutes. The present research postulates, based on the aforementioned discussion, the following hypotheses:

H<sub>1A</sub>: Culture, as defined by Hofstede, will directly influence patient information security needs for telemedicine adoption in the United States.

H<sub>1B</sub>: Culture, as defined by Hofstede, will directly influence patient information security needs for telemedicine adoption in Taiwan.

H<sub>1C</sub>: Culture, as defined by Hofstede, will directly influence patient information security needs for telemedicine adoption in Brazil.

Ifinedo (2012) considers the impact of TPB on information systems security policy compliance. The study shows that subjective norms and individual's attitude toward information security policies significantly influences the intention to follow the privacy policies. Ciganek and Francia (2009) discuss the importance of culture in the adoption of information policies. The authors find that countries with low uncertainty avoidance (e.g., Japan and Taiwan) are more likely to adopt and respond to policies and regulations to avoid uncertainty. Solms and Solms (2004) believe that for a certain policy to work and to be effective, the policy has to be aligned to the culture of the employees. Hone and Eloff (2002) discuss that information security policies will have to match with the culture of the organization and these policies should be flexible enough to be changed as the culture changes. In view of the aforementioned discussion, the current research hypothesizes:

H<sub>2A</sub>: Culture, as defined by Hofstede, will directly influence patient information policy needed for telemedicine adoption in the United States.

H<sub>2</sub>B: Culture, as defined by Hofstede, will directly influence patient information policy needed for telemedicine adoption in Taiwan.

H<sub>2</sub>C: Culture, as defined by Hofstede, will directly influence patient information policy needed for telemedicine adoption in Brazil.

The relationship between culture and privacy as indicated earlier is somewhat mixed in the literature. Krasnova and Veltri (2010) examine the influence of culture on privacy concerns in social network websites. Their study shows that countries with higher uncertainty avoidance like Germany are less likely to adopt new technology. Schmidt et al., (2008) find that there are significant differences between countries with low uncertainty avoidance culture verses high uncertainty avoidance culture on their view of perceived computer privacy. Ifinedo (2008), however, finds no differences between an organization's views on perceived privacy in different cultures. The author examines the behavior of financial services institutions on 13 key IT security and privacy issues in different cultures (e.g., Japan, USA, Middle East, Europe, Canada, and Africa). The author finds no differences, on these issues, in low and high UA countries. Bansal and Zahedi (2007) examine Hofstede's dimension, individualism, and find no impact of this dimension on health information privacy. However they find a strong relationship between feminism and privacy of healthcare information. Consistent with the aforementioned discussion, the present research puts forward the following hypotheses:

H<sub>3</sub>A: Culture, as defined by Hofstede, will directly influence patient information privacy needed for telemedicine adoption in the United States.

H<sub>3</sub>B: Culture, as defined by Hofstede, will directly influence patient information privacy needed for telemedicine adoption in Taiwan.

H<sub>3</sub>C: Culture, as defined by Hofstede, will directly influence patient information privacy needed for telemedicine adoption in Brazil.

Standing and Gururajan (2011) investigate the challenges in managing expertise in the telehealth area. The authors investigate the impact of organizational culture on expertise

management. Standing and Gururajan (2011) believe that cultures that value trust and are open to discussion can help telehealth to succeed the most. Harris et al. (2005) find that culture is a significant factor in the adoption and use of m-commerce. They apply Hofstede's cultural dimensions to show that adoption rate is lower in Hong Kong than in UK. The study by Kiffle et al. (2006) shows that in Sub-Saharan African (SSA) countries, uncertainty avoidance (UA) has low influence on telemedicine adoption. This result contradicts the findings by Thatcher et al. (2003) which demonstrate that cultures with high UA struggle in adopting new technology. This research postulates, based on the aforementioned discussion, the following hypotheses:

H<sub>4A</sub>: Culture, as defined by Hofstede, will directly influence telemedicine adoption in the United States.

H<sub>4B</sub>: Culture, as defined by Hofstede, will directly influence telemedicine adoption in Taiwan.

H<sub>4C</sub>: Culture, as defined by Hofstede, will directly influence telemedicine adoption in Brazil.

Kifle et al., (2006), in an empirical study in SSA countries, show that security policies have a positive and significant influence on telemedicine adoption. Khoumbati et al. (2008) show that security and confidentiality impact the EAI adoption. They show that there is a need for a national level guidance about security of information. Burkhard et al. (2010) examine the factors influencing employee perception and concerns about security of electronic Personal Health Records. The study shows that users of Employer-Sponsored Personal Health Records (ESPHR) consider privacy and security of ESPHR data very important. In their research, perceived importance of ESPHR's privacy and security positively affects the confidence in the use of ESPHRs for decision making. In view of the aforementioned, this research hypothesizes:

H<sub>5A</sub>: Information security will directly influence telemedicine adoption in the United States.

H<sub>5</sub>B: Information security will directly influence telemedicine adoption in Taiwan.

H<sub>5</sub>C: Information security will directly influence telemedicine adoption in Brazil.

Jennett, Scott, and Afleck (2004) emphasize the impact of policies on the adoption of EHR. The authors believe that one of the barriers to the adoption of EHR is the lack of agreement between political parties on how to spend the healthcare budget. During the last five years, most national governments have developed ICT policies for healthcare, but the relationship between the existence of these policies and the adoption of telemedicine is not quite known. In the United States, the HIPPA law of 1996 was the first national standard to protect a patient's medical records (Harari, Norton, Lockwood, and Swift, 2004). Omary et al. (2009) emphasize the impact of policies on the adoption of EHR. The authors believe that one of the obstacles to the adoption of EHR is the lack of agreement between political parties on how to spend the healthcare budget. The authors also believe that physicians' alignment to political parties can be a possible issue. The research by Miller and Tucker (2009) shows that state privacy regulation slows down the EMR adoption by 24 percent. Their study demonstrates that having privacy regulation for patients' information lowers adoption of EMRs. Consistent with the aforementioned research findings, the present study hypothesizes:

H<sub>6</sub>A: Patient information policies will directly influence telemedicine adoption in the United States.

H<sub>6</sub>B: Patient information policies will directly influence telemedicine adoption in Taiwan.

H<sub>6</sub>C: Patient information policies will directly influence telemedicine adoption in Brazil.

Earp and Payton (2006) study a group of healthcare professionals and find that these professionals are primarily concerned with errors in patient records in terms of improper access,

unauthorized secondary use, and data collection errors. Angst and Agarwal (2009) investigate the impact of privacy on the adoption of EHR. The results of their study show that patient privacy is the most important threat to adoption of EHR. Terry and Francis (2007) also believe that privacy and confidentiality impacts telemedicine adoption. Perera et al. (2011) demonstrate that privacy of patients in electronic health records does not impact the decision to use EHR. Consistent with the aforementioned discussion, current research hypothesizes:

H<sub>7A</sub>: Information privacy will directly influence telemedicine adoption in the United States.

H<sub>7B</sub>: Information privacy will directly influence telemedicine adoption in Taiwan.

H<sub>7C</sub>: Information privacy will directly influence telemedicine adoption in Brazil.

In the healthcare arena, regulations play a major role in implementing patient information policies. In the United States, the HIPPA law of 1996 requires health care organizations to protect against potential privacy and security breaches into protected health information. In addition to HIPPA, the Health Power Act of 2001 allows states to upgrade their legal, technical, and public policy infrastructure to minimize the impacts of aforementioned breaches (Bayer and Colgrove, 2002). In view of this discussion, it is clear that patient information policy will dictate patient information privacy and security. Fernando and Dawson (2009) believe that confusing and contradictory privacy and security laws impact the patient's health information security. Consistent with the aforementioned discussion, current research hypothesizes:

H<sub>8A</sub>: Information policy will directly influence information security in the United States.

H<sub>8B</sub>: Information policy will directly influence information security in Taiwan.

H<sub>8C</sub>: Information policy will directly influence information security in Brazil.

H<sub>9</sub>A: Information policy will directly influence information privacy in the United States.

H<sub>9</sub>B: Information policy will directly influence information privacy in Taiwan.

H<sub>9</sub>C: Information policy will directly influence information privacy in Brazil.

In next chapter hypotheses H<sub>1</sub>A through H<sub>9</sub>A will be empirically tested using SEM/ AMOS with data from the United States. H<sub>1</sub>B through H<sub>9</sub>B will be empirically tested using SEM/AMOS with data from Taiwan, and H<sub>1</sub>C through H<sub>9</sub>C will be empirically tested using SEM/ AMOS with data from Brazil.



## **Chapter 5: Research Method and Sample Selection**

### **5.1 Methodology**

Based on the existing literature on distance healthcare and Hofstede's TOC, an instrument is designed to gather information on telemedicine adoption. Respondent's anonymity was maintained throughout the data collection process. This instrument contains a total of the 49 questions (See appendix A). The first 24 questions were used to collect information on security, privacy, policy, and telemedicine adoption constructs. The next 20 questions collectively measured the culture construct. These items were provided by Hofstede (2001) as a part of his TOC. The respondents were asked to answer each question using a seven-point Likert-type scale with values ranging from 1 (strongly agree) to 7 (strongly disagree). The last five questions asked respondents to provide some demographic information. The instrument was hosted on Qualtrics and respondents filled out survey using a link to survey and submitted their answers online. The survey instrument was also given to the subjects in a hard copy and the respondents were asked to return the complete survey to the researcher.

### **5.2 Data Collection**

In the U.S., the data used to test the hypothesized model were obtained by surveying about 300 physicians, physician's assistants, nurse practitioners, medical students and residents, healthcare executives, and nursing professionals who used similar telemedicine systems in the state in which data were collected. An electronic link to the instrument hosted on the Qualtrics was first sent to potential participants. The participants were asked to fill out the survey instrument. When a participant did not respond, a Medical Doctor (MD) who is related to one of the authors took personal responsibility to deliver a hard copy of the questionnaire to the participant. The MD followed up with those who did not respond and asked them again to fill out

the questionnaire. Four nursing professors also gave the questionnaire to nursing professionals who enrolled in their classes. Taking into consideration the missing data and invalid responses, there were a total of 192 usable U.S. responses. Forty-five percent of the respondents were males while 55 percent were females. Thirty-four percent of the respondents were physicians, less than 1 percent were physician assistants, less than 1 percent were nurse practitioners, 4 percent were medical students, 3 percent were medical residents, less than 1 percent were healthcare executives, 1 percent were information technology specialists, 43 percent were nursing professionals, and 11 percent were others.

In Taiwan, the survey instrument was translated in Chinese. Six-hundred questionnaires were then distributed in clinics, medical centers, metropolitan hospital, and community hospitals. A total of 474 responses were received from which 433 were usable. Forty percent of the respondents were males while 60 percent were females. Twenty seven percent of the respondents had work experience between one to five years, 25 percent had between 6 to 10 years, 24 percent had between 11 to 15 years, 14 percent had between 16 to 20 years, and 11 percent had over 20 years. Twenty seven percent of the respondents were physicians, 40 percent were nurse practitioners, 17 percent were executives, 7 percent were information technology specialists, and 10 percent were others.

In Brazil, a survey was translated into Portuguese and distributed to 115 IT professionals and medical students. Eighty-six percent of the respondents were males while the rest were females. Sixty percent of the respondents had work experience between 1 to 5 years, 5 percent had between 6 to 10 years, 18 percent had between 11 to 15 years, 10 percent had between 16 to 20 years, and 7 percent had over 20 years. Forty-seven percent of the respondents were medical students and the rest were information technology specialists.

## **Chapter 6: Fit and Model Reliability Statistics**

### **6.1 Model Fit Statistics**

The chi-square/df is calculated for each country. The purpose of chi-square test is to determine if the observed frequencies significantly differ from the frequencies that are assumed by chance. The hypothesized model for the U.S., Taiwan and Brazil has a chi-square/df value of 2.75, 4.60 and 1.907 with a p value equal to .001 respectively (see Table 6.1). This indicates a good fit of the model to the data collected for this research. Wheaton, Muthen, Alwin, and Summers (1998) suggest that a model has a good fit to the data if this value is less than 5.0.

Next the comparative fit index (CFI) is reported, as proposed by Bentler (1990). CFI is a non-centrality based index which assumes that the possibility of a perfect fit between the model and the data is unlikely in the population because there is a chance that some variables may have been inadvertently left out of the model (Bentler, 1990). CFI ranges in value from 0 to 1, with a value close to 0.90 serving as a limit for acceptable fit (Hais, Anderson, Tatham, and Black, 1998). The proposed model for Brazil, Taiwan and the U.S. has a CFI value of .72, .77, and .60, respectively, which falls within the acceptable range. The next reported index in this analysis is RMSEA. RMSEA considers the error approximation and addresses the question of how well the model fits the population covariance matrix, if it is available. The hypothesized model in U.S, Taiwan and Brazil has RMSEAs of 0.10, .09 and .09, respectively. Browne and Cudeck (1993) question the fit of models with an RMSEA less than 0.10.

Following a suggestion made by Marsh (1994), the present model is compared to an independence-model (null model) in which all variables are considered to be unrelated. Table 6.1 presents statistics for the two models in three countries, which show that the hypothesized

research model is superior to the independence model. In summary, indices and other statistics used in this dissertation suggest a good fit of the hypothesized model to the data.

Table 6.1: Model Fit Statistics

<b>Model</b>	<b>Country</b>	<b>DF</b>	<b>P</b>	<b><math>\chi^2/\text{df}</math></b>	<b>CFI</b>	<b>RMSA</b>
Default model	U.S	694	0.000	2.749	.723	.10
	Taiwan	694	0.000	4.600	.770	.09
	Brazil	694	0.000	1.907	.597	.09
Independence model	U.S	780	0.000	6.619	.0	.20
	Taiwan	741	0.000	15.642	.0	.20
	Brazil	741	0.000	3.108	.0	.14

## 6.2 Reliability

Next, this study determines the reliability of constructs used in the research instrument using Cronbach's alpha. This is done to ascertain both stability and internal consistency of the instrument. For the U.S. culture, information privacy, information security, information policy and adoption of telemedicine have reliability scores of 0.82, 0.87, 0.93, 0.81, and 0.86, respectively. For Taiwan, culture, information privacy, information security, information policy, and adoption of telemedicine have reliability scores of 0.81, 0.90, 0.92, 0.92, and 0.84, respectively. For Brazil, culture, information privacy, information security, information policy, and adoption of telemedicine have reliability scores of 0.67, 0.81, 0.87, 0.74, and 0.52, respectively (see Table 6.2). Nunnally (1970) indicated that 0.70 is an acceptable level of reliability for a construct. The U.S. and Taiwan constructs meet the Nunnally benchmark. Brazilian construct, with the exception of adoption of telemedicine, also meet the Nunnally benchmark.

### **6.3 Validity**

The instrument is also validated to ensure that the study appropriately measured its intended objects. Convergent validity and discriminant validity are used to check the validity of the instrument. In order to verify that all items loaded well in their assigned constructs, factor analysis is used with a reference norm of 0.40 as the ideal loading factor as suggested by Hais et al. (1998). Table 6.3 shows the results of this test for three countries. Eleven of 20 items for Brazil and Taiwan, and thirteen for the U.S. in the culture construct load well for ( $\geq 0.40$ ). All four items in the information privacy group load very well for all three countries ( $> 0.68$ ). Also, all items in the information security group load very well for three countries ( $\geq 0.72$ ). All five items in the information policy group load well for the U.S. and Taiwan ( $> 0.52$ ); however, in Brazil the loadings are more than 0.1. Finally, all five items in the telemedicine construct load very well for all three countries ( $\geq 0.40$ ). The average variance explained by each factor obtained from factor analysis communalities for the U.S. is 1.39, 0.24, 0.26, 0.28, and 0.25, for Taiwan is 1.18, 0.09, 0.14, 0.17, and 0.20 and for Brazil is 0.81, 0.28, 0.26, 0.20, and 0.16, for culture, privacy, security, policy, and adoption, respectively.

#### **6.3.1 Discriminant Validity**

According to Campbell and Fiske (1959), discriminant validity is the degree to which measures of different concepts are distinct. The authors suggest, in order to establish discriminant validity, correlations between items within constructs must be significantly greater ( $p < .05$ ) than correlations among items between constructs (correlations among constructs is provided in Table 6.3). For the U.S., correlations among items within the information security, privacy, policies, and telemedicine constructs were greater than .79, .53, .52, and .35, respectively ( $p < .05$ ). For Taiwan, correlations among items within the information security,

privacy, policies, and telemedicine constructs were greater than .66, .58, .62, and .36, respectively ( $p < .05$ ). Finally for Brazil, most of the correlations among items within the information security, privacy, policies, and telemedicine constructs were greater than .45, .39, .22, and .02 respectively ( $p < .05$ ). Most of the correlations in culture construct were .20 or higher in three countries. Correlations among constructs for all three countries are shown in Table 6.3. All correlations among constructs are significant in the U.S. and Taiwan; however, for Brazil, correlations between culture and privacy, privacy and adoption, and security and adoption were not significant.

Table 6.2: Scale Development

Construct	Country	No. of Items	Mean	Std.	Cronbach Alpha	Factor loadings	Var. Extracted
Culture	U.S.	20	92.58	11.80	.823	.90, .74, .78, .90, .74, .84, .87, .85, .78, .82, .75, .71, .30, .40, .15, .19, .14, .24, .15, .15	1.39
	Taiwan	20	102.66	10.885	.813	.84, .84, .86, .89, .87, .80, .81, .61, .70, .47, .46, .33, .11, .04, .31, -.13, .19, .06, -.26, -.03	1.18
	Brazil	20	104.83	9.017	.668	.79, .78, .59, .48, .69, .41, .74,	.81

						.28, .69, .57, .72, .40, .003, .06, -.13, -.08, -.01, .13, .12, - .17	
Info. Privacy	U.S.	4	24.54	4.87	.870	.76, .92, .86, .68	.24
	Taiwan	4	25.23	3.058	.902	.88, .89, .82, .77	.09
	Brazil	4	21.82	5.32	.814	.85, .81, .67, 1	.28
Info. Security	U.S.	5	31.60	5.10	.930	.72, .86, .96, .95, .79	.26
	Taiwan	5	30.36	3.783	.92	.81, .86, .84, .88, .83	.14
	Brazil	5	29.97	5.06	.867	1, 1, 1.06, 1.12, 1.01	.26
Info. Policy	U.S.	5	27.66	5.26	.808	.59, .83, .95, .67, .52	.28
	Taiwan	5	29.41	4.085	.918	.84, .84, .79, .88, .85	.17
	Brazil	5	27.37	4.498	.737	.1, 1.51, 1.08, 2.28, 2.50	.20
Adoption of Telemedicine	U.S.	5	30.05	4.96	.859	.91, .92, .56, .59, .59	.25
	Taiwan	5	27.82	4.484	.842	.53, .61, .66, .91, .88	.20
	Brazil	5	26.62	4.017	.525	1, 1.31, .40, .60, - .008	.16

Table 6.3: Correlation Analysis

<b>Construct</b>	<b>Country</b>	<b>Culture</b>	<b>Policy</b>	<b>Privacy</b>	<b>Security</b>	<b>Adoption</b>
Culture	U.S	1.00				
	Taiwan	1.00				
	Brazil	1.00				
Policy	U.S	.52***	1.00			
	Taiwan	0.46***	1.00			
	Brazil	0.48***	1.00			
Privacy	U.S	0.44***	0.48***	1.00		
	Taiwan	0.44***	0.48***	1.00		
	Brazil	.01	0.35***	1.00		
Security	U.S	0.25***	0.25***	0.15*	1.00	
	Taiwan	0.38***	0.60***	0.31***	1.00	
	Brazil	0.31***	0.50***	0.16*	1.00	
Adoption	U.S	0.28***	0.60***	0.38***	0.26**	1.00
	Taiwan	0.42***	0.74***	0.44***	0.51***	1.00
	Brazil	0.23**	0.36***	.11	.14	1.00

\* means significant at the .10 level, \*\* means significant at the .05 level, and \*\*\* means significant at the .01 level



## Chapter 7: Results

This chapter presents the results of SEM and MANOVA in all three countries. The SEM results are provided first followed by Manova results.

### 7.1 SEM

Figure 7.1 shows the result for the hypothesized model for US, Taiwan, and Brazil. AMOS/SEM results reveal that the path coefficient from culture to information security ( $H_1$ ) is only significant for Taiwan at the .05 level. The path coefficient from culture to information policy ( $H_2$ ) is significant for all three countries at the .01 level. The results also indicate that, the path coefficient from culture to information privacy ( $H_3$ ) is significant at .05 level or lower for the U.S. and Taiwan only, but not for Brazil. The results further reveal that Taiwan has a significant path coefficient from culture to telemedicine adoption ( $H_4$ ) at the .10 level. The path coefficient from information security to telemedicine adoption ( $H_5$ ) is significant for the U.S. and Taiwan only at the .10 level. All three countries have significant path coefficients from information policy to telemedicine adoption ( $H_6$ ) at the .10 level. It is interesting to note that none of the countries have significant path coefficient from information privacy to telemedicine adoption ( $H_7$ ). Finally, all the path coefficients from information policy to information security ( $H_8$ ) and information privacy ( $H_9$ ) are significant for all three countries at less than the .10 level or lower.

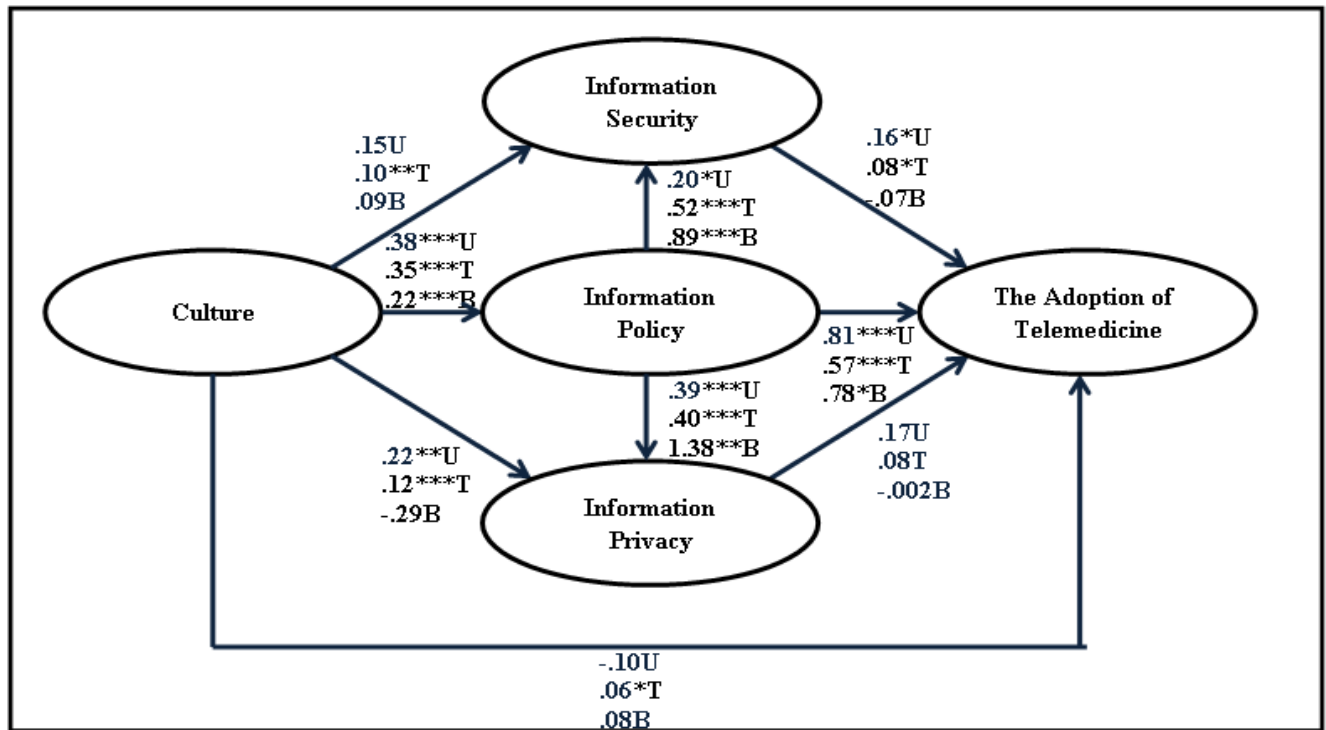


Figure 7.1: Results from the Hypothesized Model  
 \* means significant at the .10 level, \*\* means significant at the .05 level \*\*\* means significant at the .01 level

## 7.2 Manova Result

According to Swanson and Holton (2005) a Manova test is done to create a linear combination of dependent variables to maximize group differences. A test is performed to examine whether those differences are significant. The objective here is to examine whether there are significant mean differences between information security, information privacy, information policy, and telemedicine adoption among three countries. The multivariate analysis shows that overall there are significant differences among the countries in term of privacy, and policy (see Table 7.1).

Table 7.1: Multivariate Tests

Effect	Value	F	Error df	Sig.	Partial Eta Squared
Country Pillai's Trace	.358	31.654	1452.000	.000	.179
Wilks' Lambda	.656	33.981 <sup>a</sup>	1450.000	.000	.190

Table 7.2: Multiple Comparisons

			Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Dependent Variable	(I) Country	(J) Country					
Security	Taiwan	United States	-1.2831 <sup>*</sup>	.40501	.005	-2.2342	-.3319
		Brazil	.3604	.48280	.736	-.7734	1.4943
	United States	Taiwan	1.2831 <sup>*</sup>	.40501	.005	.3319	2.2342
		Brazil	1.6435 <sup>*</sup>	.54708	.008	.3587	2.9283
	Brazil	Taiwan	-.3604	.48280	.736	-1.4943	.7734
		United States	-1.6435 <sup>*</sup>	.54708	.008	-2.9283	-.3587
Privacy	Taiwan	United States	-.2850	.39775	.754	-1.2191	.6492
		Brazil	2.4574 <sup>*</sup>	.47416	.000	1.3439	3.5710
	United States	Taiwan	.2850	.39775	.754	-.6492	1.2191
		Brazil	2.7424 <sup>*</sup>	.53728	.000	1.4806	4.0042
	Brazil	Taiwan	-2.4574 <sup>*</sup>	.47416	.000	-3.5710	-1.3439
		United States	-2.7424 <sup>*</sup>	.53728	.000	-4.0042	-1.4806
Policy	Taiwan	United States	1.0996 <sup>*</sup>	.41067	.021	.1352	2.0641
		Brazil	1.4246 <sup>*</sup>	.48956	.010	.2749	2.5743
	United States	Taiwan	-1.0996 <sup>*</sup>	.41067	.021	-2.0641	-.1352
		Brazil	.3250	.55473	.828	-.9778	1.6278
	Brazil	Taiwan	-1.4246 <sup>*</sup>	.48956	.010	-2.5743	-.2749
		United States	-.3250	.55473	.828	-1.6278	.9778

Telemedicine	Taiwan	United States	-2.5899*	.39848	.000	-3.5257	-1.6540
		Brazil	.8145	.47502	.200	-.3011	1.9301
	United States	Taiwan	2.5899*	.39848	.000	1.6540	3.5257
		Brazil	3.4043*	.53826	.000	2.1402	4.6685
	Brazil	Taiwan	-.8145	.47502	.200	-1.9301	.3011
		United States	-3.4043*	.53826	.000	-4.6685	-2.1402
Culture	Taiwan	United States	10.6341*	.93829	.000	8.4305	12.8377
		Brazil	-1.6246	1.11852	.315	-4.2515	1.0022
	United States	Taiwan	-10.6341*	.93829	.000	-12.8377	-8.4305
		Brazil	-12.2587*	1.26743	.000	-15.2353	-9.2821
	Brazil	Taiwan	1.6246	1.11852	.315	-1.0022	4.2515
		United States	12.2587*	1.26743	.000	9.2821	15.2353

Based on observed means.

The error term is Mean Square (Error) = 113.683.

\*. The mean difference is significant at the .05 level.

The Table 7.2 shows that mean scores for security were statistically significantly different between Taiwan and United States ( $p < .01$ ), but not between Taiwan and Brazil ( $P = .360$ ). Mean scores in privacy were statistically different between Taiwan and Brazil ( $P < .0005$ ) and United States and Brazil ( $p < .0005$ ), but not United States and Taiwan ( $p = .285$ ). Mean scores in policy were statistically different between Taiwan and United States ( $p < .05$ ) and Taiwan and Brazil ( $p < .05$ ), but not United States and Brazil ( $p = .828$ ). Mean for telemedicine adoption were statistically different between Taiwan and United States ( $p < .0005$ ) and United States and Brazil ( $p < .0005$ ), but not between Taiwan and Brazil ( $p = .20$ ). Mean culture were statistically significantly different between Taiwan and United States ( $p < .0005$ ) and United States and Brazil ( $p < .0005$ ), but not between Taiwan and Brazil ( $p = .32$ ).

## Chapter 8: Discussion and Recent Research

In order to generalize and effectively gauge telemedicine adoption success in a culture, one must identify a number of macro indicators and ascertain how they collectively affect this success. The AMOS-based SEM analysis of the present research, using data collected from the United States, Taiwan, and Brazil, indicates that the proposed model is able to explain telemedicine adoption success. The proposed model utilizes the constructs identified and grounded earlier using culture, information privacy, information policy, and information security literature and using the PMT, RDT, TOC, and RAT theories.

The result of present research on the influence of culture on telemedicine adoption is mixed. The present research is unable to empirically validate the proposed impacts of culture on information security in the U.S. and Brazil ( $H_{1A}$  and  $H_{1C}$ ); however, there is an effect in Taiwan supporting  $H_{1B}$ . This is not surprising given that there are statistically significant differences, as shown in Table 7.1, in security, privacy, policy, adoption of telemedicine, and culture among the countries,  $F(5, 1450) = 33.981$ ,  $p < .0005$ ; Wilk's  $\lambda = 0.656$ , partial  $\epsilon^2 = .190$ . The multiple comparisons tests indicate that there is a significant difference in security between Taiwan and the U.S. ( $p=.005$ ) (see Table 7.2).

This dissertation's results disagrees with the results of Vroom and Solms (2004) that indicate organizational culture can help employees be aware of security rules and policies. Glaser (2009) also finds that the uncertainty avoidance part of culture influences information security in U.S., China, and Germany. This dissertation's results, however, agree with the results of Ifinedo (2008) study that indicates that there is no relationship between culture and IT security in Africa, Canada, Europe, Japan, Middle East, and USA. The Vroom and Solms (2004) and Glaser (2009) results, however, validate the Taiwan outcomes.

The result of present research indicates that culture has a positive and significant impact on information policy in all three countries, supporting H<sub>2</sub>A, H<sub>2</sub>B and H<sub>2</sub>C. This means the findings are in line with Solms and Solms (2004) who establish that for a certain policy to work and to be effective, it will have to be aligned to the culture of employees. Ifinedo (2012) also shows that subjective norms and individual's attitude as part of the culture significantly influence information security policies. Höne and Eloff (2002) also demonstrate that information security policies should complement the culture of the organization and these policies should be adaptable to the changes in the culture.

The results of present research suggest that information privacy is only affected by culture in the U.S. and Taiwan but not in Brazil (validating H<sub>3</sub>A and H<sub>3</sub>B but not H<sub>3</sub>C). The results from multiple comparisons show that privacy is significantly different between Taiwan and Brazil (see Table 7.2). The relationship between culture and privacy is somewhat mixed in the literature. Schmidt et al. (2008) show that, when it comes to privacy, there are important differences between countries with low uncertainty avoidance culture and high uncertainty avoidance culture. Ifinedo (2008), on the other hand, finds no differences between an individual's views on perceived privacy in different cultures. Bansal and Zahedi (2007) examine Hofstede's dimension of individualism and find no impact of individualism on health information privacy. Based on the results in the U.S. and Taiwan, the study by Schmidt et al. (2008) is validated (H<sub>3</sub>A and H<sub>3</sub>B). On the other hand, the results from Brazil agree with Bansal and Zahedi (2007) and Ifinedo (2008) (not supporting H<sub>3</sub>C).

The present research empirically demonstrates that telemedicine adoption in the U.S. and Brazil is not directly and significantly affected by culture despite what is hypothesized (H<sub>4</sub>A and H<sub>4</sub>C). Telemedicine adoption in Taiwan is, however, directly and significantly affected by

culture as is hypothesized in H<sub>4</sub>B. The multivariate comparisons results reveal that the cultural differences for Taiwan and Brazil are significant. But the same is not true for Taiwan and the U.S. Several recent studies present a positive and significant relationship between culture and the adoption of new technologies. Harris et al., (2005), for example, find a significant relationship between culture and m-commerce adoption. Similarly, Thatcher et al., (2003) discover a significant relationship between culture and technology adoption in general, telehealth devices (Whittaker and Soicher, 2011), health information systems (Peng and Kurnia, 2010), and electronic health records adoption in particular. Current research is unable to validate the results of the aforementioned studies in the context of telemedicine adoption in the U.S. and Brazil (see Figure 7.1). On the other hand, results from Taiwan validate the above studies. Moreover, this study is able to agree with Kifle et al. (2006) who state that in some countries uncertainty avoidance does not have much influence on telemedicine adoption.

The present research empirically shows that telemedicine adoption is also significantly affected by information security in the U.S. and Taiwan (H<sub>5</sub>A and H<sub>5</sub>B) and not in Brazil (H<sub>5</sub>C). The multiple comparisons tests indicate that there is not a significant difference in adoption of telemedicine between Taiwan and Brazil. (see Table 7.2). These support the findings of Kifle et al. (2006) who find, using an empirical study, security has a positive and significant influence on telemedicine adoption in some countries. Khoubati et al., (2008) show that security and confidentiality impact EAI adoption in healthcare. They determine that there is a need for a national level guidance about security of information. Burkhard et al. (2010) believe that perceived importance of ESPHR's privacy and security positively affects the adoption and use of ESPHRs for decision making. The results from the U.S. and Taiwan are in agreement with these authors. The present research finds that, as stated earlier, the information security construct does

not significantly impact telemedicine adoption in the context of Brazil ( $H_5C$  is not supported). This result from Brazil, however, supports the study by Hewitt (2009) who conclude that security does not impact EHR adoption.

The results of present research show that information policy in all three countries significantly and positively impacts telemedicine adoption supporting  $H_6A$ ,  $H_6B$ , and  $H_6C$ . The multiple comparisons test results indicate that there is a significant difference in adoption of telemedicine between Taiwan and the U.S. and also Brazil and the U.S. (see Table 7.2). Jennett et al. (2004), for example, emphasize the impact of policies on the adoption of EHR. Omary et al. (2009) also emphasize the impact of policies on the adoption of EHR. The research by Miller and Tucker (2009) shows that having privacy regulation for patients' information lower adoption of EMRs. The results from all three countries empirically validate the assertion made by Jennett et al. (2004), Omary et al. (2009), and Miller and Tucker (2009).

The results of present research demonstrate that information privacy doesn't significantly impact adoption of telemedicine in any of the three countries (not supporting  $H_7A$ ,  $H_7B$ , and  $H_7C$ ). This is an interesting finding because privacy of patient records should be of paramount concern to all involved in telemedicine adoption. The multiple comparisons test results also indicate that there is a significant difference in adoption of telemedicine between Taiwan and Brazil (see Table 7.2). Angst and Agarwal (2009) and Terry and Francis (2007) find that these issues play a very important role in EHR adoption. Perera et al. (2011), on the other hand, believe that privacy of patients in electronic health records does not impact the decision to use the EHR.

Lastly, the present research results reveal that in all three countries information policy impacts information security and privacy policies supporting  $H_8A$ ,  $H_8B$ ,  $H_8C$ ,  $H_9A$ ,  $H_9B$  and



H<sub>9</sub>C. This is validated by multiple comparisons test results that indicate that there is a no significant difference in security between Taiwan and Brazil (see Table 7.2). The multiple comparisons test results also show that there is a significant difference in policy between Brazil and the U.S. (see Table 7.2). This is in line with the Breaux and Anton (2008) methodology that allows patient information privacy and security requirements to be obtained from the HIPPA Privacy Law and, therefore, likely to be similar.

## **Chapter 9: Conclusion, Limitations and Suggestions for Future Research**

### **9.1 Conclusions**

The literature suggests that culture plays an important role in telemedicine adoption. In order to address this important issue, the present research first posited a new theory-based comprehensive model to explain factors affecting telemedicine adoption. The model is derived by combining elements from PMT, RDT, TOC, and RAT. The model is then empirically validated using data collected from the United States, Taiwan, and Brazil. The results from the SEM-based data analysis show that culture plays an important and direct role in telemedicine adoption in Taiwan and not in the U.S. and Brazil. Culture, however, indirectly influences telemedicine adoption in the U.S. and Brazil through information policy. This simply means that, before bringing in telemedicine, authorities must consider the culture of the country and its policies under which the telemedicine will function to make ensure that there is a synergy between the two.

It should also be noted that the empirical results show information security influences telemedicine adoption in the U.S. and Taiwan but not in Brazil. This suggests that before a telemedicine system is implemented, it is essential to have established security standards.

The empirical results show that information policy affects adoption of telemedicine in all three countries. This implies that information policies must be carefully looked at before a decision is made for telemedicine adoption.

The results of present dissertation reveal that information privacy doesn't significantly impact adoption of telemedicine in any of the three countries. This is an interesting finding, but it can just mean that the users believe that benefits of telemedicine outweigh the risk of violating patients' privacy.

## **9.2 Limitations**

The limitations of this study are discussed in this section. One limitation is due to the difficulty in gathering the data especially in these countries. Unwillingness to respond to a research survey was one of the biggest obstacles in collecting data. Many individuals did not fill out the online survey sent out to them and had to be asked in person. Also, in Brazil collecting data was very difficult because healthcare professionals did not want to take time to complete the survey resulting in the smallest sample size for this country. A larger sample could increase the validity of this dissertation's results.

Another limitation is convincing and reaching the physicians. In the U.S. most physicians were too busy to fill out the survey. A greater proportion of nurses were, therefore, included in the dissertation sample. In Brazil, due to the unavailability of physicians, they were excluded from the sample.

Another limitation of the present study is that it cannot be generalized to all countries, but it can be safely state that before a telemedicine is adopted, the authorities must pay close attention to telemedicine policies since these significantly and directly impact information security, privacy, and telemedicine adoption in all three countries.

## **9.3 Suggestions for Future Research**

This study highlights several avenues for future research on telemedicine adoption which I intend to pursue. First, a research study based on a pairwise comparison of data collected from the U.S. and Brazil will be conducted. This will be my second essay. Next, a study based on a pairwise comparison of data between the U.S. and Taiwan will be undertaken. This will be my third essay.

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## Appendix A

Please indicate to the extent you agree or disagree with the following statements by choosing the appropriate box.

### Patient Information Security Issues

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
1. Confidentiality of electronic patient records is an important issue that affects the utilization of telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Appropriate control of access to electronic patient records is an important factor in the use of telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Appropriate utilization of authentication procedures, before allowing someone to have access to electronic patient records, is important in the use of telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Appropriate use of authorization procedures, before allowing someone to have access to electronic patient records, is important in the utilization of telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Security of electronic patient records is an important factor that affects the use of telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Privacy Issues

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
6. A patient's electronic medical information provided for one purpose should not be used for another purpose unless it has been authorized by the patient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. A patient's electronic medical information should not be used for any purpose unless it has been authorized by the patient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Healthcare providers should not share a patient's electronic medical information with other providers without prior authorization from the patient	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Healthcare providers should not share a patient's electronic medical information with health care services (e.g., hospitals, and insurance companies) without prior authorization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

from the patient

### Financial Issues

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
10. In implementing telemedicine, it is a concern as to how the telemedicine project is funded	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. The way telemedicine services are reimbursed for the healthcare providers is a concern in accepting telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. The level of out of pocket expenses incurred by patients for using telemedicine services is a concern in accepting telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. Cost of telemedicine technology (e.g., electronic patients records, telehealth records, and telehealth platforms) is an issue in implementing telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. Maintenance of telemedicine technology and providing adequate training for using this technology is a factor in utilizing telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Policy Issues

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
15. The top manager awareness and willingness to adopt telemedicine is an issue in implementing telemedicine.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. The lack of organizational policies and procedures that encourage access to telemedicine technology is a factor in implementing telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
17. The lack of organizational policies and procedures that encourage the use of telemedicine is an issue in implementing telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. The lack of government laws and regulations that encourage the development of telemedicine technology is a concern in implementing telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
19. The lack of government laws and	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

regulations that encourage the access to and use of telemedicine technology is a concern in implementing telemedicine

☐ ☐ ☐ ☐ ☐ ☐ ☐

### Telemedicine Implementation

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
20. In order for it to be implemented, costs of telemedicine use need to be at least equal or less than the alternatives for healthcare providers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. In order for it to be implemented, costs of telemedicine use need to be at least equal or less than the alternatives for patients	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
22. Compliance with privacy and security laws as dictated by the Health Insurance Portability and Accountability Act (HIPPA) is a concern in implementing telemedicine	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
23. In implementing telemedicine, it must reduce time-to-diagnosis and time-to-treatment for those where distance to a health care facility is an issue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
24. In implementing telemedicine, it must reduce time-to-diagnosis and time-to-treatment for those where physical and mental condition is a factor	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### Hofstede (1994) Culture Dimensions

Please think of an ideal job, disregarding your present job, if you have one. In choosing an ideal job, how important would it be to you to..... (please mark one answer in each line across).

	Not at all Important	Very Unimportant	Neither Important nor Unimportant	Very Important	Extremely Important
25. Have sufficient time for your personal or family life	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
26. Have good physical working conditions (good ventilation and lighting, adequate work space, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
27. Have a good working relationship with your direct superior	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
28. Have security of employment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
29. Work with people who cooperate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

well with one another

30. Be consulted by your direct superior in his/her decisions
31. Have an opportunity for advancement to higher level jobs
32. Have an element of variety and adventure in the job

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**In your private life, how important is each of the following to you? (please mark one answer in each line across)**

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
33. Personal steadiness and stability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
34. Thrift	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
35. Persistence (perseverance)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
36. Respect for tradition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Never	Rarely	Sometimes	Quite Often	Very Often
37. How often do you feel nervous or tense at work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
38. How frequently, in your experience, are subordinates afraid to express disagreement with their superiors?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**To what extent do you agree or disagree with each of the following statements (please mark one answer in each line across).**

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
39. Most people can be trusted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
40. One can be a good manager without having precise answers to most questions that subordinates may raise about their work	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
41. An organization structure in which certain subordinates have two bosses should be avoided at all costs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
42. Competition between employees usually does more harm than good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
43. A company's or organization's rules should not be broken not even	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



when the employee thinks it is in the company's best interest

44. When people have failed in life it is often their own fault

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

#### Demographics and profile items

45. How old are you?

- ☐ 18-29
- ☐ 30-39
- ☐ 40-49
- ☐ 50-59
- ☐ 60+

46. Are you a:

- ☐ Male
- ☐ Female

47. Country of residence

- ☐ U.S.A
- ☐ Taiwan
- ☐ Brazil

48. Occupation

- ☐ Physician
- ☐ Physician Assistant
- ☐ Nurse Practitioner
- ☐ Medical Student
- ☐ Medical Resident
- ☐ Executive
- ☐ Information Technology
- ☐ Nurse
- ☐ Others

49. Years of professional experience

- ☐ 1-5
- ☐ 6-10
- ☐ 11-15
- ☐ 16-20
- ☐ 20+

## **Vita**

Parand Mansouri Rad, the second child of Davood Mansouri Rad and Iran Naderi Sani was born in Bryan, Texas. She completed her high school from Motahari High School, Hamedan, Iran. She earned a Bachelor of Arts Degree in English from Azad University, Hamedan, Iran. Shortly after her graduation, she came to the United States for higher education. She earned a Master of Science Degree in Industrial Engineering from New Mexico State University, New Mexico. She also taught Mathematics at Dona Ana Community College affiliated with New Mexico State University. In fall 2008, she entered the Graduate School at the University of Texas at El Paso, Texas, to pursue a Doctor of Philosophy in International Business with the specialization in Information Systems. She taught numerous Information Systems and Statistics courses at the University of Texas at El Paso. She also presented several research papers at Information Systems conferences.

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