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Predicting Adoption of Telemedicine by VA Mental Health Professionals

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DEDICATION

To my wife, Julie, who supported me each step of the way.

To my parents, Insuk & Jinsim, who sold their only house to send their three sons to the United States for a better future.

To my boys, Aaron and Noah for their love.

To all the men and women who gave their lives serving our country.

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Abstract

Providing primary health and specialty services to 3.4 million rural and highly rural veterans is a challenging task because of geographic barriers and the uneven distribution of rural healthcare providers. Although the Veterans Health Administration is hoping that technology such as telemedicine expands availability of specialties' access to rural veteran patients, the adoption of telemedicine has been slow.

The purpose of this study was to investigate factors that affect the telemedicine adoption rate by mental health professionals in Veterans Affairs. The research study involved psychiatrists, psychologist, primary care providers, clinical social workers, and other mental health professionals from VA medical centers and Community-Based Outpatient Clinics that have experience in telemedicine or are about to use telemedicine. Rogers' theory of diffusion of innovations provided a framework for analysis of the diffusion of innovation at a complex systems level taking into account the differences in users' rate of adoption.

The data for this analysis were collected using an online survey that remained open for 14 weeks and also from Veterans Affairs' electronic medical records for gathering the number of telemedicine encounters. The survey questions consisted of

demographic, perceived characteristics, self-reported usage, and recommendation rate on the VA telemedicine. The survey contained 33 items to measure the perceptions of adopting telemedicine focused on variables that were found to affect the rate of adoption.

Correlations were used with adoption rate in order to discover whether using Clinical Video Tele-Heath increased the strength of agreement with the innovation attributes. As Moore and Benbasat predicted, voluntariness negatively correlated with adoption rate, and all other constructs were positively correlated except Image.

Pearson Correlation was conducted to examine potential multi-collinearity problems. None of the squared correlations was close to 0.80 to suggest a problem with multi-collinearity among the research variables (Hair, Anderson, Tatham, & Black, 1995). Therefore, there was no evidence of significant multi-collinearity among the research variables.

A stepwise multiple regression was conducted to evaluate eight perceived characteristics of innovation that were necessary to predict telemedicine adoption by VA mental health professionals at the Department of Veterans Affairs. The multiple correlation coefficient was .75 for trialability and compatibility, indicating approximately 55.5 percent of the variance of the adoption rate could be accounted for by trialability and compatibility.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

Chapter 1

Introduction and Purpose

Background

The Department of Veterans Affairs (VA) was established in 1930 to provide assistance to veterans. Since then it has grown from 54 hospitals to 153 medical centers, 1,400 community-based outpatient clinics (CBOCs), community living centers, veterans centers, and domiciliaries. The VA Health Administration (VHA) is the United States' largest integrated health care system providing comprehensive health care services to more than 8.3 million veterans each year with a budget of $47 billion and 239,000 staff (U.S. Department of Veterans Affiars, 2012).

About 41 percent of these 8.3 million veterans live in rural or highly rural areas (VHA Office of Rural Health, 2012). To enhance access to and quality of health care for 3.4 million veterans residing in rural regions of the country, the VHA began implementing community-based outpatient clinics in 1995. Since the VHA began its CBOC initiative, more than 800 clinics have opened throughout the United States (Panangala & Mendez, 2010).

A CBOC is defined as "a fixed health care site that is geographically distinct or separate from its parent medical facility" (Panangala & Mendez, 2010). Although services delivered to veterans at CBOCs vary, primary care, mental health, and specialty referral services are available in most places. Primary care includes assessment, diagnosis, and medically necessary treatment(s) for physiological and pathological conditions. Many sites include at least one mental health provider, most of whom are psychologists. Rosenheck's study (2000) indicates that CBOCs not only improve

geographic access to primary care, particularly for veterans in rural areas but also access to mental health services for veterans leading to a dramatic increase in the number of veterans served from these rural areas.

Veterans from rural areas have huge barriers, however, in terms of receiving specialty services. Since CBOCs do not offer a diverse range of health care services at rural locations, these patients still have to travel long distances to receive the specialty services to which they are entitled. Traveling to the nearest VA medical center can be a difficult and arduous task. The health care challenges facing rural veterans are similar to those that face all rural Americans: distance from health care facilities, transportation issues, lack of specialty care, and difficulty in recruiting and retaining medical providers. For patients who have conditions such as traumatic brain injury (TBI) or spinal cord injury, travel becomes even more complicated. Travel time is also time away from the veteran's work and family.

One of the biggest challenges for the VA's CBOCs is recruiting and retaining medical doctors at rural locations. The distribution of physicians has long been unbalanced between urban and rural areas in the United States. Although rural regions constitute 20 percent of the U.S. population, only 11 percent of physicians practice in rural vicinities (Ricketts, 2000). This shortage of professionals creates a huge impediment for the VHA when attempting to create stable medical teams in CBOCs. The problem also affects patients directly, with a high turnover of primary care doctors translating to a patient having to meet new and different doctors frequently rather than receiving care from a single doctor who knows the patient's condition and family history. Recruiting and retaining medical specialists in rural areas is almost impossible when demand in

urban areas is high. Rural patients with chronic diseases have no choice but to drive long distances in order to receive the care that they need.

Hart (2000) has described telemedicine as the single most important way to equalize the difference in resource availability between rural and urban areas. Telemedicine removes time and distance barriers for delivering health care services by allowing patients to stay in their own hometown and connecting with specialists by video teleconference. In 1977 the VHA was piloting the use of telemedicine in Nebraska and started a major expansion of telemedicine infrastructure throughout the country since the 1990s.

Approximately 1,000 clinical video conferencing devices are currently available within the VA's clinical enterprise network, linking VA medical centers with 500 CBOCs. In 2011 the VA telemedicine program provided more than 250,000 consults and expected to see a 50 percent growth by the end of 2012. The VA clinical video telemedicine program currently provides poly-trauma, tele-mental health, tele-rehabilitation, and tele-surgery. However, telemedicine programs wouldn't work effectively without making patients' data available to medical professionals from VA medical centers and CBOCs. Telemedicine systems must be integrated with electronic medical records in order to provide safe and effective medical services to patients. Treating patients with incomplete or without patient information could lead to a misdiagnosis, which could result in serious consequences. Collaboration between specialists at the medical centers and the clinicians at CBOCs is key to this successful telemedicine program.

In their *New England Journal of Medicine* article, "Use of Electronic Health Records in U.S. Hospitals," Jha, DesRoches, Campbell, Donelan, Rao, Ferris, and Blumenthal (2009) reported that only 1.5 percent of U.S. hospitals have a comprehensive electronic records system, and an additional 7.5 percent have a basic system. Computerized provider order entry for medications has been implemented in only 17 percent of hospitals. On the other hand, the VA has implemented electronic medical records (EMR) at every VA medical center and CBOC throughout the country. The Veterans Health Information Systems and Technology Architecture (VistA) is the VA's health information technology platform designed to store inpatient and outpatient electronic health records for VA patients, as well as handle administrative functions. The VistA system consists of more than 160 integrated software modules for clinical care, financial functions, and infrastructure and serves as one of the world's models for health care information technology.

The benefits of using EMR are obvious. Integration of all the patients' record keeping creates efficiency and preserves critical medical information for patients and providers. EMR improves legibility, accuracy, and completeness resulting in less potential for medical error, such as allergic and adverse drug reactions. A clinical decision support (CDS) system integrated with VistA is designed to assist medical professionals with decision-making tasks at the point of care for the individual patient and to alert medical providers with important reminders and recommendations based on best-practice guidelines. According to a systematic review of 100 studies, CDS improved practitioner performance by 64 percent and improved patient outcomes in 13 percent of the studies (Adhikari, Beyene, Sam, & Haynes, 2005). Most importantly, VistA allows

specialists at medical centers and clinicians at CBOCs to exchange patients' information securely for telemedicine consultations.

According to Dr. Andrew Watson from the Center for Connected Medicine, three top barriers to telemedicine adoption exist:

1. Lack of an adequate plan for telemedicine reimbursement,
2. Inadequate sharing of health information, and
3. Mind-sets that need to be more open to telemedicine's possibilities (Watson, 2012).

Telemedicine reimbursement distribution isn't an issue at the VA, because all VA medical centers and VA CBOCs are under one administration. Also, as mentioned above, the VA already has a state-of-the-art electronic medical record keeping system, and every VA facility has a VistA system that allows clinicians to exchange patient information between medical centers and CBOC. According to Adam Darkins (2013), director of the VA national telemedicine program, the implementation of telemedicine was championed by VA senior leadership.

Although telemedicine seems to be the perfect fit for veteran patients who live in rural areas, the adoption of telemedicine has been slow. Large numbers of patients from rural areas are still driving to VA medical centers to receive specialty care that telemedicine could provide in their own hometowns. The VA is in a unique position to conduct research to better understand the adoption of telemedicine without considering reimbursement and electronic medical records integration issues.

According to the 2012 VA Office of Public Health report, approximately 2.4 million troops have served since the beginning of the conflicts in Iraq and Afghanistan.

About 1.5 million Operations Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) veterans left active duty and became eligible for VA healthcare. About 53 percent (424,803) of OEF/OIF/OND veterans who are enrolled and obtained VA health care have received mental disorders services. Addressing PTSD (Post-Traumatic Stress Disorder), depression, and traumatic brain injury (TBI) among those who deployed to Afghanistan and Iraq is a national priority.

To align with the high priority that the VA has placed on behavioral health assessment, treatment, and program and to eliminate the variability in terms of adopting different types of telemedicine, this research is focused on tele-mental service.

Purpose of Study

The purpose of this study was to investigate factors that affect the telemedicine adoption rate by mental health professionals at the VA. The research study involved psychiatrists, psychologists, primary care providers, clinical social workers, and other mental health professionals from VA medical centers and CBOCs that have experience in telemedicine or about the use of telemedicine. Rogers' (1983) theory of diffusion of innovations provided a framework for analysis of the flow of innovation at a complex systems level, taking into account the differences in users, rate of adoption, types of information and decisions, and communication channels, while simultaneously facilitating identification of highly specific attributes of an innovation that affects dissemination.

Rogers identified five perceived characteristics of innovations that a variety of diffusion studies have shown to consistently influence adoption:

1. Relative Advantage - the degree to which an innovation is perceived as being better than its precursor;
2. Compatibility - the point at which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters;
3. Complexity - the extent to which an innovation is perceived as being difficult to use;
4. Observability - the measure of results of an innovation are observable to others; and
5. Trialability - the degree to which an innovation may be experimented with before adoption.

Moore and Benbasat (1991) identified two more constructs beyond Rogers' classification that were thought important factors in the decision of adopting innovation in the organizations:

- Image - the degree to which use of innovation is perceived to enhance one's image or status in one's social system, and
- Voluntariness of use - the scale to which use of the innovation is perceived as being voluntary or of free will.

The objective of this study was to:

- Contribute to current research on telemedicine adoption,
- Diffuse innovations, and
- Provide recommendations to VA policy makers on improving the usage of telemedicine.

Research Question

The core research question was:

> What perceived characteristics of innovation predict telemedicine's rate of adoption by VA mental health professionals?

The sub-research question was:

> What combination of perceived characteristics of innovation best predicted telemedicine's rate of adoption by VA mental health professionals?

The perceived characteristics of innovation are explored within these questions.

Summary

Providing primary health and specialty services to rural veterans is a challenging task because of geographic barriers and the uneven distribution of rural health care providers. The VHA hopes that technology such as telemedicine changes the uneven distribution, yet the adoption has been slow. A large number of veteran mental health patients from rural areas are still traveling long distances to see specialists for their care. This study investigated factors that affect the telemedicine adoption rate by VA mental health professionals.

Definition of Terms

Community-Based Outpatient Clinics (*CBOCs*) - A VA-operated clinic or a VA-funded or reimbursed health care facility or site that is geographically distinct or separate from the parent medical facility.

Department of Veterans Affairs (*VA*) - Established as an independent agency under President Herbert Hoover by Executive Order 5398 on July 21, 1930, the VA was elevated to cabinet level on March 15, 1989 (Public Law No. 100-527). The VA's mission is to serve U.S. veterans and their families with dignity and compassion and to be their principal advocate in ensuring that they receive medical care, benefits, social support, and lasting memorials promoting the health, welfare, and dignity of all veterans in recognition of their service to the United States. The VA comprises a central office located in Washington, DC and field facilities throughout the country administered by its three major line organizations: the Veterans Health Administration, the Veterans Benefits Administration, and the National Cemetery Administration. Services and benefits are provided through a nationwide network of 153 hospitals, 784 community-based outpatient clinics, 134 community living centers, 90 domiciliary residential rehabilitation treatment programs, 264 vet centers, 57 veterans' benefits regional offices, and 131 national cemeteries.

Domiciliary - A VA facility that provides care on an ambulatory, self-care basis for veterans disabled by age or disease who are not in need of acute hospitalization and who do not need the skilled nursing services that a nursing home provides.

VA Medical Center (*VAMC*) - VA hospital facilities that provide a diverse range of health care services to veterans.

Veterans Health Administration (*VHA*) - VA organizational component that is responsible for coordinating and providing health care for all enrolled veterans based upon need and service. With over 160 VA medical centers (VAMCs) nationwide, VHA manages one of the largest health care systems in the United States. VAMCs within a Veterans Integrated Service Network work together to provide efficient, accessible health care to veterans in their areas. Additionally, the VHA conducts research and provides education as well as emergency medical preparedness information.

Veterans Integrated Service Network (*VISN*) - This organizational element within the VA's health care system includes a total of 21 VISNs that provide geographic oversight to a collection of health care facilities within the established jurisdictions.

Chapter 2

Literature Review

This chapter reviewed the most current literature on rural veterans, mental health veterans, telemedicine, diffusion of innovations, and the development of perceived characteristics of innovations instrument.

Rural Veterans

The U.S. Census Bureau defines "urban" as "comprising all territory, population, and housing units in urbanized areas and in places of 2,500 or more persons outside urbanized areas." "Rural" encompasses all population, housing, and territory not included within an urban area. Rural areas have fewer than 2,500 persons outside of an urban area, and highly rural areas have fewer than 7 persons per square mile in a rural setting (U.S. Census Bureau, 2010). About 3.4 million veterans, or 41 percent of Veterans Administration (VA) enrolled patients, live in rural or highly rural areas (VHA Office of Rural Health, 2012).

There is a significant shortage of rural health care providers in the United States. Only 11 percent of the available physicians are currently providing care to 20 percent of the total U.S. population (U.S. Department of Health and Human Services Health Resources and Services Administration, 2010). Although only 20 percent of Americans live in rural areas, almost 50 percent of all military recruits come from small towns and rural areas. According to the Department of Defense (DOD) casualty figures in 2005, 42.9 percent of service members killed in action during Operation Iraqi Freedom and 43.9 percent of the service members killed in action during Operation Enduring Freedom

were from rural cities and towns (Heady, 2011; U.S. Department of Defense Office of the Under Secretary of Defense Personnel and Readiness, 2008).

Not only a disproportionate measure of veterans from rural and highly rural areas, rural veterans face difficulties receiving health care service**.** In the late 1970s the Veterans Health Administration (VHA) started reimbursing eligible veterans for their travel to VA medical centers in order to address their needs (Nelson, Hicken, West, & Rupper, 2011). In 1995 the VHA started building community-based outpatient services. Distance from health care facilities, transportation issues, lack of specialty care, and difficulty in recruiting and retaining medical providers have been critical issues for rural veterans. As a result of these and other issues, rural populations tend to be in poorer health (Hedeen, Heagerty, Fortney, Borowsky, Walder & Chapko, 2002).

The rural population in the United States is usually older, has lower socio-economic status, is more likely to be uninsured, in fair or poor health, suffer from chronic disease, and have higher mortality rates associated with chronic disease compared to the urban population. Rural veterans exhibit the same characteristics as the rural population. Compared to urban veterans, rural veterans are older, have greater physical and mental comorbidities, have lower physical and mental quality-of-life scores, and live much farther away from VA and non-VA health care facilities. Although rural veterans have more health issues, they use VA health care services less than urban veterans (Morgan, Teal, Reddy, Ford, & Ashton, 2005).

According to Morgan et al. (2005), veterans represent a distinct and special population. As a group, they are predominately male, more educated, and better off financially compared to the U.S. general population (Klein, 2001; Klein & Stockford,

2001). Most veterans at the time of the research had served in World War II, the Korean War, and the Vietnam War. Their median age was 55, with veterans comprising a majority of all civilian males older than 65 (Morgan et al., 2005). Surprisingly, veterans who qualify to use VA Health Administration services are an even more highly select population of veterans. Although all honorably discharged service members are eligible to receive care through VHA facilities, priority for care goes to veterans who have service-related disabilities or who meet specific criteria for financial need. Others can receive care with co-payments and a lower priority for their care (Morgan et al., 2005).

Users of VA facilities are poorer, older, less educated, more likely unemployed or underemployed, more likely to report poorer physical and mental health, and more chronic health conditions than either the general population or veterans who do not use the VA health care system (Weeks, Wallace, Wang, Lee & Kazis, 2006). The median self-reported household income of enrolled veterans is $20,400 for those from urban areas, $19,632 from rural areas, and $18,528 from highly rural areas (Bair, n.d.). An estimated 15 percent of homeless veterans live in rural areas. Heady (2011) once called them “invisible heroes” - invisible because the public is unaware that a disproportionate number of veterans reside in rural and highly rural areas where they lack the health care services to which they are entitled.

In 2006 President George Bush signed the Rural Veterans Care Act to develop centers of excellence to improve health care services for rural veterans, making them more effective and closer to home (Weeks, Wallace, West, Heady & Hawthorne, 2008). This act was initiated for the following reasons:

1. Veterans from rural areas have lower health-related quality-of-life scores than urban veterans, in aggregate, after risk adjustment and across disease categories.
2. Although the VA has improved access to primary care services by establishing hundreds of CBOCs, access to specialty and inpatient care services is still lacking. More than 35 percent of veterans still had restricted access to primary care services, according to the VA's Capital Asset Realignment in 2001.
3. Forty-one percent of veteran patients currently reside in rural or highly rural areas (VHA Office of Rural Health, 2012).

In 2007 the VA Office of Rural Health (ORH) was developed to "improve access and quality of care for enrolled rural and highly rural Veterans by developing evidence-based policies and innovative practices to support the unique needs of enrolled Veterans residing in geographically remote areas" (VHA Office of Rural Health, 2012).

Providing primary health and specialty services to rural veterans is a challenging task because of geographic barriers and the uneven distribution of rural health care providers. The VHA and ORH hope that technology such as telemedicine changes the uneven distribution.

Mental Health Veterans

According to the 2012 VA Office of Public Health report, approximately 2.4 million troops have served since the beginning of the conflicts in Iraq and Afghanistan. About 1.5 million Operations Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND) veterans have left active duty and become

eligible for VA health care (VA Office of Public Health, 2012). It is unprecedented that not only a high proportion of the armed forces are being deployed but also the duration of deployment has been longer and redeployment to combat has been common (Hosek & Kavanagh, 2006). Due to the advancement of combat medicine and body armor, the casualty rates of killed or wounded are much lower compare to Vietnam and Korea wars (Regan, 2004; Warden, 2006). More wounded soldiers are surviving war experiences that would have led to death in prior wars. Although it is great news that more service members are surviving, it's creating a different kind of casualty – invisible wounds, such as mental health conditions and cognitive impairments.

Significant numbers of service members returning from Iraq and Afghanistan have suffered traumatic brain injuries (TBI), and many have shown symptoms of post-traumatic stress disorder (PTSD) and depression. They find that readjusting their lives off battlefield and reconnecting at home, work, and school is an ongoing struggle. RAND Corporation (2008) conducted a survey with 1,965 veterans who returned from Operations Enduring Freedom and Operation Iraqi Freedom (OEF/OIF) regarding trauma exposure. It reported that almost 50 percent of all participants experienced tragic events such as

1. Having a friend who was seriously wounded or killed,
2. Seeing dead or seriously injured noncombatants, and/or
3. Witnessing an accident resulting in serious injury or death.

Iraq and Afghanistan Veterans of America (IAVA, 2013) also reported in the 2013 member survey that 30 percent of respondents have thought about taking their own lives, and 45 percent of respondents know an Iraq/Afghanistan veteran who has

attempted suicide. Since 2001 about 3,000 active duty service members have committed suicide. Although addressing PTSD, depression, and TBI among those who deployed to Afghanistan and Iraq is a national priority, the VA is struggling to meet the demand.

According to the VA, any vet asking for help is supposed to be evaluated within 24 hours and start treatment within two weeks, but a new investigation by the agency's inspector general says this isn't happening. A report from the Center for Investigative Journalism (Glantz, 2013) shows that it takes 273 average days for veterans to go through VA admission processing claims, and veterans from major cities such as San Francisco, Los Angeles, and New York could wait for almost two years.

Some veterans refused to get mental health treatments due to the fear of losing respect from colleagues and hurting their careers. Stigma associated with mental illness is a major barrier for veterans in need of mental health care. Privacy and confidentiality are crucial for those who are considering mental health care. According to the Substance Abuse and Mental Health Services Administration (SAMHSA) (2012), service members frequently expressed fear of personal embarrassment, disappointing family, and dishonorable discharge as motivations to hide symptoms of mental illness.

Veterans seeking mental health care in rural areas may not have access to any psychiatrists at all without traveling long distance to VA medical centers. The VHA and ORH (Office of Rural Health) hope that telemedicine changes the uneven distribution in behavioral health services.

Telemedicine

The World Health Organization (WHO) makes a distinction between tele-health and telemedicine. "Tele-health is the integration of telecommunications systems into the

practice of protecting and promoting health, while telemedicine is the incorporation of these systems into curative medicine" (World Health Organization, 1997). Adam Darkins, the director of the VA telemedicine program, believes that telemedicine is a subset of tele-health (Darkins & Cary, 2000). This paper uses the words "tele-health" and "telemedicine" interchangeably.

Telemedicine is the transfer of patients' data - including high-resolution images, audio, video, and patients' records - from one location to another. This transfer may take place in a variety of forms of telecommunications technology, including landline, ISDN (Integrated Services Digital Network), DSL (Digital Subscriber Line), the Internet, satellite, etc. (Ramos, 2010).

Even as early as 1764, Dr. William Cullen used mail as a form of telemedicine writing 200 consultation letters per year to communicate with his patients. He learned that getting quantitative data such as a patient's pulse was more informative than seeing actual patients in some instances.

Physicians and patients were exchanging medical information during the late 1800s and the early 1900s through the use of telegraph, telephone, and radio. In 1862 during the American Civil War, Major Albert Myer, a surgeon and a medical officer in the Union Army, became the first chief signal officer to use a telegraph to request medical supplies and arrange the transportation of patients. In the early 1900s people living in rural areas used two-way radios to communicate with doctors in Australia. In 1905 Einthoven successfully transmitted and received heart impulses via a telephone line from the University of Leiden Hospital (Netherlands) to his laboratory about a mile away from each other (Blackburn, 1957). He was also able to notify physicians from a distance

when a patient's heart had dropped a beat. He was awarded the Nobel Prize in physiology and medicine in 1924 for improving the electrocardiograph and his related research (Einthoven, 2003) and is known as the father of telemedicine.

In 1910 Sidney Brown invented the first electrical stethoscope by using a telephone relay. He replaced the telephone headpiece with a transformer and the stethoscope and was able to transmit the sound of the heart over several miles from his house to doctors in various parts of London. He stated, "The sounds received in the telephone were as good and clear as when heard locally" (Brown, 1910; Gregory, 1951).

In 1920 telecommunications was being used on a large scale for medical purposes in Norway (Rafto, 1955). Bergen's Haukeland hospital implemented a remote radio service for ships at sea whereby medical personnel were able to communicate with doctors at the hospital for diagnoses and recommendations for treatments. Doctors were able to guide ship providers to conduct even complicated surgical operations by radio. In 1947 Johns Hopkins televised a black and white surgical operation TV program for educational purposes (Castle, 1963). The following year the American Medical Association (AMA) used a color television to provide continuing medical education (Richards, 1978). The transmission of the Roentgenogram (X-ray) was also taking place in the 1950s (Gershon-Cohen & Cooley, 1950).

In the 1950s there was serious concern about caring for large numbers of mental patients with only limited medical personnel around the country. Tucker, Lewis, Martin, and Over (1957) from Agnews State Hospital in California investigated the effectiveness of closed-circuit television for mass therapy. Tucker and his colleagues demonstrated the closed-circuit television program to administrators and employees from numerous

departments. There was general consensus that closed-circuit television would be a useful tool for mental hospitals. According to their surveys, 73 percent indicated that the system would be useful for educational and training purposes, 38 percent indicated that it would be useful for group care and group therapy, and only 13 percent felt that it would be useful for individual therapy.

Eventually the project closed due to the systemic inability to deliver the service economically to large numbers of patients. While this test was going on in California, the Nebraska Psychiatric Program also started testing closed-circuit two-way television in psychiatric consultations and group therapy. The test proved in 1957 that the providers and patients were able to interact and consult effectively over long distance (Tucker, Lewis, Martin, and Over, 1957).

Due to the success of the tele-psychiatry pilot project in Nebraska, the National Institute of Mental Health (NIMH) awarded a seven-year grant to implement tele-psychiatry services between the Nebraska Psychiatric Institute in Omaha and the Norfolk State Hospitals in 1964 (Benschoter, 1971). Through closed-circuit television, they were able to provide psychiatric, neurological, and other related specialized medical consultations to patients and educational and in-service trainings for Norfolk State Hospital staff at all levels, despite the 112 mile distance. The project met every primary goal of the grant; in addition, family members who lived in the Omaha area were able to have virtual visits with institutionalized patients, and discharged patients were able to use the system as well. Unfortunately, the program wasn't able to prove that it was financially sustainable beyond the funding period. The cost of transmission was $5.80 per

hour in 1960 for the dedicated use of the microwave link between the two cities ($40.60 per hour in 2008 dollars).

In 1968 the very first complete prototype telemedicine system was established in Boston (Park, 1974). Unlike the Nebraska program, which only provided psychiatric consultations, the new system provided a wide range of primary care and emergency services to the employees as well as the traveling public at Logan International Airport by linking with Massachusetts General Hospital (MGH). This same system was expanded to the Department of Veterans Affairs Psychiatric Hospital in Bedford, MA. The MGH and VA hospital telemedicine link was designed for tele-consultation services, including speech pathology and psychiatric services that allow doctor-to-doctor consultation while the patient is present during the session. However, the VA's medical professional staff was reluctant to adopt the tele-consultation system, because they weren't comfortable receiving critiques from another doctor in front of patients.

Established in 1968, the New Hampshire–Vermont Medical Interactive Television Network (INTERACT) (Hays, 1973) was the first telemedicine program connecting ten health facilities in two different states receiving $1.1 million from several federal agencies (about $6.4 million in 2008 dollars). This project was the largest telemedicine program to that point. Since the system was connected to multiple sites, the cost of transmission was about $75 per hour (approximately $400 per hour in 2008 dollars). INTERACT was used mostly for educational and training purposes and was being utilized for direct patient care only 10 percent of the time. By 1970 it became obvious that INTERACT wasn't financially sustainable due to the high operational cost. It was

reported, “Efforts to achieve self-sufficiency and improve the efficiency and effectiveness of operations were not successful” (Hageboeck & Rosenberg, 1975).

Nebraska’s Psychiatric Institute, Boston’s Logan Airport Medical Station, and the Vermont–New Hampshire network also closed down after funding was exhausted, mostly due to highly overpriced transmission costs. These programs weren’t able to establish a critical mass of applications or financial suitability. Up until recently, telemedicine has utilized expensive telecommunications technologies such as telegraph, telephone, radio, and closed-circuit television. In the 1970s the emergence of telemedicine on a large scale was imminent as the nation committed to an electronic highway system called the “wired nation” (Smith, 1972). Just as the United States developed a new interstate highway system to modernize the flow of automotive traffic beginning in the 1950s**,** it was about to change the way of exchanging information and ideas by developing the communication superhighway.

In the midst of this new era of telecommunication, the Health Care Technology Division (HCTD) of the U.S. Department of Health provided funding to seven telemedicine projects to investigate the potential of telecommunications to “cut costs and improve the efficiency of health care services” (Bashshur & Shannon, 2009). This initiative was designed for three implementation stages:

1. To identify the appropriate technology infrastructure for telemedicine;
2. To generate estimates of future telemedicine utilization requirements including technological configurations, human resources, and logistics; and
3. To establish cost effective communication and transportation networks for telemedicine. (p.210)

As both the government and the funded projects started to implement telemedicine infrastructures, they realized that they underestimated the complexity of building the system while feeling political pressure to demonstrate success to receive continued funding. Unfortunately, the three implementation stages quickly became one stage; grantees spent most of the time in the beginning trying to set up a robust technology infrastructure. Regrettably, they weren't able to demonstrate financial sustainability at the end. The purpose of the grant was to establish successful telemedicine projects that would become part of mainstream medical care, but all of the projects closed down after funding expired. All of the project managers expressed that the acceptance level for telemedicine from patients and medical professionals was high, and patients didn't find telemedicine impersonal or invasive (Park, 1974).

From a long-term historical perspective, the diffusion of tele-health was erratic until the late 1980s when state-based initiatives motivated the development of large networks within states. According to a survey conducted in 1996, 28 states were very interested in developing tele-health, and 16 states had already taken the initiative of developing tele-health infrastructures (Lipson & Henderson, 1996). Georgia, Kansas, Texas, South Dakota, and Louisiana were identified as states having "well-developed" tele-health programs. Important lessons that the state of Georgia learned from developing a large tele-health project are:

- Establishing long-term sustainability through ongoing collaboration among university, state government, and rural community centers is essential to success.

- There is no guarantee that patterns of clinical practice and utilization will change as a result of installing a telemedicine system.
- There is no guarantee that physicians and patients will use a telemedicine system even if the technology is available (Stachura, 2001).

Georgia's telemedicine project had its beginnings in a financial settlement with a telecommunications carrier. Out of $140 million that Georgia received, the state used $73 million to promote statewide programs in telemedicine and distance education between 1992 and 2003. Georgia had little planning for or consideration of an ongoing revenue stream to sustain its operation. Unfortunately, the program had to cease operations (GHSU Telehealth, 2012).

Texas has two separate telemedicine programs, one in the eastern section of the state and the other in the western section - both supported by state and federal funds. Due to reimbursement issues, expansion of the telemedicine project was limited (Field, 1996)

Alaska is the largest state in the United States - twice as large as Texas and bigger than France. About 75 percent of communities in Alaska have no road connection to a hospital (Hudson, 2005) and have a doctor shortage of 30 percent (Tanner, 2007). Additionally, traveling to certain areas is hazardous due to extreme weather conditions. Although Alaska's telemedicine program received multiple rounds of funding, that state couldn't sustain the program.

On the other hand, the Arizona Telemedicine Network didn't have the luxury of starting the project immediately due to insufficient funds, so the network had to carefully create a business plan, form partnerships, and develop a sustainable model for building a statewide telemedicine system. Unlike telemedicine in Georgia, Arizona's program has

been able to sustain its operations and became a great example for other states interested in developing telemedicine.

Since the 1990s, the VA has invested in a major expansion of telemedicine infrastructure throughout the country. The VA clinical video telemedicine program currently provides poly-trauma, tele-mental health, tele-rehabilitation, and tele-surgery. Tele-mental is currently the most used telemedicine service among all telemedicine services the VA provides. According to Dr. Linda Godleski, director of the national tele-mental health center for the Department of Veterans Affairs, the number of patients who received mental health care by telemedicine each year grew from 8,000 to 55,000 VA patients. The VA's tele-mental program began with remote medication management in the early 2000s, but today it offers an entire spectrum of mental health services. Dr. Godleski said, "In addition to medication management, today's services include individual therapy, couples therapy, group therapy, family therapy, behavior therapy, and psychological testing. Treated disorders include affective disorders, anxiety disorders, post-traumatic stress disorder, psychotic disorders, and substance abuse disorders" (Zoler, 2012).

In a recent publication by Godleski, Darkins, and Peters (2012), they compared clinical outcomes of tele-mental patients and non-tele-mental patients between 2006 and 2010 and found that patients who received mental health care by telemedicine had 24 percent fewer psychiatric hospital admissions than patients who had face–to-face encounters with mental health providers. Although they can't explain the clear association between the use of telemedicine and decreased hospitalization rates, they believed that remote tele-mental services may circumvent the need for hospitalization by

making mental health clinicians readily available for patients on the verge of decompensation or dangerousness.

Despite the conclusive evidences that telemedicine technology is an effective way to provide health care services to patients, questions still remain about the costs and benefits of telemedicine delivery compared to in-person care. Therefore, the diffusion of telemedicine has been slow and limited. According to Bashshur (1997), "When technological innovations are not accepted or implemented properly, generally failure may be traced to a poor fit between the nature of the innovation and the vested interests, resources, and expectations of its major gatekeepers." These major gatekeepers include payers, providers, policy makers, engineers, and consumers.

Telemedicine is a sector "in perpetual pilot phase . . . just waiting . . . the pending market breakthrough . . . the devices, sensors, software and services that will see rapid market growth and acceptance. We are still waiting," according to John Moore, who moderated the MIT Enterprise Forum Event in 2011, "What Does Telemedicine Say about Technology Adoption?" (Jacobson, 2011). Panelists who are entrepreneurs and pioneers in telemedicine stated that they are optimistic that sometime in the next ten years telemedicine will be mainstream in the United States.

Diffusion of Innovation

The benefits of telemedicine for rural areas are obvious. Rural veteran patients can simply drive to local clinics to see a specialist through a clinical videoconference system instead of driving several hours to see the same doctor. The question still remains: Why aren't more VA mental health professionals using telemedicine? According to

Rogers (2003), “Getting a new idea adopted, even when it has obvious advantages, is difficult.”

As described previously, telemedicine technology has been around at least 100 years. Studies have shown repeatedly that it is an effective way to get treated, and the satisfaction of patients who use telemedicine is also high. Nonetheless, adoption seems to be slow within the VA as well as non-VA organizations. Several barriers to telemedicine exist in a non-VA health care setting, including lack of telemedicine reimbursement, electronic medical records not connected among hospitals and clinics, and lack of organizational buy-in. Unlike the private sector, the VA has one payer source, electronic medical records are being used since 1997, and VA senior leadership fully supports the use telemedicine technology. Telemedicine seems to be a perfect fit at the VA, yet adoption of telemedicine has been slow.

Diffusion is a special type of communication in which the messages are about a new idea. Good ideas aren’t always adopted just because they are good ideas. Rather, a good idea is sometimes adopted because innovation is “communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 5). A good example is the Dvorak keyboard. After years of research, Professor August Dvorak at the University of Washington in 1932 created a much more efficient keyboard arrangement than the QWERTY keyboard. At that time everyone was used to using the QWERTY keyboard on which Christopher Sholes had purposefully anti-engineered the letter order to minimize jamming on typewriters. Hence, the QWERTY keyboard was intentionally designed in 1873 to slow down typists. The Dvorak keyboard has proved to be not only faster for typing but also with less jamming**.** Even the American National Standards

Institute and the Equipment Manufacturers Association have approved the Dvorak keyboard. On the basis of its overwhelming advantages, one might expect that the Dvorak keyboard should be adopted, but even after 80 years, almost all typists still use the inefficient QWERTY keyboard (Rogers, 2003, p. 8).

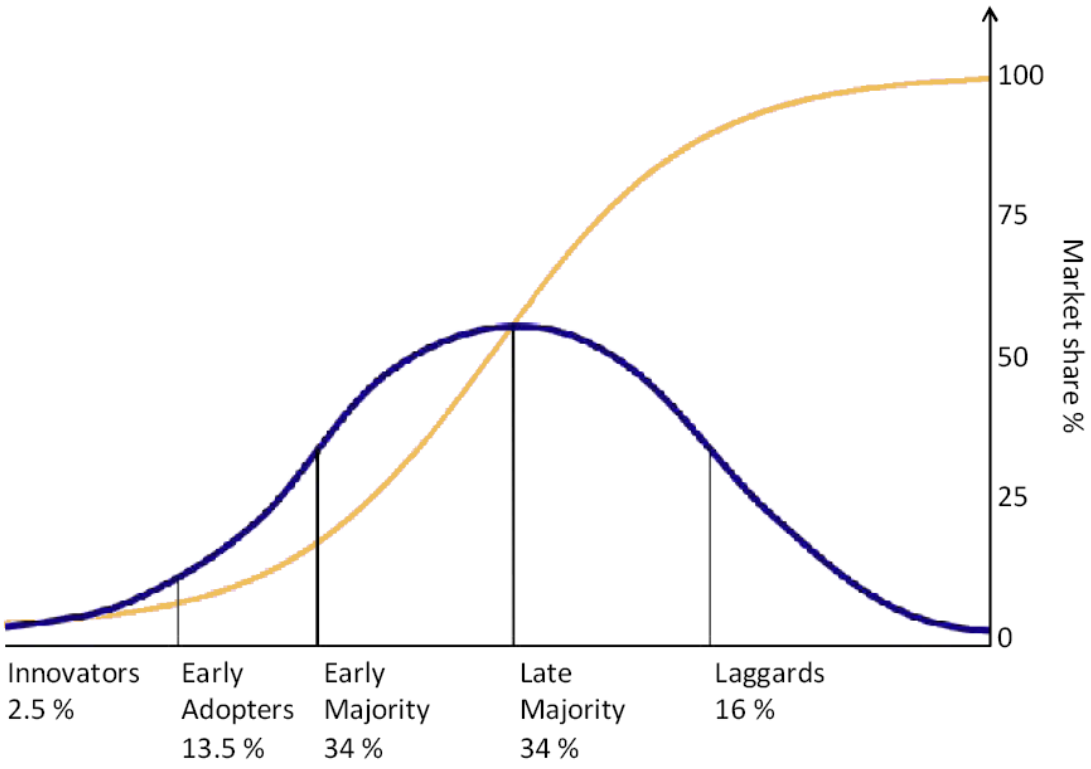
Another example can be found from the British Navy. After 160 men who sailed around the Cape of Good Hope died due to scurvy in 1497, Captain Lancaster decided to serve three teaspoons of lemon juice every day to his sailors during a journey, and every sailor stayed healthy, whereas 100 out of 278 sailors from another ship who weren't given any lemon juice died from scurvy around the same year. These results were clear and obvious, but the British Navy didn't adopt this innovation until almost 300 years later (Rogers, 2003, p. 7).

The cellphone is one of the fastest innovations adopted around the world. In just under 20 years, the cellphone reaches 80 percent of the U.S. population, and, according to Cisco's visual networking index (Cisco, 2013) global mobile data traffic forecast update, the number of mobile devices exceeded the number of the world's population by the end of 2013.

Good ideas can be rejected, slowly adopted, or adopted. Diffusion of innovation theory provides a useful framework for investigating the adoption process. This research has been tested in more than 6,000 research studies and field tests known for one of the most reliable theories in the social sciences. Rogers believes that a population can be broken down into five different segments in terms of adopting a specific innovation: innovators, early adopters, early majority, late majority, and laggards. Each group has its own unique personality toward a particular innovation.

Figure 1

Innovation Adaptor Categories



Taken from Rogers (2003)

- Innovators are known as visionary and imaginative people and are usually the first to adopt advancement. They are constantly looking for next new ideas and they are willing to take risks by trying them out.
- Early adopters are the second fastest category of individuals who adopt an innovation; they love to talk about new ideas with their family, friends, and colleagues. They have the highest degree of opinion leadership among the other adopter categories. Opinion leaders can influence others in terms of spreading either positive or negative information about an innovation.

- Early majorities take significantly longer than innovators and early adopters in accepting new advancements. They wait until the innovation becomes mainstream. They are comfortable with moderately progressive ideas, but they won't embrace a new revolution without solid proof of benefits.
- Late majorities are typically skeptical about a modernization and are not willing to take risks until the majority of society has adopted the innovation.
- Laggards wait until the bitter end. Unlike other categories, they don't want to take any risk in adopting a particular product. They tend to focus on traditions rather than next new things.

No one is an innovator or a laggard on every new innovation. Most people who are in the majority stay as majority on most innovations, but innovators and laggards become different types of adopters based on specific innovations. It's tempting to come up with a strategy to move laggards into the early adopters segment on a particular innovation, but according to Rogers (2003), each segment is static. The question still remains why certain innovation spreads faster than other innovation.

Rogers (2003) states that five perceived characteristics of innovation determine between 49 and 87 percent of the variation in the adoption of new innovations.

- Relative advantage is the degree to which an innovation is perceived as being better than its precursor (p.250). The greater the perceived relative advantage, the faster the rate of adoption. Relative advantage can be measured in terms of economics, social prestige, convenience, and satisfaction.
- Compatibility is the extent an innovation is recognized as being consistent with the existing values, needs, and past experiences of potential adopters

(p.250). The rate of adoption increases as the compatibility of the innovation with the adopters increases. A new innovation that is compatible based on the adopter's perception creates less uncertainty and helps to adapt to new innovation. If a new idea is perceived as very similar to past innovation, then the rate of adoption increases. A good example is the cellphone. Everyone knew how to use a landline phone; therefore, adopting a cellphone was easy for them.

- Complexity is the level to which an innovation is perceived as being difficult to use. Any innovation can be viewed on a continuum from simple to complex. The more complicated the innovation, the slower the rate of adoption.
- Observability is the extent of results of an innovation that are observable to others. If the adopters can see the results, they are motivated to communicate with others about the idea and thus increase the rate of adoption .
- Trialability is the point to which an innovation may be experimented with before acceptance (p.251). If potential adopters are able to try new innovation, then it creates less uncertainty; therefore, adoption rate increases.

Rogers (2003) believes that the heart of the diffusion process consists of the modeling and imitation by potential adopters of their network partners who have previously adopted. He also stated that re-invention increases the overall diffusion process. Re-invention is the level to which an innovation is changed or modified by a user in the process of adoption. No product or process can rest on its laurels, but it takes continuous improvement to receive wider adoption.

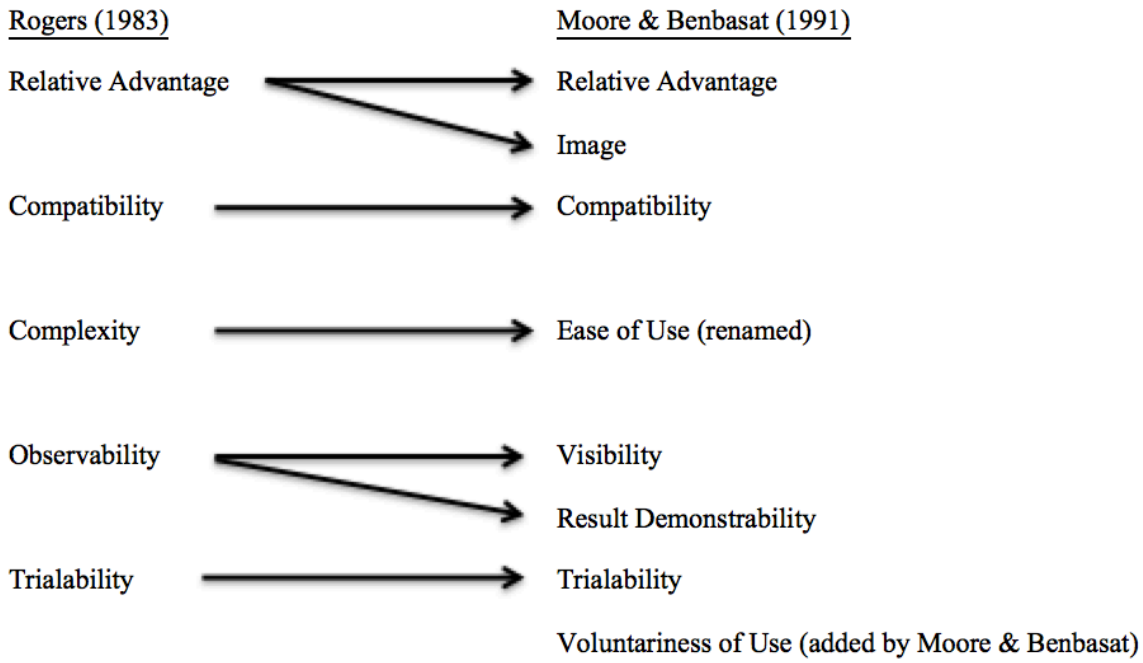
Moore and Benbasat (1991) identified two more constructs beyond Rogers' classifications that are important factors in the decision of adopting an innovation in an organization:

- Image - the degree to which use of innovation is perceived to enhance one's image or status in one's social system;
- Voluntariness of use - the extent to which use of the innovation is perceived as being voluntary or of free will.

Observability construct was separated to show two different dimensions: Result Demonstrability and Visibility. Visibility refers to the observability of the innovation itself, while Result Demonstrability focuses on the observability of the outcomes of using the innovation (Moore & Benbasat, 1991).

Figure 2

Modification by Moore & Benbasat Based on Rogers' Diffusion Theory



Development of Perceived Characteristics of Innovations Instrument

Although the adoption of information technologies has been an area of much research interest since the inception of computerizations, diffusion research efforts have led to mixed and inconclusive outcomes. Inadequate measurement of constructs created difficulty in diffusion research in a wide variety of topics. Among the authors who have noted the problems with poor operationalization of constructs are:

- Taylor and Benbasat (1980) and Huber (1983) for cognitive styles,
- Ives and Olson (1984) for user involvement,
- Jarvenpaa (1989) for the study of information presentation,
- Treacy (1986) for IT and competitive advantage, and
- Benbasat (1989) for laboratory studies in information system in general.

As Keen (1980) has argued, the lack of cumulative tradition in information system is one of the serious issues facing the field (Moore & Benbasat, 1991).

In the mid-1980s, researchers in information systems began to rely on the theories of innovation diffusion to investigate implementation problems (Alexander, 1989; Brancheau & Wetherbe, 1990; Johnson & Rice, 1987; Moore, 1987). A major focus in these research studies was potential users' perceptions of the information technology innovation influencing its adoption rather than looking at the primary characteristics of innovations. Previous studies (Downs & Mohr, 1976) examined the primary characteristics of innovation and have shown inconsistency. The behavior of individuals is predicated by their perception of these primary attributes, because different categories of adopters might perceive primary characteristics in different ways. This is the main reason why primary attributes show inconsistency (Moore & Benbasat, 1991). For example, the actual price of a sports car is $75,000, which is a primary attribute, whereas the perception of cost is a secondary attribute. What might appear costly to one potential adopter could be inexpensive to another, depending on their relative levels of income and perspective. It is argued that it is relative cost that has the greatest effect on buying behavior rather than actual cost.

In spite of the importance of perceived characteristics in diffusion research, most existing instruments designed to tap these characteristics lacked reliability and validity. To fulfill the need of diffusion research, Moore and Benbasat (1991) developed an instrument to measure the perceptions of adopting an information technology innovation based on the extensive work of Rogers' five perceived characteristics of innovations.

Development of the instrument was carried out in three stages: item creation, scale development, and instrument testing.

Item Creation

The purpose of creating pools of items for each perceived characteristic of innovations construct was to cover the definition of its theory holistically to ensure content validity. Items that were identified in the previous research were categorized based on perceived characteristics of innovation, and the items kept were only those that were considered to be applicable to each category. New items were added in order to fulfill all dimensions of the construct.

Moore and Benbasat (1991) stated that Rogers' definitions are based on perceptions of the innovation itself and not on assessments of actually using the innovation. Ajzen and Fishbein (1980, p.8) argued that attitudes towards an object (Ao) can often differ from attitudes toward a particular behavior (Ab) concerning that object. For example, a difference could exist between any employer's attitudes towards a certain interviewee (the object) versus employer's attitude towards hiring that individual (the behavior). An employer might like the individual, but he/she may not hire him/her, because the interviewee might not be a good fit for the organization. Therefore, the attitude towards hiring that individual is negative. For this reason, all characteristics were redefined in terms of the potential adopters' use of the innovation.

Scale Development - the objectives of this stage were to assess the construct validity of the various scales being developed and to attempt to identify any particular items that may be ambiguous (Moore & Benbasat, 1991). To accomplish these goals, panels of judges were asked to sort items into concept categories. This sorting technique was used

by Davis (1986, 1989) who was interested in assessing the coverage of the domain of his theories. Davis asked judges to rank how well the items fit the construct definition he had provided, and then asked the judges to sort items into hypotheses categories. The only difference with this study and Davis's study was that judges were asked to provide their own definition of each construct instead of having the definition be provided for them. According to Moore and Benbasat, if these definitions matched the scale's intent, then their confidence in the idea's validity of the scales increased. Each item was printed on a 3 x 5 inch index card. The printed cards were shuffled into random order. Each judge sorted the cards into each category and labeled the groups of items. During four rounds of sorting, a different set of judges was chosen. For each pair of judges in each sorting step, their level of agreement in categorizing items was measured using statistical measure of inter-rater agreement or Cohen's kappa coefficient (Cohen, 1960). If each item was consistently placed within a specific category, then it was considered to demonstrate convergent validity with the related construct and discriminant validity with the others. If the number of items in each category was consistent during sorting rounds by judges, then scales based on these categories could also be said to demonstrate convergent and discriminant validity. Kappa scores averaged 0.80 in the first round, 0.83 in the second, 0.71 in the third, and 0.82 in the fourth round. The following table shows the result from four rounds of sorting.

Table 1

Inter Judge Agreements

Agreement Measure	Round 1	Round 2	Round 3	Round 4
Raw Agreement	0.86	0.88	0.64	0.74
	0.74	0.87	0.60	0.74
	0.83	0.85	0.82	0.78
	0.80	0.87	0.79	0.91
	0.85	0.86	0.74	0.96
			0.94	
			0.76	
			0.78	
			0.75	
Average	0.83	0.86	0.75	0.85
Cohen's Kappa	0.84	0.86	0.58	0.70
	0.70	0.85	0.53	0.72
	0.76	0.82	0.79	0.74
	0.82	0.84	0.76	0.89
	0.89	0.83	0.70	0.96
	0.80	0.79	0.64	0.92
			0.94	
			0.70	
			0.74	
			0.71	
Average	0.80	0.83	0.71	0.82
Placement Ratio Summary				
Voluntariness	0.83	0.96	0.93	1.00
Image	0.91	1.00	0.72	0.93
Relative Advantage	0.99	0.90	0.98	0.87
Compatiability	0.66	0.91	0.53	0.98
Ease of Use	0.96	0.96	1.00	0.93
Trialability	0.68	0.96	0.83	0.84
Observability	0.43	0.73		
Result Demonstrability			0.94	0.91
Visibility			0.73	0.94
Average	0.78	0.92	0.85	0.92

Moore & Benbasat, (1991)

Instrument Testing -The purpose of instrument testing was to conduct reliability assessment of the scales by piloting the survey. The initial pilot test was conducted only with 20 participants. The respondents pointed out 75 items were too many for this type of instrument and recommended a reduction in the number of items. Analysis was performed using the six measures of reliability (Guttman, 1945) to drop items.

The correlation of items within each scale (henceforth item-item), the corrected item-to-total correlations (henceforth item-scale), the effects on ALPHA if the item were deleted, and the item standard deviation scores were used to determine which items were candidates for deletion from the scale. Items with low item-item and item-scale correlations, which would raise ALPHA if deleted, or which showed low variance (and hence would have low explanatory power in any model) were all candidates for elimination. Before any item was deleted, review of the domain coverage (content validity) of the construct was performed to make sure it would not suffer. As a result, 32 items were dropped (Moore & Benbasat, 1991).

Table 2

Reduced Length

Scale	Original Length	Reduced Length
Voluntariness	5	4
Image	7	5
Relative Advantage	14	9
Compatibility	11	4
Ease of Use	10	8
Result Demonstrability	8	4
Trialability	11	5
Visibility	9	4
Total	75	43

Moore & Benbasat, (1991)

The second pilot survey was conducted with a larger sample. A survey was distributed to 75 individuals, and only 66 (88%) surveys were completed. The same analysis was conducted as was conducted for the first test focusing on reliabilities and the item-item and item-scale correlations. As a result, small modifications were made for ease of use and trialability. Two items were dropped from ease of use, and one item was dropped to improve ALPHA. Visibility scale retrieved one item, which had been dropped during an earlier culling to improve ALPHA. There was no change to all other constructs.

During the final field test, 800 surveys were distributed, and only 540 (68%) surveys were usable. Instead of analyzing all 540 surveys, they were divided into two: one half was used to refine the scales even further, and the other half was kept for testing any revisions. After conducting factor analysis, the reliability of all scales for the first half final field test were .80 level or above except trialability and visibility. These two constructs were near a .70 lower bound set for the study. Principal components analysis

was also conducted with VARIMAX rotation, the results of which indicated all factors emerged fairly clean except for compatibility. Although relative advantage and compatibility were separated as two constructs during four rounds of card sorting by judges, respondents viewed them identical or as a causal relationship between the two. After examining rotated factor matrix analysis, five items were identified as being too complex; therefore, researchers deleted those items. Two items from ease of use and one item from each of the relative advantage, image, result demonstrability, and visibility scales were removed.

All scales achieved the minimum reliability scores. ALPHA coefficients of short scales for each construct are as follows.

Table 3

ALPHA Coefficients of Short Scales

Construct	Items	ALPHA
Relative advantage	5	0.90
Compatibility	3	0.86
Ease of Use	4	0.84
Result Demonstrability	4	0.79
Image	3	0.79
Visibility	2	0.83
Trialability	2	0.71
Voluntariness	2	0.82
Total Number of Items	25	

Moore and Benbasat (1991)

The purpose of creating this instrument is to measure various perceptions for using information technology innovation. Moore and Benbasat developed both a 38 item and a 25 item instrument. All of the scales will have Chronback's alpha levels of .71 or

above, with the majority > 80. This instrument has been cited 3,623 times by Google Scholar in September 2012 and has been proven to be useful in investigating how perceptions affect individuals' actual use of information technology.

Summary

Although only 20 percent of Americans live in rural areas, about 41 percent of enrolled veteran patients reside in rural and highly rural areas. Technology such as telemedicine could equalize the uneven distribution of health care resources between urban and rural areas and make mental health services available to rural veteran patients. The question still remains: Why aren't more VA mental health professionals using telemedicine?

This research paper will investigate the perceived characteristics of innovation that predict telemedicine rate of adoption by VA mental health professionals based on Rogers' theory of diffusion of innovations and Moore and Benbasat's perceived characteristics of innovations instrument. Furthermore, the intention of this research paper is to contribute to the body of research to ultimately promote the usage of telemedicine to improve the quality of specialty care for our rural veterans.

Chapter 3

Methods

Introduction

Providing primary health and specialty services to 3.4 million rural and highly rural veterans is a challenging task because of geographic barriers and the uneven distribution of rural health care providers. Although the Veterans Health Administration (VHA) is hoping that technology such as telemedicine expands availability of specialties access to rural veteran patients, the adoption of telemedicine has been slow. Due to Operations Enduring Freedom, Operation Iraqi Freedom, and Operation New Dawn (OEF/OIF/OND), significant numbers of service member have suffered traumatic brain injuries (TBI), and many have shown symptoms of post-traumatic stress disorder (PTSD) and depression. To align with the high priority that the Veterans Administration (VA) has placed on behavioral health assessment, treatment, and program and to eliminate the variability in terms of adopting different types of telemedicine, this research was focused on tele-mental service.

Chapter 1 depicted the importance of telemedicine for rural veterans, and Chapter 2 described the characteristics of rural veterans, mental health veterans, telemedicine, diffusion of innovations, and the perceived characteristics of innovations instrument. This chapter will portray how this research was conducted systematically and address research design, participants, ethical consideration, instrument, procedure, data analysis and limitation of the study in detail.

Research Design

The purpose of this study was to investigate factors that affect the telemedicine adoption rate by mental health professionals in Veterans Affairs. The research study involved psychiatrists, psychologists, primary care providers, clinical social workers, and other mental health professionals from Veterans Administration (VA) medical centers and community-based outpatient clinics (CBOC) that have experience in telemedicine or are about to use telemedicine. Rogers' theory of diffusion of innovations provided a framework for analysis of the diffusion of innovation at a complex systems level taking into account the differences in users, rate of adoption, types of information and decisions, and communication channels, while simultaneously facilitating identification of highly specific attributes of an innovation that affects diffusion.

This paper focused on the VA mental health professionals' perceptions regarding the use of telemedicine innovation as explanatory and predictive variables. The core research question is:

> What are the perceived characteristics of innovation that best predict the rate of telemedicine by VA mental health professionals?

The sub-research question is:

> What combination of perceived characteristics of innovation best predict telemedicine rate of adoption by VA mental health professionals?

Independent variables are perceived characteristics of innovations, and the dependent variable is the participants' telemedicine usage from electronic medical records and self-reported usage from the survey. This study involved online surveys and the analysis of existing electronic medical records to gather the number of telemedicine

encounters by each clinician. Self-reported usage from surveys was compared with the actual number of telemedicine encounters from electronic medical records for accurate usage.

Participants

The population that plays an important role in diffusing VA tele-mental is VA mental health professionals. Rural veteran patients are recipients of the service, whereas VA mental health professionals are the actual users of telemedicine. Therefore, having an acceptance from this population is crucial in making the service available in rural areas. Adjusting routine workflow to adopt telemedicine in clinics is not an easy task. Skepticism still remains regarding the effectiveness in quality of care to patients. Overwhelming barriers exist for VA mental health professionals, such as five-hour required telemedicine training, three appointments needed to make one telemedicine appointment, and technical difficulties in using telemedicine.

A survey was given to mental health professionals from VA medical centers and CBOCs. The usage of telemedicine was asked in the survey and also extracted from electronic medical records for an accurate number of telemedicine encounters.

Ethical Consideration

The risks of involvement in this study were no greater than those encountered in everyday life. Ms. Murata from the VA Albuquerque Informatics Center acted as an honest broker by providing a firewall between clinical and research activities. Clinical information was stripped of Health Insurance Portability and Accountability Act-denoted personal health identifiers by an honest broker. The data contained only the number of encounters and the type of telemedicine service. The honest broker linked this data with

each respondent who participated in the survey and provided the report in an aggregate format.

The non-identifiable data was stored in electronic format on the co-PI's computer and analyzed as group-level data. The findings from this study were published in aggregate form. Upon completion of the analyses, the electronic documents were returned to the VA research center and data backup destroyed from the work computer.

Instrument

Chapter 2 described the development of perceived characteristics of innovations instrument by Moore and Benbasat. This study used their instrument for measuring and predicting perceived characteristics of innovations for the VA tele-mental.

Modification

The instrument for this study is the intellectual property of Dr. Izak Benbasat. Permission for its use was sought and obtained on July 23, 2012. This study used his instrument with some modifications in order to meet specific needs to this report. The modified survey was designed by interviewing various diffusion research and VA telemedicine experts.

Specialists in diffusion research and telemedicine reviewed the modified items. Dr. Izak Benbasat, author of the original article and an expert in diffusion research, was asked to assess the degree to which individual items measured the intended attributes. Dr. Thomas Klobucar, an authority on VA telemedicine, was asked to review items for accuracy in depicting the telemedicine adoption and to check the definition of its construct holistically to ensure content validity. Based upon these reviews, the primary change made was to restate items to include both positive and negative direction. The

items for this survey were written using a Likert scale that ranged from 1 = 'Strongly Disagree' to 7 = 'Strongly Agree' and were intended to include at least two items for each attribute. The modified survey was designed to measure the response on all eight attributes of adopting VA telemedicine innovation.

Appendix # - The Survey

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Voluntariness

1. My superiors expect me to use CVT (clinical video tele-health).

2. My use of CVT is voluntary.

3. If I had the time and technology was easily available, I would use CVT voluntarily.

Comment:

Relative Advantage

1. Using CVT enables me to accomplish tasks more quickly.

2. Using CVT makes it easier to do my job.

3. The disadvantages of my using CVT far outweigh the advantages for my patients.

4. The disadvantages of my using CVT far outweigh the advantages for me as a care provider.

5. Overall, I find using CVT to be advantageous in my job.

Comment:

Compatibility

1. Using CVT is compatible with the way I currently perform my work.

2. Using CVT fits into my work style.

3. Using CVT requires me to change how I work.

Comment:

Image

1. Using CVT improves my image within my organization.

2. Because of my use of CVT, others in my organization see me as a more valuable employee.

Comment:

Ease of Use

1. CVT is cumbersome to use.

2. It's easy to get my CVT system to do what I want it to do.

3. CVT training is quick and easy.

4. It is difficult to schedule a CVT session for patients.

5. Reaching a CVT support team is difficult.

6. Overall, I believe that CVT is easy to use.

7. It's easy to access CVT system in my facility.

Comment:

Result Demonstrability

1. I would have no difficulty telling others about the advantages of CVT.

2. I believe that I could communicate to others the reasons for using CVT.

3. I would have difficulty explaining why using CVT is beneficial.

Comment:

Visibility

1. I have seen others using CVT in my organization.

2. I have seen CVT in use outside my organization.

3. CVT use is not very visible in my organization.

Comment:

Trialability

1. I've had many opportunities to try CVT system.

2. I know where I can go to try out a CVT system.

Comment:

Usage and Recommendation

1. I consider myself to be a frequent CVT user.

2. A lot of my patients receive CVT service(s) in my facility.

3. I plan to use CVT in the future.

4. I recommend CVT to my colleagues.

5. I recommend CVT to my patients.

Comment:

Data Collection Procedures

Data was collected from online surveys and electronic medical records. The survey asked identifiable information such as the respondent's name and email address in order to link the survey with telemedicine usage from EMR. The online survey was also available for anyone from the VA Albuquerque region who wished to take it online. Surveymonkey.com was chosen because of its simplicity and clean user interface. The online survey was sent to clinicians and medical professionals in an unsupervised format.

The survey contained three essential components: introduction, confidentiality, and main survey questions.

Appendix # - Introduction and Confidentiality

Glen Murata from the Raymond G. Murphy VA Medical Center and Wesley Pak from the University of New Mexico, Department of Organizational Learning and Instructional Technology are conducting a research study. The purpose of the study is to measure VA mental health professionals' perception in terms of using telemedicine. You are being asked to participate in this study because you are a VA mental health professional. Your participation will involve filling out this survey. The survey should take about 7 minutes to complete. Your involvement in the study is voluntary, and you may choose not to participate.

There are names or identifying information associated with this survey. The reason why we are asking for your name and email address is, we want to correlate your perceptions and actual usage of telemedicine to better understand the perceptions. We will be working with an honest broker, who will ensure that there is a secure separation between clinical and research activities. Clinical information will be stripped of Health Insurance

Portability and Accountability Act-denoted personal health identifiers by the honest broker. The data contains only the number of encounters and type of telemedicine service. After that, the honest broker linked this data with each respondent who participated in the survey and provided the report in an aggregate format to us.

The survey includes questions such as "Using clinical video tele-health makes it easier to do my job." You can refuse to answer any of the questions at any time. There are no known risks in this study, but some individuals may experience discomfort when answering questions. All data will be kept in a locked file in Dr. Glen Murata's office until the study is closed and then archived with the VA research office; records will be destroyed according to the VA record retention schedule.

The findings from this project will provide information for predicting adoption of telemedicine by VA mental health professionals. If published, results will be presented in summary form only.

If you have any questions about this research project, please feel free to call Wesley Pak at (505) 314-3833 or send email to chong.pak@va.gov. If you have questions regarding your legal rights as a research subject, you may call the UNM Human Research Protections Office at (505) 272-1129.

By filling out this survey, you will be agreeing to participate in the above described research study.

Thank you for your consideration.

Sincerely,

The survey questions consisted of demographic, perceived characteristics, self-reported usage, and recommendation rate on the VA telemedicine. The survey contained

33 items to measure the perceptions of adopting telemedicine focused on variables that were found to affect the rate of adoption.

The aim was to have approximately 100 respondents and to distribute to the following VISN 18 networks.

VA VISN 18 - VA Southwest Health Care Network

- Amarillo - Amarillo VA Health Care System
- Big Spring - West Texas VA Health Care System
- El Paso - El Paso VA Health Care System
- Phoenix - Phoenix VA Health Care System
- Prescott - Northern Arizona VA Health Care System
- Tucson - Southern Arizona VA Health Care System

Accidental sampling was used to collect the samples. The primary data was reported as aggregate data and was maintained in a locked cabinet. Electronic aggregate data was secured in the VA network in compliance with VHA policy. Participants were free to choose not to participate or not to answer particular questions, or they could stop the survey at any point by simply exiting the survey. There was no cost for taking the survey and no monetary compensation for participation. It took approximately seven minutes to complete the survey.

Since the research was conducted at the Department of Veterans Affairs, a proposal was first submitted to the VA Research Center and then to the University of New Mexico Health Sciences Center IRB (Institutional Review Board) to receive permission from both institutes. The researcher was required to receive the VA WOC

(Without Compensation) appointment and attend VA trainings to receive the following certifications.

- CITI – VA Human Subjects Protection & Good Clinical Practices – Human Studies
- VA Privacy and Information Security Awareness and Rules of Behavior
- Privacy and HIPAA Training
- Information Security 201 for Research & Development Personnel
- Ethics Most Wanted

The VA also conducted a background check as a part of the process. A waiver of informed consent and waiver of HIPAA authorization were requested and accepted, since the researcher worked with an honest broker to retrieve the telemedicine usage from electronic medical records.

Data Analysis

Research data was gathered from a number of telemedicine encounters in 2011, 2012, and 2013. The primary dependent variable is the number of telemedicine encounters from electronic medical records and the self-reported usage from the survey. Self-reported usage from the surveys were compared and merged with the actual number of telemedicine encounters from electronic medical records for accurate usage. Since telemedicine is between a specialist and a patient, telemedicine encounter wouldn't show "association" with the patient's primary care provider, although it is possible that a patient's primary care provider (PCP) may or may not recommend a telemedicine consultation. Therefore, the number of telemedicine encounters for primary care providers were counted, although the PCP wasn't present during the telemedicine

consult. For CBOC providers, the number of encounters toward CBOC providers' telemedicine usages were counted, as well as the patients who utilized telemedicine. For specialists from VA medical centers, only the number of telemedicine encounters was counted. VA medical providers were the main participants for this study, but surveys from VA medical professionals such as nurses, tele-health coordinators, and tele-health clinical technicians were also collected to evaluate their perceptions as well.

During the data analysis stage, the research performed reliability analysis using SPSS (Statistical Package for the Social Sciences) to assess reliability of the scales for the modified survey. Cronbach's ALPHA was highlighted in the analysis, as is fairly standard in most discussions of reliability. The correlation of items within each scale (henceforth item-item), the corrected item-to-total correlations (henceforth item-scale), the effects on ALPHA if the item were deleted, and the item standard deviation scores were used to determine which items were candidates for deletion from the scale. Items with low item-item and item-scale correlations, which would raise ALPHA if deleted, or which would show low variance (and hence would have low explanatory power in any model) were all candidates for elimination. Before any item was deleted, a review was conducted to make sure the domain coverage (content validity) of the construct would not suffer.

Correlation analysis was conducted to analyze the relationship among perceived characteristics of innovation (independent variables) and also with telemedicine usage (dependent variables) from VISN 18 data and survey. The Pearson Correlation was also performed to examine potential multi co-linearity problems. To examine the joint impact, a regression analysis was accomplished to investigate what perceived characteristics of

innovation predict telemedicine rate of adoption and to also look at the combination of perceived characteristics of innovation that best predict telemedicine' rate of adoption.

According to diffusion theory, adopters should have more positive perceptions of using new innovation than non-adopters, except voluntariness. Therefore, the response to the scales for a split sample of adopters and non-adopters was compared to the validity of the instruments.

The non-identifiable data was stored in electronic format on the co-PI's computer and analyzed as group-level data using a SPSS (Statistical Package for the Social Sciences). The finding from this study may be published in aggregate form. After the completion of the analyses, the electronic documents have returned to the VA Research Center and data backup will be destroyed from the work computer.

Limitation of the Study

1. Since this survey is based on accidental samples, the results of the study may not represent the opinions and practices of tele-mental users and non-users.
2. The results of this study may not represent the opinions of the whole VA medical professional population, since it is only focused on VISN 18 and geographical variation needs to be considered.

Chapter 4

Analysis and Results

The purpose of this study was to investigate factors that affect the telemedicine adoption rate by mental health professionals at the U.S. Department of Veterans Affairs. The research study involved psychiatrists, psychologists, primary care providers, clinical social workers, and other mental health professionals from Veterans Administration (VA) medical centers and community-based outpatient clinics (CBOC) that have experience in telemedicine or about the use of telemedicine.

The primary research question was:

> What perceived characteristics of innovation predict telemedicine's rate of adoption by VA mental health professionals?

The sub-research question was:

> What combination of perceived characteristics of innovation best predict telemedicine's rate of adoption by VA mental health professionals?

Additional barriers exist when it comes to adopting telemedicine outside of the Department of Veterans Affairs, such as a lack of telemedicine reimbursement and interoperability of electronic medical records among hospitals and clinics. The U.S. Veterans Affairs is in a unique position to conduct research to better understand the adoption of telemedicine without considering reimbursement and electronic medical records integration issues.

Pre-Analysis Preparation

The data for this analysis were collected using an online survey that remained open for 14 weeks and also from Veterans Affairs' electronic medical records for

gathering the number of telemedicine encounters. All behavioral health medical directors in the VA VISN 18 network were contacted for permission to distribute the survey. Out of seven healthcare systems in VISN 18, Albuquerque, Prescott Health Care Systems and their unions agreed to distribute the survey to their medical staff.

Ms. Murata, an honest broker who provided a firewall between clinical and research activities, used a Microsoft SQL to collect data from the VA's VistA electronic medical records (EMR). Clinical information was stripped of Health Insurance Portability and Accountability Act-denoted personal health identifiers by the honest broker. The data from the EMR contains only the number of encounters. The honest broker linked this data with each participating respondent in the survey and provided the report in an aggregated format.

The non-identifiable data were downloaded into the VA network drive for extra security, and all data analysis was conducted at the VA Albuquerque Informatics Center. SPSS (Statistical Package for the Social Sciences) software was used to analyze the data, and the electronic documents were archived with the VA Research Service.

Reliability and Validity

The internal consistency estimate of reliability was computed for all eight constructs with its items. This refers to the degree to which the items that make up the scale hang together. Ideally, the Cronbach's alpha coefficient of a scale should be above .7; however, Cronbach's alpha values could generate low values due to constructs with fewer than 10 items (DeVellis, 2003). Based on survey responses, reliability of the majority of the scales was at or above .7, except three constructs: voluntariness, compatibility, and visibility. Negative items were reversed to align with positive items.

Table 4.1

The Internal Consistency Estimate of Reliability of the PCI

Scale Name	Original Items	Original ALPHA	If reduced Item	If reduced ALPHA
Voluntariness	**3**	.469	2	.602
Relative Advantage	**5**	**.735**		
Compatibility	**3**	.636	2	.921
Image	**2**	**.813**		
Ease of Use	**7**	**.709**		
Result Demonstrability	**3**	**.872**		
Visibility	**3**	.541	**2**	.544
Trialability	**2**	**.887**		
Usage & Recommendation	**5**	**.806**		

Item-total correlations for the compatibility construct yielded only one correlation that was less than.100: "Using CVT requires me to change how I work." A review was conducted to ensure the domain coverage (content validity) of the construct did not suffer. This item was deleted and raised the reliability of the scale from .636 to .921.

Table 4.2

Compatibility's Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Compatibility1	7.7073	6.262	.659	.704	.196
Compatibility2	7.7561	5.989	.682	.706	.149
Compatibility3r	9.1220	11.960	.100	.012	.912

Voluntariness and visibility both have three items and were lower than the recommended scale. After reviewing item-total correlations for both constructs, Cronbach's alpha was less than .7. Even with potential elimination of an item, Cronbach's alpha couldn't reach .7. The low values of Cronbach's alpha may mean that either a number of items were too small or it may have other issues. Further study is needed to elucidate the low value of Cronbach's alpha in voluntariness and visibility scale.

Pearson Correlation was conducted to examine potential multi-collinearity problems. The results in Table 4.3 indicate that none of the squared correlations was close to 0.80 to suggest a problem with multi-collinearity among the research variables (Hair, Anderson, Tatham and Black, 1995). Therefore, there was no evidence of significant multi-collinearity among the research variables.

Table 4.3

Correlation Matrix between Perceived Characteristics of Innovation

PCI	Volunt.	Advant.	Compat.	Image	Ease of Use	Demo	Visible	Trial	Usage
Volunt.	1	.079	-.100	-.084	-.152	-.017	-.063	-275*	-.146
Advant.	.079	1	.627**	.068	.686**	.534**	.137	.401**	.635**
Compat.	-.100	.627**	1	.351*	.480**	.596**	.015	.257	.546**
Image	-.084	.068	.351*	1	.301	.568**	.255	.408**	.457**
Ease of Use	-.152	.686**	.480**	.301	1	.383*	.289*	.672**	.596**
Demo	-.017	.534**	.596**	.569**	.383*	1	.318*	.396**	.650**
Visible	-.063	.137	.015	.255	.289*	.318*	1	.546**	.502**
Trial	-.275*	.401**	.257	.408**	.672**	.396**	.546**	1	.646**
Usage	.303	.635**	.546**	.457**	.596**	.650**	.502**	.646**	1

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

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

Experts in diffusion research and telemedicine reviewed the modified items. Dr. Izak Benbasat, author of the original article and an expert in diffusion research, was asked to assess the degree to which individual items measured the intended attributes. Dr. Thomas Klobucar, an expert in VA telemedicine, was contacted to review items for accuracy in depicting the telemedicine adoption and to check the definition of its construct holistically to ensure content validity. Based upon these reviews, the primary change made was to restate items to include both positive and negative direction. The items for this survey were written using a Likert scale that ranged from 1 = Strongly Disagree to 7 = Strongly Agree and were intended to include at least two items for each attribute. The modified survey was designed to measure the response on all eight

attributes of adopting VA telemedicine innovation. Therefore, the measures are believed to have sufficient content validity.

Demographics

The online survey yielded a 24 percent response rate (60/251). The sample of respondents was representative of all behavioral health medical staff in the Albuquerque VA and Northern Arizona VA. A total of 60 respondents participated in the survey: 45 females and 15 males as seen in Table 4.4; two-thirds of the participants were female and one-third was male. The ages of the participants were categorized into five ranges.

- 25-34 (8),
- 35-44 (13),
- 45-54 (10),
- 55-64 (23), and
- 65 or older (6).

The age range of 55-64 had the largest response with 38.3 percent of the study's participants, followed by 21.7 percent in the range of 35-44. This data is reflected in Table 4.5.

Table 4.4

Gender

Gender	%	N
Male	25	15
Female	75	45
Total	100.0	60

Table 4.5

Age

Age	%	N
25-34	13.3	8
35-44	21.7	13
45-54	16.7	10
55-64	38.3	23
65 or older	10.0	6
Total	100.0	60

The majority of the participants were either psychologists (Ph.D. or Psy.D) (41.7 percent) or clinical social workers (25 percent) when asked their profession. The numbers and percentages for each profession associated with this sample are presented in Table 4.6.

Table 4.6

Profession

Profession	%	N
Psychologist (Ph.D. or Psy.D)	41.7	25
Clinical Social Worker	25	15
Psychiatrist (M.D.)	15	9
PC Provider (PA/ARNP)	5	3
Nurse (RN)	5	3
Primary Care Doctor (M.D.)	1.7	1
Psychiatric Nurse	1.7	1
Counselor	1.7	1
Tele-health Coordinator	1.7	1
Tele-health Clinical Technician	1.7	1
Total	100.0	60

The participants in this research were predominantly from VA medical centers (85 percent) and urban areas (75 percent). Some participants chose rural areas as their region, although they are physically located in an urban setting since they use tele-health to provide care to patients in rural areas. One of the participants stated in the survey, “I am located in an urban setting, but the veterans I serve are in rural locations.”-That explains variation between practice location and region in Table 4.7 and 4.8.

Table 4.7

Practice Location

Practice Location	%	N
VA Medical Center	85.0	51
VA CBOC	6.7	4
Tele-health Outreach Clinic	8.3	5
Total	100.0	60

Table 4.8

Region

Region	%	N
Urban	75.0	45
Rural	25.0	15
Total	100.0	60

Although 96.7 percent of participants reported that they have video-based tele-health equipment in their facility, only 65 percent of participants or participants' team use a clinical video tele-health system.

Table 4.9

Tele-Health Equipment Availability

Do you have a video-based tele-health equipment in your facility?

Yes		No		Total	
%	N	%	N	%	N
96.7	58	3.3	2	100.0	60

Table 4.10

Tele-Health Usage by Participant or His/Her Team

Do you or your team use a clinical video tele-health system?

Yes		No		Total	
%	N	%	N	%	N
65.0	39	35.0	21	100.0	60

The absence of a physical presence between a healthcare provider and the patient was believed by 21.7 percent of participants to severely limit the effectiveness of treatment, and 58.3 percent believed otherwise. Some of participants expressed that it depends on the type of treatments and populations in terms of effectiveness of treatment. Adopters stated that although it does limit somewhat, they could overcome the obstacles, and some non-adopters weren't sure, because they hadn't actually used the system yet.

Table 4.11

Absence of Physical Presence

Do you believe that the absence of a physical presence between a healthcare provider and the patient severely limits the effectiveness of treatment?

Yes		No		Missing		Total	
%	N	%	N	%	N	%	N
21.7	13	58.3	35	20	12	100.0	60

Perceptions of Innovation Attributes

Voluntariness

As of 2013, medical providers at the VA are currently mandated to use some form of distance technology tool (phone and video, etc.) to provide patient care. A high percentage of respondents reported that they would use clinical video tele-health (CVT) voluntarily if they had the time and technology easily available to them. Some respondents stated that using CVT is too cumbersome and that the VA doesn't have enough staff to support the technology. One respondent has concerns about the safety and stated, "One simply cannot observe body language and other physical features clearly enough to do an accurate clinical assessment in some circumstances"

Table 4.12

Attribute - Voluntariness

Attribute	Mean	SD	Median
Voluntariness	**4.18**	**1.673**	
My superiors expect me to use CVT (clinical video tele-health).®	4.76	2.370	5.50
My use of CVT is voluntary.	4.04	2.231	4.00
If I had the time and technology was easily available, I would use CVT voluntarily.	5.37	1.755	6.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)
® - Scores reversed for items requesting disagreement

Relative Advantage

Respondents reported "disagree" on the first two items meaning that it's neither quick nor easy when it comes to using CVT. It was interesting to see the difference between the third and fourth items, meaning that VA mental health professionals are willing to use CVT for the sake of patients, although it's not beneficial for them as an individual, but they would use it because they are medical providers. One respondent stated, "Of course it is easier for me to just sit in my office and have the patient show up, but getting the machine set up and seeing the patient over CVT is really not difficult. If it means the vet doesn't have to drive into Albuquerque, that's worth it to me."

Table 4.13

Attribute – Relative Advantage

Attribute	Mean	SD	Median
Relative Advantage	4.36	1.150	
Using CVT enables me to accomplish tasks more quickly.	3.33	1.264	4.00
Using CVT makes it easier to do my job.	3.72	1.395	4.00
The disadvantages of my using CVT far outweigh the advantages for my patients. ®	2.98	1.469	3.00
The disadvantages of my using CVT far outweigh the advantages for me as a care provider. ®	3.41	1.647	3.00
Overall, I find using CVT to be advantageous in my job.	4.73	1.768	5.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)
® - Scores reversed for items requesting disagreement

Compatibility

Respondents reported "Neutral" when asked about using CVT in terms of compatibility. One respondent wrote,

> *Primarily, it requires that I prepare ahead of time and think about what handouts or paperwork I want the veteran to have for our session. I need to mail them to the veteran beforehand or fax them to the CBOC and hope that staff there will get them to the vet before our (CVT) session.*

Others responded that they don't have experience in using CVT; therefore, they aren't sure whether it's compatible with their workflows.

Table 4.14

Attribute - Compatibility

Attribute	Mean	SD	Median
Compatibility	4.43	1.788	
Using CVT is compatible with the way I currently perform my work.	4.51	1.804	5.00
Using CVT fits into my work style.	4.38	1.886	5.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Image

Respondents felt that using CVT slightly improves their images but not significantly.

Table 4.15

Attribute -Image

Attribute	Mean	SD	Median
Image	4.53	1.498	
Using CVT improves my image within my organization.	4.63	1.644	4.50
Because of my use of CVT, others in my organization see me as a more valuable employee.	4.33	1.621	4.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Ease of Use

Respondents chose "Agree" on item 4: "It is difficult to schedule a CVT session for patients." One respondent stated,

Scheduling patients is the trickiest part of using CVT, because most rural outpatient clinics have one or two machines that are used by several disciplines in the hospital. More machines would make scheduling much easier.

Another respondent stated,

The issue I face when scheduling appointments for veterans is that the CBOC schedule is not often concurrent with the provider's schedule.

Respondents chose "Disagree" on Item 3: "CVT training is quick and easy." A respondent stated,

The only time I would use it is for screenings, which would be preferable to the phone screenings we now do. However, until the training/scheduling issues are dealt with, it is impossibly difficult.

All other questions were slightly higher than neutral.

Table 4.16

Attribute – Ease of Use

Attribute	Mean	SD	Median
Ease of Use	3.81	1.096	
CVT is cumbersome to use. ®	4.30	1.712	4.00
It's easy to get my CVT system to do what I want it to do.	4.35	1.631	4.00
CVT training is quick and easy.	3.67	1.805	4.00
It is difficult to schedule a CVT session for patients. ®	5.00	1.897	5.00
Reaching a CVT support team is difficult. ®	4.17	1.774	4.00
Overall, I believe that CVT is easy to use.	4.44	1.598	4.00
It's easy to access CVT system in my facility.	4.29	1.914	4.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Result Demonstrability

Responses were very positive for every item in Result Demonstrability. One respondent wrote,

> *It's pretty obvious that this helps us reach rural veterans; I think the primary hesitation is before someone has used it and their fears that it puts a barrier between them and their client.*

Whether potential users agree or disagree on positive effectiveness of CVT, everyone agreed there is a huge benefit for rural veterans in terms of geographic convenience. Therefore, they are willing to tell others about using CVT.

Table 4.17

Attribute – Result Demonstrability

Attribute	Mean	SD	Median
Result Demonstrability	5.20	1.581	
I would have no difficulty telling others about the advantages of CVT.	4.76	1.979	5.00
I believe that I could communicate to others the reasons for using CVT.	5.31	1.715	5.50
I would have difficulty explaining why using CVT is beneficial. ®	2.54	1.637	2.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Visibility

Every item came out positive in Visibility. In 2012 the VA received funding to implement CVT equipment in every VA medical center and CBOC. Based on the responses, it is apparent that respondents knew that there are CVTs being used. One respondent wrote,

We all know it is used but most have not seen it in use, leaving some assumptions in place of knowledge.

Table 4.18

Attribute - Visibility

Attribute	Mean	SD	Median
Visibility	4.84	1.496	
I have seen others using CVT in my organization.	5.67	1.845	6.00
I have seen CVT in use outside my organization.	4.20	2.298	5.00
CVT use is not very visible in my organization. ®	3.27	1.820	3.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Trialability

Although most respondents knew where they could experiment with a CVT system, they didn't get to actually try the system.

Table 4.19

Attribute - Trialability

Attribute	Mean	SD	Median
Trialability	4.39	2.214	
I've had many opportunities to try CVT system.	3.75	2.320	4.00
I know where I can go to try out a CVT system.	4.94	2.257	6.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Usage and Recommendation

Although the median of Item 1: "I consider myself to be a frequent CVT user" is 1.00, the median of Item 3: "I plan to use CVT in the future" is 6.00. It is very positive to

see that they view themselves as future users of CVT and also recommend CVT to colleagues and patients. One respondent wrote,

> *If given the opportunity, I would be glad to use CVT to see how it works and how it can be used to help veterans.*

Table 4.18

Attribute - Usage and Recommendation

Attribute	Mean	SD	Median
Usage and Recommendation	3.98	1.814	
I consider myself to be a frequent CVT user.	2.90	2.323	1.00
A lot of my patients receive CVT service(s) in my facility.	3.73	2.182	4.00
I plan to use CVT in the future.	5.00	2.114	6.00
I recommend CVT to my colleagues.	4.82	1.936	5.00
I recommend CVT to my patients.	5.27	1.643	6.00

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

Comparisons between Adopters and Non-Adopters

In order to effectively compare adopters to non-adopters, the author verified and merged data between "I consider myself to be a frequent CVT user" item from the usage and recommendation construct and the actual number of telemedicine encounters from electronic medical records into *Adoption Rate* as a dependent variable into a 1-7 Likert scale. There were 19 adopters and 41 non-adopters.

Demographics of Adopters and Non-Adopters

There wasn't any major difference between adopters and non-adopters in terms of gender. About two-thirds of the adopters and non-adopters were female and one-third

was male. The ages of the participants were categorized into five ranges. The age range of 55-64 was highest for both adopters (47.4%) and non-adopters (31.1%), followed by the age range of 45-54 for adopters (21.1%) and the age range of 35-44 for non-adopters (29.3%). The numbers and percentages for each profession associated with this sample are presented in Table 4.20.

Table 4.21

Gender (Adopters vs Non-Adopters)

Gender	Adopters (N)	Non-adopters (N)
Male	26.3% (5)	24.4% (10)
Female	73.7% (14)	75.6% (31)
Total	100% (19)	100% (41)

Table 4.22

Age (Adopters vs Non-Adopters)

Age	Adopters (N)	Non-adopters (N)
25-34	15.8% (3)	12.2% (5)
35-44	5.3% (1)	29.3% (12)
45-54	21.1% (4)	14.6% (6)
55-64	47.4% (9)	34.1% (14)
65 or older	10.5% (2)	9.8% (4)
Total	100% (19)	100% (41)

The majority of the adopters were either psychologists (Ph.D. or Psy.D) (31.6%) or psychiatrists (M.D.) (31.6%), and the majority of the non-adopters were psychologists (Ph.D. or Psy.D) (46.3%). It was interesting to see that tele-health coordinators and tele-health clinical technicians view themselves as non-adopters.

Table 4.23

Profession (Adopters vs Non-Adopters)

Profession	Adopters (N)	Non-adopters (N)
Psychologist (Ph.D. or Psy.D)	31.6% (6)	46.3% (19)
Clinical Social Worker	21.1% (4)	26.8% (11)
Psychiatrist (M.D.)	31.6% (6)	7.3% (3)
PC Provider (PA/ARNP)	10.5% (2)	2.4% (1)
Nurse (RN)	0.0% (0)	7.3% (3)
Primary Care Doctor (M.D.)	5.3% (1)	0.0% (0)
Psychiatric Nurse	0.0% (0)	2.4% (1)
Counselor	0.0% (0)	2.4% (1)
Tele-Health Coordinator	0.0% (0)	2.4% (1)
Tele-Health Clinical Technician	0.0% (0)	2.4% (1)
Total	100% (19)	100% (41)

Adopters (68.4%) and non-adopters (92.7%) were predominantly from VA medical centers. Some adopters chose rural areas as their region, although they are physically located in urban areas since they use tele-health to provide care to patients in rural areas. One of participants stated in the survey,

I am located in an urban setting, but the veterans I serve are in rural locations.

That explains variation between practice location and region in table 4.22 and 4.23.

Table 4.24

Practice Location (Adopters vs Non-Adopters)

Practice Location	Adopters (N)	Non-adopters (N)
VA Medical Center	68.4% (13)	92.7% (38)
VA CBOC	5.3% (1)	7.3% (3)
Tele-health Outreach Clinic	26.3% (5)	0.0% (0)
Total	100% (19)	100% (41)

Table 4.25

Regions (Adopters vs Non-Adopters)

Region	Adopters (N)	Non-adopters (N)
Urban	52.6% (10)	85.4% (35)
Rural	47.4% (9)	14.6% (6)
Total	100% (19)	100% (41)

While 100 percent of adopters reported that they have video-based tele-health equipment in their facility, only 4.9 percent of non-adopters reported otherwise. When asked whether a participant or participant's team used a clinical video tele-health system, 89.5 percent of adopters and 53.7 percent of non-adopters answered yes.

Table 4.26

Tele-Health Equipment Availability (Adopters vs Non-Adopters)

Do you have a video-based tele-health equipment in your facility?

Yes		No		Total	
Adopters (N)	Non-adopter (N)	Adopters (N)	Non-adopters (N)	Adopters (N)	Non-adopters (N)
100.0% (19)	95.1% (39)	0.0% (0)	4.9% (2)	100% (19)	100% (41)

Table 4.27

Tele-Health Usage by Participant or His/Her Team (Adopters vs Non-Adopters)

Do you or your team use a clinical video tele-health system?

Yes		No		Total	
Adopters (N)	Non-adopter (N)	Adopters (N)	Non-adopters (N)	Adopters (N)	Non-adopters (N)
89.5% (17)	53.7% (22)	10.5% (2)	46.3% (19)	100% (19)	100% (41)

A high number of adopters (68.4%) disagreed that the absence of a physical presence between a healthcare provider and the patient severely limits the effectiveness of treatment. Some of the participants expressed that it depends on the type of treatments and populations. Some adopters stated that although it does limit somewhat, it could be

overcome, and some non-adopters weren't sure, because they hadn't actually used the system yet.

Table 4.28

Absence of Physical Presence (Adopters vs Non-Adopters)

Do you believe that the absence of a physical presence between a healthcare provider and the patient severely limits the effectiveness of treatment?

Yes		No		Missing		Total	
Adopters (N)	Non-adopter (N)	Adopters (N)	Non-adopters (N)	Adopters (N)	Non-adopters (N)	Adopters (N)	Non-adopters (N)
21.1% (4)	22.0% (9)	68.4% (13)	53.7% (22)	10.5% (2)	24.4% (10)	100% (19)	100% (41)

Perceptions of Innovation Attributes (Adopters vs Non-Adopters)

According to Moore and Benbasat (1991), adopters should have stronger agreement than non-adopters on every scale except voluntariness. This finding soundly supported the validity of their instrument, because they previously identified PCI (Perceived Characteristics of Innovation) associated with innovation adoption. In order to verify this research study with Moore and Benbasat's finding, a scale score was calculated for each respondent that was the sum of all item ratings within a construct and calculated overall scores for each construct. Scores were reversed for items requesting disagreement (see items from Table # that has ® sign); a ratings of 1 was changed to 7, 2 to 6, etc. The two groups (adopters/non-adopters) were then compared with the Mann-Whitney U test, which is the appropriate test for ordinal/nonparametric data.

Table 4.29

Perceptions of Innovation Attributes (Adopters vs Non-Adopters)

Attribute	Adopter Means (SD) N= 19	Non-**A**dopter Means (SD) N= 41	U-Test Z-Score	Significance
Voluntariness	3.36 (1.568)	4.57 (1.598)	-2.449	0.014*
My superiors expect me to use CVT (clinical video tele-health). ®	6.76 (.562)	3.73 (2.281)	-4.651	0.000**
My use of CVT is voluntary.	3.76 (2.488)	4.21 (2.094)	-0.611	0.541
If I had the time and technology was easily available, I would use CVT voluntarily.	5.77 (1.536)	5.24 (1.822)	-0.921	0.357
Relative Advantage	4.70 (1.171)	4.13 (1.097)	-2.853	0.004*
Using CVT enables me to accomplish tasks more quickly.	3.33 (1.328)	3.33 (1.238)	-0.132	0.895
Using CVT makes it easier to do my job.	3.83 (1.465)	3.62 (1.359)	-0.736	0.462
The disadvantages of my using CVT far outweigh the advantages for my patients. ®	2.44 (1.464)	3.33 (1.387)	-2.179	0.029*

The disadvantages of my using CVT far outweigh the advantages for me as a care provider. ®	2.71 (1.759)	3.85 (1.433)	-2.614	0.009*
Overall, I find using CVT to be advantageous in my job.	5.65 (1.539)	4.04 (1.637)	-2.975	0.003**
Compatibility	5.35 (1.589)	3.90 (1.699)	-3.033	0.002**
Using CVT is compatible with the way I currently perform my work.	5.35 (1.618)	4.00 (1.743)	-2.444	0.015*
Using CVT fits into my work style.	5.35 (1.693)	3.79 (1.771)	-2.723	0.006*
Image	4.66 (1.513)	4.44 (1.513)	-1.220	0.222
Using CVT improves my image within my organization.	4.56 (1.672)	4.67 (1.659)	-0.300	0.764
Because of my use of CVT, others in my organization see me as a more valuable employee.	4.75 (1.612)	4.00 (1.589)	-1.287	0.198
Ease of Use	4.33 (1.062)	3.53 (1.024)	-3.301	0.001**

CVT is cumbersome to use. ®	3.82 (1.704)	4.62 (1.675)	-1.452	0.146
It's easy to get my CVT system to do what I want it to do.	4.94 (1.526)	3.83 (1.581)	-1.965	0.049*
CVT training is quick and easy.	4.13 (2.029)	3.30 (1.559)	-1.17	0.242
It is difficult to schedule a CVT session for patients. ®	4.40 (2.063)	5.43 (1.690)	-1.582	0.114*
Reaching a CVT support team is difficult. ®	4.13 (1.857)	4.21 (1.751)	-0.152	0.879
Overall, I believe that CVT is easy to use.	4.76 (1.480)	4.21 (1.668)	-1.001	0.317
It's easy to access CVT system in my facility.	4.88 (1.799)	3.88 (1.918)	-1.679	0.093*
Result Demonstrability	5.63 (1.301)	4.97 (1.690)	-1.762	0.078*
I would have no difficulty telling others about the advantages of CVT.	5.06 (1.853)	4.57 (2.063)	-0.728	0.466
I believe that I could communicate to others the reasons for using CVT.	5.76 (1.251)	5.06 (1.896)	-1.068	0.285

I would have difficulty explaining why using CVT is beneficial. ®	1.94 (1.298)	2.87 (1.727)	-2.125	0.034*
Visibility	5.19 (1.324)	4.68 (1.559)	-1.093	0.274
I have seen others using CVT in my organization	6.17 (1.465)	5.44 (1.971)	-1.539	0.124
I have seen CVT in use outside my organization.	4.38 (2.156)	4.11 (2.386)	-0.269	0.788
CVT use is not very visible in my organization. ®	2.82 (1.629)	3.47 (1.885)	-1.187	0.235
Trialability	6.00 (1.38)	3.67 (2.147)	-4.284	0.000**
I've had many opportunities to try CVT system.	5.71 (1.611)	2.83 (2.021)	-4.124	0.000**
I know where I can go to try out a CVT system.	6.29 (1.312)	4.31 (2.340)	-3.045	0.002*
Usage and Recommendation	5.67 (1.444)	3.20 (1.389)	-4.577	0.000**
I consider myself to be a frequent CVT user.	5.53 (1.744)	1.37 (.888)	-6.355	0.000**
A lot of my patients receive CVT service(s) in my facility.	5.00 (2.000)	3.09 (2.006)	-2.909	0.004*

I plan to use CVT in the future.	6.47 (.874)	4.29 (2.177)	-3.669	0.000**
I recommend CVT to my colleagues.	5.94 (1.519)	4.26 (1.896)	-3.015	0.003*
I recommend CVT to my patients.	6.24 (1.200)	4.75 (1.626)	-3.459	0.001**

Response: 1-7 Likert (Strongly Disagree – Strongly Agree)

* Mann-Whitney U test (R) is significant at the 0.3 level or higher (medium)

** Mann-Whitney U test (R) is significant at the 0.5 level or higher (high)

This instrument reflected the higher agreement on every scale except voluntariness for adopters just as Moore and Benbasat predicted. Voluntariness's scale for adopters was less intentional compared to non-adopters, which shows that there is more pressure from supervisors for adopters to use CVT. Adopters believe that using CVT is more compatible, easy to use, and they have a good chance to try the system compared to non-adopters. Compatibility, Ease of Use, and Trialability were significantly higher for adopters.

When comparing the scores of adopters and non-adopters on the individual items, Mann Whitney U tests revealed that adopters had significantly stronger agreement on one voluntariness question and one relative advantage question in Table 4.27.

Based on adopters' comments, they made it clear that using CVT requires pre-planning in order to have a telemedicine consultation with each patient. One adopter stated,

> *Primarily it requires that I prepare ahead of time and think about what handouts or paperwork I want the veteran to have for our session. I need to mail them to*

the veteran beforehand or fax them to the CBOC and hope that staff there will get them to the vet before our session.

Another adopter made a similar statement:

Time needs to be scheduled for faxing measures back and forth, for managing tech difficulties, so less patients can be seen per hour at this point.

A non-adopter showed willingness to use the system but was reluctant because of training and scheduling issues. He/She is waiting for the VA to improve the system.

The only time I would use it is for screenings, which would be preferable to the phone screenings we now do. However, until the training/scheduling issues are dealt with it, (CVT) is impossibly difficult.

Another non-adopter stated,

I expect CVT to be compatible with how I perform my work, but as I have stated I have not started seeing patients this way yet. It has added to my work so far in that we have to go through the trainings, developing protocols, and installing technology. Sharing handouts with patients is very challenging in CVT.

Both adopters and non-adopters expressed concern about effectiveness of treatment using CVT:

I worked with this technology for three years in rural Colorado. Staffing was never sufficient to support needs of patients and providers, and there were some significant concerns about safety. Also, one simply cannot observe body language and other physical features clearly enough to do an accurate clinical assessment in some circumstances. Most of my patients have been interested in this resource.

However, there is one of my patients who refuse to believe that the interaction via CVT will be the same quality as a face-to-face interaction.

A non-adopter stated that a patient liked using CVT but didn't like a little room that has a CVT.

From what I have heard from providers using CVT, they find that it works well and that they are able to help veterans as much as they feel they could seeing them face to face in the same room. However, I have heard from some veterans that have used CVT that do not like it but not because of the CVT itself but rather because they are cramped in a little room and trying to hear and see using the CVT and that makes it hard on them. Lack of studio space at the CBOCs is a major impediment.

Adopters expressed frustrations over scheduling and workflow issues:

Scheduling patients is the trickiest part of using CVT, because most rural outpatient clinics have one or two machines that are used by several disciplines in the hospital. More machines would make scheduling much easier.

The issue I face when scheduling appointments for veterans is that the CBOC schedule is not often concurrent with the provider's schedule.

Scheduling is cumbersome.

The problem at the VA is the paperwork needed to set up CVT - at least forms including a business plan, scheduling at sites outside our facility catchment area, and potential errors when encounter forms do not match at the destination and origination sites.

The training and certification process is very unclear, and the "conditions of participation" each site has to meet are very difficult. Each site has to separately construct policies and safety procedures when a template example could have been provided nationally. The VA's "two encounter" method of workload capture and documentation requires two progress notes and two encounters per visit. Logistical issues with other-end personnel and equipment.

I believe eventually staff will become familiar enough with CVT that less reliance on support staff will be require; however, presently, the infrastructure to facilitate the use of CVT is lacking.

Non-adopters showed interests in using CVT.

If given the opportunity, I would be glad to use CVT to see how it works and how it can be used to help veterans.

I would still prefer face-to-face to my patients; have to be convinced after I use CVT for the first time. I'm willing to try it.

It's pretty obvious that this helps us reach rural veterans. I think the primary hesitation is before someone has used it and their fears that it puts a barrier between them and their client.

We all know it is used, but most have not seen it in use, leaving some assumptions in place of knowledge.

Association between Perceptions and Adoption Rate

Correlations were used with the adoption rate in order to discover whether using CVT increased the strength of agreement with the innovation attributes. As Moore and Benbasat predicted, voluntariness negatively correlated with the adoption rate, and all

other constructs were positively correlated except Image. According to Moore and Benbasat, Image is the degree to which use of innovation is perceived to enhance one's image or status in one's social system. Image didn't correlate with the adoption rate.

Table 4.30

Correlation Matrix for Adoption Rate and Perceived Characteristics

Adoption Rate	Volun.	Advant.	Compat.	Image	Ease of Use	Demo	Visible	Trial
Pearson Correlation	-.366**	.492**	.439**	.234	.532**	.377**	.341*	.694**
Sig. (2-tailed)	.003	.000	.001	.073	.000	.004	.005	.000

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

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

Multiple Regression Analysis

A stepwise multiple regression was conducted to evaluate eight perceived characteristics of innovation that were necessary to predict telemedicine adoption by VA mental health professionals at the Department of Veterans Affairs. At Step 1 of the analysis, trialability entered into the regression equation and was significantly related to adoption rate $F(1, 33) = 30.725$, $p < .001$. The multiple correlation coefficient was .69, indicating approximately 48.2 percent of the variance of the adoption rate could be accounted for by trialability. The other seven characteristics did not enter into the equation in Step 1.

The primary research question was What perceived characteristic of innovation predicts telemedicine's rate of adoption by VA mental health professionals?

The telemedicine adoption by VA mental health professionals will be positively related to the perceived trialability (Predicted Adoption Rate = .372 * Trialability - .433).

At Step 2 of the analysis, compatibility joined trialability into the regression equation and was significantly related to adoption rate F (2, 32) = 19.948, p<.001. The multiple correlation coefficient was .75 for trialability and compatibility, indicating approximately 55.5 percent of the variance of the adoption rate could be accounted for by trialability and compatibility. The other six characteristics did not enter into the equation.

The sub-research question was What combination of perceived characteristics of innovation best predict the telemedicine rate of adoption by VA mental health professionals? Trialability and compatibility are the combination of perceived characteristics of innovation that best predict telemedicine's rate of adoption by VA mental health professionals; thus, the regression equation (Predicted Adoption Rate = (.333 + .173) * (trialability + compatibility) – 1.583).

Table 4.31

Variables Entered / Removed

Model	Variables Entered	Variables Removed	Method
1	Trialability	.	Stepwise (Criteria: Probability-of-F-to-enter <= . 050, Probability-of-F-to-remove >=.100).
2	Compatibility	.	Stepwise (Criteria: Probability-of-F-to-enter <= . 050, Probability-of-F-to-remove >=.100).

1. Dependent Variable: Adoption Rate

Table 4.32

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.694	.482	.466	1.677
2	.745	.555	.527	1.579

a. Predictors in model 1: (Constant), Trialability

b. Predictors in model 2: (Constant), Trialability, Compatibility

c. Dependent Variable: Adoption Rate

Table 4.33

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig
1. Regression	86.406	1	86.406	30.725	.000
Residual	92.805	33	2.812		
Total	179.211	34			
2. Regression	99.447	2	49.724	19.945	.000
Residual	79.764	32	2.493		
Total	179.211	34			

Table 4.34

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig
1	(Constant)	-.433	.630		-.687	.497
	Trialability	.372	.067	.694	5.543	.000
2	(Constant)	-1.583	.777		-2.036	.050
	Trialability	.333	.065	.623	5.103	.000
	Compatibility	.173	.076	.279	2.287	.029

Table 4.35

Excluded Variables

Model		Beta In	t	Sig	Partial Correlation
1	Voluntariness	-.190	-1.483	.148	-.254
	Relative Advantage	.255	1.942	.061	.325
	Compatibility	.279	2.287	.029	.375
	Image	-.060	-.429	.671	-.076
	Ease of Use	.119	.697	.491	.122
	Result Demo	.121	.888	.381	.155
	Visibility	-.054	-.354	.726	-.062
2	Voluntariness	-.181	-1.503	.143	-.261
	Relative Advantage	.124	.773	.445	.138
	Image	-.154	-1.150	.259	-.202
	Ease of Use	-.046	-.258	.798	-.046
	Result Demo	-.061	-.389	.700	-.070
	Visibility	-.004	-.027	.979	-.005

a. Dependent Variable: Adoption Rate

b. Predictors in the Model 1: (Constant), Trialability

c. Predictors in the Model 2: (Constant), Trialability, Compatibility

Chapter 5

Discussions and Conclusions

In this chapter, the major findings regarding the factors that affect the telemedicine adoption rate by mental health professionals at the U.S. Department of Veterans Affairs will be discussed, as well as the implications of the study, recommendations, limitations, and areas for future research.

Major Findings

This study surveyed mental health professionals at the Albuquerque and Prescott Veterans Administration (VA) Health Care System at the U.S. Department of Veterans Affairs to investigate factors that affect the telemedicine adoption rate. Out of 60 usable responses, there were 19 (32%) adopters and 41 (68%) non-adopters. The correlation analysis shows that there was a significant correlation between perceived characteristics of innovation and adoption rate, except Image. Relative Advantage, Compatibility, Ease of Use, Result Demonstrability, Visibility, and Trialability were positively correlated with adoption rate, which means that the positive perception of these six characteristics led to higher adoption rates. On the other hand, Voluntariness negatively correlated with adoption rate indicating when there is pressure from supervisors, the adoption rate increases.

Regression analysis further investigated which characteristics of innovation best predict telemedicine adoption within a significant level. The results show that trialability emerged as the most important factor affecting telemedicine adoption by mental health professionals, which is significant, because many of non-adopters didn't get to actually

try telemedicine equipment. According to Rogers (2003), if potential adopters are able to try new innovation, then it creates less uncertainty; therefore, adoption rate increases.

Compatibility is another important factor in explaining telemedicine adoption by VA mental health professionals along with Trialability. Compatibility is the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters (Rogers, 2003, p.250). The rate of adoption increases as the compatibility of the innovation with the adopter increases. A new innovation that is compatible based on the adopter's perception creates less uncertainty and helps to adapt to new innovation. If a new idea is perceived as very similar to past innovation, then the rate of adoption increases.

Based on comments submitted by respondents, both adopters and non-adopters believe it requires enormous administrative work in order to conduct a telemedicine consultation.

Using clinical video tele-health (CVT) requires

1. Multiple scheduling: an appointment with a specialist, arranging for the telemedicine equipment, the availability of the CBOC coordinator, room availability, etc.
2. Faxing patient surveys back and forth between medical centers and CBOC.
3. Troubleshooting telemedicine equipment and Internet connection with technical support personnel (The medical center and CBOC telemedicine equipment have to work together)
4. Calling and locating patients from CBOC when the patient doesn't show up.

A respondent stated,

Time needs to be scheduled for faxing measures back and forth, for managing tech difficulties, so less patients can be seen per hour at this point.

There is also a question whether using CVT means seeing fewer patients because of additional administrative work. Further research is needed to evaluate the work productivity of telemedicine compared to face-to-face consultation.

Implications and Recommendations

Hart (2000) has described telemedicine as the single most important way to equalize the difference in resource availability between rural and urban areas. The benefits of telemedicine for rural areas are obvious. Rural veteran patients can simply drive to local clinics to see a specialist through a clinical videoconference system instead of driving several hours to see the same doctor. For those who have conditions such as traumatic brain injury (TBI) or post-traumatic stress disorder (PTSD), telemedicine service is crucial for them, because less travel time means that they can stay with their families and friends. Although telemedicine seems to be the perfect fit for veteran patients who live in rural areas, the adoption of telemedicine has been slow.

The population that plays an important role in diffusing VA tele-mental is VA mental health professionals. Rural veteran patients are recipients of the service, whereas VA mental health professionals are the actual users of telemedicine. Therefore, having an acceptance from this population is crucial in making the service available in rural areas. After conducting regression analysis on perceived characteristics of innovation with the adoption rate, the result identified that trialability and compatibility emerged as the important combination factor that affects telemedicine adoption by mental health professionals, indicating approximately 55.5 percent of the variance. Based on comments

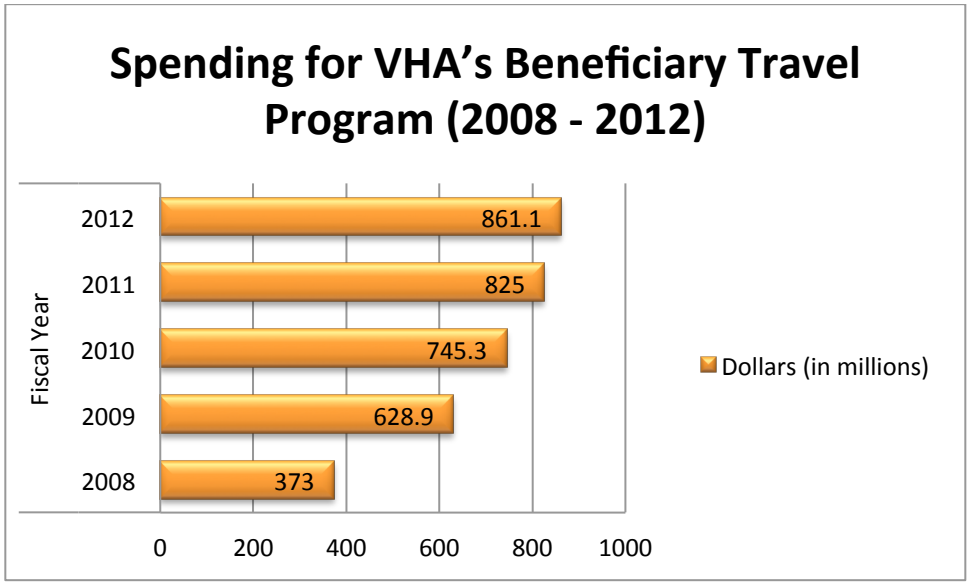
submitted by respondents, there is a clear indication that there is enormous administrative work when using a CVT compared to a face-to-face session with each patient.

Adjusting routine workflow to adopt telemedicine in clinics is not an easy task, especially when using CVT requires additional work, which is not compatible with workflow. The VA recently initiated a mandate to use some form of distance technology such as CVT and/or phone to provide patient care. This research confirmed the importance of the mandate initiative in terms of increasing the use of CVT based on the significant correlation between adoption rate and the voluntariness Item 1 ("My superiors expect me to use CVT.").

As described in Chapter 2, the use of telemedicine has been around more than 100 years. Surprisingly, the adoption of telemedicine has been slow in spite of obvious benefits. The VA recently reported to the Congressional Requesters in July 2013 that spending for the VA beneficiary travel program doubled in the last five years increasing from approximately $370 million in 2008 to approximately $860 million in 2012. Based on the current trend, expenses will surpass $1 billion within the next three years in order to sustain the beneficiary travel program at the VA. Telemedicine for the VA means more than providing alternative option for its patients. It is the only solution for the VA to be able to control the budget crisis for the VA beneficiary travel program and still provide high quality healthcare to 3.4 million veterans in rural areas.

Figure 3.

VHA Spending



Source: VA Health Care Report to Congressional Requesters, July 2013

There were major challenges while early innovators were trying to implement telemedicine, including establishing appropriate technology infrastructure and sustaining high operating costs during the last 100 years. Due to the advancement of technology and the decreased cost of high-speed bandwidth and clinical videoconference equipment, those barriers are no long challenges in the 21st Century. For the VA, telemedicine infrastructure is already established and operational throughout the country, but because of the unsolved challenges previously mentioned, the adoption of telemedicine is still slow.

Recommendations

1. Staging – Using CVT requires enormous administrative work for medical providers. Therefore, the VA leadership needs to consider a pilot study to evaluate the effectiveness of the staged telemedicine program, which allows

medical providers to simply walk in and see patients through CVT without handling multiple administrative tasks. Administrative assistants set up telemedicine equipment, make schedules, and collect patient survey documents ahead of time. Staging will create a homologous work environment like a face-to-face session that medical providers are accustomed to and will allow them to focus on providing high quality care to veteran patients without juggling administrative details. As the adoption rate increases, this program will not only reduce significant travel reimbursement fees but also improve patient satisfaction and work productivity. Further research is needed to measure satisfaction and work productivity when-using CVT accurately.

2. Trialability - CVT adoption rate increases once non-users try it. Just hearing about CVT is not enough for non-users to adopt it; it actually takes them using the system. According to Rogers (2003), the heart of the diffusion process consists of the modeling and imitating by potential adopters of their network partners who have previously adopted. Therefore, the VA leadership needs to create a program to give an opportunity for non-users to try the system along with their colleagues that are currently using it. Therefore, the VA leadership needs to mandate mental health professionals to try the system along with their colleagues that are currently using it after improving workflow of CVT.
3. Compatibility – Using CVT requires significant workflow adjustment for medical providers; therefore, VA leadership needs to focus on improving:

- Multiple scheduling:
    1. With specialist,
    2. With telemedicine equipment,
    3. Availability of CBOC coordinator, and
    4. Room availability, etc.
- Faxing patient survey back and forth between medical center and CBOC
- Troubleshooting telemedicine equipment and Internet connections with the technical support team (both medical center and CBOC telemedicine equipment have to work together).
- Manually calling CBOC when the patient doesn't show.

4. Benefit – There is a misalignment when it comes to using CVT in terms of benefits. VA mental health professionals are the actual users of the CVT, and veteran patients are the recipients of the service. Using CVT doesn't generate any real benefits to medical providers; the benefit is on the patient side. Rural veteran patients can simply go to local clinics to see a specialist through a clinical videoconference system instead of driving several hours to see the same doctor. Although there is no real benefit to medical providers, they are considering using CVT for their patients' sake. It is the inner gratification that medical providers receive when they see patients receiving the benefit when using CVT. Therefore, the VA leadership needs to consider creating incentive programs for CVT users, such as telecommuting option, financial benefits, and an increase in RVU (relative value unit), etc., to encourage the use of CVT.

Limitations

1. Because this study was limited in its degree of analysis and sample size, the results of the study may not represent the opinions and practices of tele-mental users and non-users.
2. This survey is based on accidental samples. The results of the study may not represent the opinions and practices of tele-mental users and non-users.
3. The result of this study may not represent the opinions of the VA medical professional population, since it is only focused on VISN 18. Geographical variation needs to be considered.

Directions for Future Research

1. Further research is needed to measure satisfaction of using CVT for medical providers compared to face-to-face consultation.
2. There is also a question whether using CVT means seeing fewer patients because of additional administrative work. Further research is needed to evaluate the work productivity of telemedicine compared to face-to-face consultation.
3. Using CVT requires enormous administrative work for medical providers. Therefore, VA leadership needs to consider conducting a pilot study to evaluate the effectiveness of the staged telemedicine program.
4. Further research is needed for ceiling and floor effects to be able to substantiate predictions and also consider conducting a regression diagnostic to explain patters of using CVT.

5. Further research is needed to increase the value of the research by conducting power analysis.

Conclusions

Fifty percent of all military recruits come from rural areas. As a result, 41 percent of VA-enrolled patients are from rural areas. Since VA CBOCs do not offer a diverse range of healthcare services at rural locations, these patients still have to travel long distances to receive specialty services to which they are entitled. For that reason, the VA spent $861 million just for transferring patients between rural and urban areas in 2012. Technology such as telemedicine could equalize the uneven distribution of healthcare resources between urban and rural areas and make healthcare services readily available to rural veteran patients, but the adoption of telemedicine has been slow by VA medical providers.

Rogers (2003), Moore, and Benbasat (1991) identified eight perceived characteristics of innovations that a variety of diffusion studies have shown to consistently influence adoption:

- Relative Advantage,
- Compatibility,
- Complexity,
- Image,
- Ease of Use,
- Result Demonstrability,
- Visibility, and
- Trialability.

After conducting regression analysis on perceived characteristics of innovation with the adoption rate, the result identified Trialability and Compatibility as the most important combination factor that affects telemedicine adoption by mental health professionals, indicating approximately 55.5 percent of the variance. Based on comments submitted by respondents, there is a clear indication that there is a large administrative workload when using a CVT compared to a face-to-face session with each patient.

Due to the advancement of technology and the decreased operational cost of high-speed bandwidth and clinical videoconference equipment, technology isn't a focal point of telemedicine anymore. Perhaps our early innovators thought that faster and better technology was the answer for diffusing telemedicine. Using the framework of diffusion of innovation theory by Rogers, the research demonstrated that it is the acceptance of the innovation by people that sparks diffusion, not the other way around. The diffusion of telemedicine won't become the mainstream until we closely look at the workflow of people using the system.

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