2015

# The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach

Grace Bonanno
*Nova Southeastern University*, gracebonanno@gmail.com

# The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach

by

Grace Bonanno

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in
Computer Information Systems

Graduate School of Computer and Information Sciences
Nova Southeastern University

2015

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

Maxine S. Cohen, Ph.D. — Date
Chairperson of Dissertation Committee

James R. Templeton, Ph.D. — Date
Dissertation Committee Member

Richard D. Manning, Ph.D. — Date
Dissertation Committee Member

Approved:

Eric S. Ackerman, Ph.D. — Date
Dean, Graduate School of Computer and Information Sciences



Graduate School of Computer and Information Sciences
Nova Southeastern University

2015

An Abstract of a Dissertation Submitted to Nova Southeastern University
in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

# The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach

by
Grace Bonanno
May 2015

When face-to-face physical medical exams are not possible, virtual physical exams, in the form of a pictorial medical exam/history, can be substituted, and telemedicine can be the means to deliver these virtual exams. The goal of this work was to determine if presence in the form of a visual and/or pictorial medical history can be of benefit to clinicians in the diagnosis of medical conditions of individuals with developmental disabilities (DDs) and/or intellectual disabilities (IDs), in particular those who cannot, because of their cognitive and/or physical disabilities, verbally relate their illness to a clinician. Virtual exams can also be useful in cases where clinicians may need additional advice from fellow experts, especially if those experts are not physically present.

A web-based telemedicine application used for treating persons with DD/IDs was developed. This application includes a visual medical history component incorporated into an electronic medical records application. The purpose is to allow the clinician to use an environment that integrates a written and visual representation of a patient's medical history and physical findings to aid the clinician in determining a medical diagnosis.

Twenty-two clinicians and five direct service aids of a New York State Developmental Disabilities Services Office facility, who deliver healthcare to DD/ID patients on a daily basis, accessed the telemedicine application instead of their traditional hardcopy/paper medical history when examining patients. A comprehensive survey was distributed to the clinicians to determine the effectiveness of the application as well as help answer the primary questions proposed by this research.

The results of this study showed that presence in the form of a video medical history is preferred by clinicians rather than having just a written medical history of the patient. Clinicians felt the visual medical history component of the telemedicine application was useful and informative for delivering healthcare to individuals with DD/ID and enabled them in diagnosing a patient as well as lessened the need to transfer patients to the emergency room, resulting in a significant cost savings.

# Acknowledgements

First, I would like to thank God for giving me the intellectual ability, the tenacity, and the fortitude to complete this dissertation and for placing persons in my life who have assisted and supported me throughout this learning experience.

I would like to especially thank Dr. Maxine Cohen, my dissertation chairperson, for her guidance and direction, support in believing that this research is worthwhile, instrumental feedback and encouragement which gave me the resolve I needed to stick it out through the entire process. To Dr. Manning and Dr. Templeton, my dissertation committee, thank you for your valuable input and insightful comments as well as your encouragement.

To my family, friends and colleagues, for your enduring support and the countless words of encouragement and exhortations; I am truly blessed to have such wonderful people in my life.

To those who take care of and serve individuals with DD/ID, especially to those individuals who work for NYS DDSO, you have my utmost respect and appreciation for the tireless efforts you demonstrate on behalf of individuals with disabilities.

I dedicate this dissertation to my nephew, Nathanael, who was the inspiration for me to pursue this research endeavor. It is because of his developmental disabilities and the challenges he encounters on a daily basis that has impelled me to investigate a method that would in some way benefit his life and others with DD/ID.

Table of Contents

List of Tables

## Tables

List of Figures

## Figures

# Chapter 1

# Introduction

## Background

Information technology and the combination of hardware and software products have greatly impacted our lives. One arena that technology has significantly altered is the practice of medicine. Telemedicine, the use of technology to deliver health care, enables clinicians to provide health care remotely to patients (Alem, Hansen, & Li, 2006). Currently being deployed in a variety of settings, real-time consultations (synchronous communications) and batch processing of patient data (asynchronous communications), telemedicine is offering solutions to problems of managed healthcare and will likely contribute to and have an impact on the effectiveness of healthcare (Huston & Huston, 2000).

Two studies (Harrison, MacFarlane, Murray, & Wallace, 2006; Tachakra, & Rajani, 2002), on the use of technology and its promotion of health care have been conducted as well as clinical studies measuring the outcomes of the use and adoption of telemedicine applications. Patients' perceptions, social presence, and telepresence (giving the appearance that one is present), have been studied in the context of a user's satisfaction with the use of telemedicine applications (Harrison, et al., 2006; Tachakra et al., 2002); however, little research has been conducted on the necessity of presence to assist clinicians in the diagnosis of medical conditions of individuals with developmental disabilities (DD) such as patients with Down syndrome, mental retardation, or cerebral palsy. Those with DD and/or intellectual disabilities (ID) are

referred to as either having a cognitive impairment or having a cognitive adaptive disability (Baldor & O'Brien, 2010). Those with DD/ID typically have physical and/or mental impairments that substantially limit their ability to take care of themselves, speak and be understood clearly, learn, walk/move, make decisions, live on their own, and/or able to function independently without coordinated services (US Department of Health and Human Services, 2013).

**Problem Statement**

A physical examination is necessary to provide the physician with the whole picture. It allows the physician to explore the body in ways technology-related procedures, such as X-rays or MRI's, cannot. Technology-related procedures should be used as an extension to the physician's visual and physical exam and should not be used as a replacement (Max, 2009). According to Max, studies have proven that a patient's medical history and physical exam play a vital role in a correct diagnosis; approximately 80 to 85% of diagnoses are reached when regular physical exams are conducted and a patient's medical history is reviewed. Lab tests and imaging are just complementary to the exam.

When face-to-face physical medical exams are not possible, virtual physical exams, in the form of a pictorial medical exam/history, can be substituted, and telemedicine can be the means to deliver these virtual exams. Face-to-face physical exams may not always be possible for individuals who reside in assisted homes such as the Taconic Developmental Disabilities Services Offices (DDSO) which is one of New York State's regional offices for persons with developmental disabilities. Virtual exams can also be useful in cases where clinicians may need

additional advice from fellow experts, especially if those experts are not physically present. In addition, having a virtual exam/medical history available for a clinician may better help the clinician in determining a diagnosis, especially if the patient is not able to communicate his/her condition or illness to the clinician, such as those with cognitive disabilities.

Evidence-based medicine (EBM) combines research evidence, clinical expertise, and patient values to facilitate healthcare decision making, to assist clinicians in deciding on treatment options, screening programs, and risk management, as well as to know the different treatment interventions available for patients (Schlesselman, 2004). According to Hayes and Abowd (2006), evidence-based practices are becoming a guiding factor in healthcare decisions where evidence-based care (EBC) is being used to capture episodes of real life or daily life activities. That information is then analyzed, and a plan is developed to improve the life of the individual. Hayes, Kientz, Truong, White, Abowd, and Pering found that the monitoring and diagnosis of children with special needs was greatly enhanced due to the collection of the evidence such as empirical data, narratives, video, and medical records (as cited in Hayes & Abowd, 2006, p. 938). Within the Wielkopolska, Poland health network, a medical digital library was constructed as part of a telemedicine infrastructure providing a collection of information and electronic information objects to help build decision support and medical teleeducation services (Kosiedowski, Mazurek, Stroinski & Weglarz, 2009). The digital library is organized into four parts which include a medical database of descriptions and domains, a user interface to define the look and feel of how cases should be displayed, the case database where medical cases are stored, and the multimedia storage section where medical images or video are stored (Kosiedowski et al., 2009). The medical library served as an evidence-based reference of medical cases to enable faster diagnosis and to better utilize specialist medical competence.

Within the medical field, common practice is to keep just a written medical history. The problem is that written or oral evaluations are not enough to determine the extent of an injury of one with ID, or if there is an injury at all. Since experts (Max, 2009; Hayes & Abowd, 2006) agree that medical exams and history are necessary for a diagnosis, and EBC's have been shown to be effective in the diagnosis of those with special needs, developing a framework where these two methodologies complement each other may be beneficial, especially when treating individuals with ID. Can presence, in the form of a visual, pictorial medical history, assist clinicians in reaching a diagnosis of cognitively and/or physically disabled individuals?

**Dissertation Goal**

The goal of this work is to determine if presence in the form of a visual and/or pictorial medical history is beneficial to clinicians in the diagnosis of medical conditions of individuals with DD, in particular those who cannot, because of their cognitive and/or physical disabilities, verbally relate their illness to the clinician. The interface that displays a patient's medical history will contain a combination of written and visual information. A list of such information is noted below:

- Chief complaint (CC)
- History of present illness (HPI)
- Past medical history (PMH)
- Past surgical history (PSH)
- Family history (FH)
- Review of System (ROS)
- Physical Exam Section
- Assessment & Plan

The physical exam section includes full-length pictures and/or video of the patient. The set of pictures may include a frontal, back, and side view of the patient and may include video as well that shows live motion of the person, e.g., how the person walks (if able)

and talks (if able). A pictorial medical history is noted for all patients, regardless of age. A baseline measurement, which includes either a full set of still or static pictures and/or video at first visit to the clinician, was taken of the patient. At each subsequent medical visit, pictures and/or video were taken again to keep an on-going pictorial history available. Under the Physical Exam Section, the body area(s) that may be graphically documented may be found in the Evaluation and Management Services Guide (Department of Health and Human Services Centers for Medicare & Medicaid Services, 2010).

A secure web-based, or cloud-based, telemedicine application was developed. Using the cloud, which offers convenient, versatile, and efficient services, to deliver telemedicine is a "promising approach to pervasive and cost-effective health services" (Zhanpeng & Chen, 2014, p.54). Since this application is a web-based application, access to view any patient information will require a valid username and password. The application will provide the clinician with a written medical history of the patient, similar to typical electronic medical records (EMR) interface, and information about the patient will be listed in text format. However, unlike a typical EMR interface this application also includes a visual medical history of a patient. The application includes a separate retrieval option where clinicians are able to search for visual images of the patient stored by date of image taken.

The clinicians who work closely with DD/ID patients on a regular basis at the New York State Taconic DDSO facilities were asked to review this application and then complete a survey as to the usefulness of this type of application. Their responses were coded and analyzed.

The visual/pictorial medical history may consist of both still photos and video clips of either a centralized area of the body or the entire body of the patient. Images were taken over time. A baseline snapshot and/or video of the patient were taken at his/her first medical exam

and additional snapshots/video was taken at every medical visit or exam thereafter. In this way, a visual/pictorial medical history is available for each patient.

**Research Questions**

The hypothesis of the research is that presence, in the form of a visual or pictorial representation of a patient's medical history, can assist in delivering correct or more accurate diagnosis of cognitively disabled individuals. This form of presence can assist in the treatment process by not only saving a patient's life but sparing undue cost, time, and effort of patient and ancillary medical professionals. The following questions have been addressed by this research:

1. Can presence, in the form of a visual medical history, beginning with a baseline measurement and periodic updates, updates taken each time the patient visits the clinician within a three month period, provide a more direct medical assessment or diagnosis than a purely written medical history?
2. Will the perceived content of the medical information (i.e., visual medical history) presented to the clinician have a significant impact on the cost effectiveness (time and money) of delivering health care via a telemedicine application?
3. Can the design elements (i.e., how the site is displayed or represented to the clinician) of the telemedicine system have significant impacts on the perceived usefulness (i.e., quicker and/or more informative method of delivering healthcare) of the telemedicine application?

**Relevance and Significance**

Fontelo, Ackerman, and Kim (2004) declare the necessity for clinicians to be equipped with resources in order to access information repositories to help them make proper point-of-care decisions. Sackett and Strauss demonstrated that allowing clinicians access to evidence-based resources increased the likelihood that clinicians would research and incorporate evidence information into their patient care decisions (as cited in Fontelo et al., 2004, p. 2).

A significant finding of an 18 month study conducted of caregivers of children with special needs showed that the collection of evidence, such as empirical data, narratives, and rich media/video about the child greatly enhanced the diagnosis and monitoring of such children (Abowd & Hayes, 2006). According to Abowd and Hayes, ubiquitous computing may be the catalyst that links EBC to healthcare.

In addition to special programs or assistance, information and communication technologies (ICTs) are being used to provide direct support to caregivers of those with cognitive disabilities. For example, a patient who experienced excessive volubility due to a brain injury was helped via a communication system (Lewis, 2005). Through the use of this system, a clinician was able to monitor the conversation of the patient and prompt the patient to shorten their speaking time and redundancies which in turn allowed the patient to establish control of his conversation. With the use of ICT's, clinicians can issue a verbal command prompting the person to exert appropriate control. This "always-on communication" (Lewis, 2005, p.14) may be of great assistance to the problems of ordinary life for those with cognitive disabilities. Interestingly enough, it is suggested that this technology can be used to allow clinicians or caregivers to remotely monitor the everyday interactions of an individual with DD and/or ID

allowing them to detect and/or respond appropriately to that individual in order to prevent a potentially upsetting situation.

Alem, et al. (2006) state that users of telemedicine applications are influenced by the degree of presence available in the technology used. It is found that a stronger relationship is created between consulting clinicians when presence is used in consultations (Templeton, 2010). More important than establishing a strong social connection between clinician and patient, presence is a necessity for the diagnosis of certain medical conditions of the cognitively disabled, or those with DD/ID. Although people with DD/ID's sometimes experience poor health, regrettably their poor health may not necessarily be linked to their disability but may be linked to difficulty in accessing needed services and programs (World Health Organization, 2010). Unfortunately, patients with DD/ID receive less than adequate care compared to the general population (World Health Organization, 2010). Clinicians agree that persons with DD/ID require periodic physical exams, and certain guidelines for routine health maintenance should be followed (Baldor & O'Brien, 2010). This may be due in part to their inability to express what concerns them because of the limitation they have in verbally communicating.

According to Glatter (2010), an initial physical exam has become a token gesture, performed only because patients expect it. Similarly, the senior associate chairman for the theory and practice of medicine at Stanford University states that the physical exam has become a lost art even though the old-fashioned form of physical examinations enabled physicians to "swiftly diagnose a peculiar walk, sluggish thyroid or leaky heart valve using just keen eyes, practiced hands and a stethoscope" (Grady, 2010, p.1). If physical exams are important in helping physicians diagnose the general population, then all the more so it is vital for the diagnosis of patients with DD/ID and especially for those who cannot express for themselves

what they are experiencing. In order to avoid medical problems in individuals with DD/ID, routine physical exams must be conducted and medical history documented. Along with the written medical history, a visual (pictorial) history should be made available. The adage, "a picture is worth a thousand words" and comments such as "they just don't look like themselves" or "they are not acting right" from caregivers, are evidence that a pictorial medical history is essential in aiding clinicians in treating individuals with DD/ID.

A large component of a health care system is communication (Alpay, Toussaint, & Zwetsloot-Schonk, 2004); however, communication is usually ignored in informatics thinking (Coiera, 2000). Reddy and Spence found three major occurrences determine whether clinicians will collaborate with each other on patient care: lack of expertise, lack of immediate accessible information, and the complexity of information needed (as cited in Karunakaran, Hee-Nam, & Reddy, 2012, p. 744). According to Coiera, "the biggest information repository in health care lies in the people working in it, and the biggest information system is the web of conversations that link the actions of these individuals" (p.278). Unfortunately, not all patients are able to communicate their medical needs. In addition, some healthcare facilities, especially those that house individuals with DD/ID's, do not have 24-hour qualified staff or clinicians who are familiar with the medical history of all the residents available to verbally communicate medical concerns to other clinicians.

A 2001 Institute of Medicine report stated that approximately 100,000 people die each year due to preventable medical errors; in light of this, the report strongly encourages developing and applying information technology as a possible solution (El-Gayar, Sarnikar & Wills, 2010). El-Gayar et al. suggest that there is a lack of evidence about medical treatments at the point of

care and providing better retrieval of information, possibly via a cyberinfrastructure framework, can better improve healthcare outcomes as well as lower health care spending.

Since individuals with DD/ID's have a higher frequency of needing medical attention, these individuals require more monitoring than the general population. They are more prevalent to injuries, sores, and cell deformity. Although enhancing communication can be a key element to treating those with DD/ID, many individuals with DD/ID cannot themselves communicate to others that they need medical attention. If, however, a clinician had a visual (pictorial) medical history of a patient in which to refer, the clinician may be able to see that something is out of the norm. A telemedicine application that makes use of both written and visual medical history, establishing a baseline measurement and continuing throughout the life of the patient, may be valuable and can make a difference in the primary care of individuals with DD/ID.

In addition, the medical costs of treating individuals with DD/ID may be inflated because of the extended services they require. Since non-verbal individuals with DD/ID are not able to communicate their medical needs, medical treatment may be exaggerated due to the lack of practical medical information. According to the Center for Disease Control (CDC MMWR, 2006), those with DD/ID require long-term supportive care or services. Moreover, lifetime costs average $1,014,000 per person for those with mental retardation and $921,000 for those with cerebral palsy (CDC MMWR, 2006). "Total direct costs (i.e., direct medical plus direct nonmedical) amounted to approximately $12.3 billion for persons with mental retardation and $2.2 billion for persons with cerebral palsy" (CDC MMWR, 2006, p.2).

For these reasons, it is necessary to develop a telemedicine application model that provides clinicians the means to seamlessly and effectively diagnosis and treat individuals with DD/ID's and at same time potentially reduce cost of travel, time, and unneeded medical visits.

**Barriers and Issues**

To some extent medical diagnosis and treatment are subjective and only as good as the examiner and his or her expertise. It is a well-known fact that, when individuals with cognitive disabilities are sent to the emergency room, an appropriate diagnosis and treatment may be delayed or overlooked simply on the bias of the clinician feeling the problem or presentation is just a behavior characteristic of the individual's disability (J. Bonanno, personal communication, May 10, 2011).

Developing an interface/application that offers video and/or pictorial archival documentation of a patient's medical history and physical exam can be invaluable to the clinician taking care of an individual with an ID. This technology, in the hands of an appropriate clinician, especially one trained in DD/ID, can utilize the benefits of this interface for the advantage of the patient. This interface has the potential to be a valuable tool for diagnoses and treatment of these particularly challenging individuals. It can improve a clinician's judgment call and possibly prevent further injury of an individual, as well as avoid unnecessary transfer of these individuals to hospitals. However, an interface of this type would not preclude a clinician's judgment or order to transfer a patient to an appropriately needed facility for specific and specialty testing should the clinician so deem. Direct video interaction should, in fact, improve such judgment.

**Assumptions, Limitations and Delimitations**

One assumption of this study is that a specialized telemedicine application including a graphical, pictorial medical history along with a written electronic medical history will help

clinicians in treating patients with DD/ID. Another assumption is that this application will help reduce costs in delivering health care to DD/ID individuals. If the attending clinician can view an individual's pictorial medical history, the clinician would be able to better determine if there is a present concern or not; if there is no viewable difference or change in the individual's condition. This may lead to a reduction in unnecessary emergency room or hospital visits for these patients, reducing the cost of health care. Along with cost, time taken by clinicians, hospital workers, and ambulance workers needed to transport disabled individuals to a hospital may be reduced.

One limitation that may have potentially impacted the internal validity of the study is that the group used in the testing did not experience a vast range of health problems that can help validate the need for the type of framework proposed. Another potential limitation was the small sample size as to patients and clinicians.

A delimitation of this study is that this framework is designed specifically for DD/ID individuals, a particular population with very specific medical needs. Second, the framework is designed for a specific institution where the clinicians are limited to physician assistants, internists, nurses, and clinical pathologists.

**Definition of Terms**

**Affective Diary** is a digital diary that allows a user to not only scribble notes but records body memorabilia through the use of body sensors such as a body sensor armband. Activity such as text messages or pictures taken is logged on a mobile phone. Movement is registered by a pedometer. Emotion is measured by a Galvanic Skin Response system that measures electricity emitted through one's skin (Hook, 2008).

**Activities of Daily Living (ADL)** is a term used in healthcare to describe the activities an individual may do during a normal day such as eating, bathing, dressing, toileting, and transferring (walking) (Beach, Schulz, Downs, Matthews, Barron, & Seelman, 2009).

**Affective Computing** is the study and development of computers that can recognize and express human emotion (Picard, 2003).

**Asynchronous communications** is the intermittent transmission of data; a predetermined timeframe is not set or followed (Huston & Huston, 2000).

**Convention on Rights of Person with Disabilities (CRPD)** is a declaration proclaiming the rights and freedoms of all individuals with a disability (United Nations, 2006).

**Community Based Rehabilitation (CBR)** offers strategies to people with disabilities and their family members on ways to access and benefit from education, employment, health and social services; empowering those with disabilities and enhancing their quality of life (World Health Organization, 2010).

**Computer-Supported Corporative Work (CSCW)** is a term used to describe when technology is used to support individuals in the work place (Beach, Schulz, Downs, Matthews, Barron, & Seelman, 2009).

**Developmental Disability (DD)** is a term used to describe a mental and/or physical disability that occurred at birth or at an early age and that prevents an individual from functioning in major life activities (Baldor & O'Brien, 2010).

**Evidence-based Care (EBC)** seeks out the best empirical evidence and professional wisdom in order to provide the greatest possible care for an individual (Hayes & Abowd, 2006).

**Evidence-based Medicine (EBM)** is the practice of integrating clinical expertise with the best clinical evidence when making health care decisions (Schlesselman, 2004).

**Electronic Medical Record (EMR)** is an electronic record of one's health-related information (Nisanbayev, Na, Lim & Ko, 2009).

**Health Information Technology (HIT)** is the electronic exchange of health information used to improve the quality of health care, reduce health care costs, decrease paperwork, and increase access to health care (Goldschmidt, 2005).

**Human Computer Interaction (HCI)** studies the interaction of humans with computerized systems; focusing on the design, evaluation, and implementation of computerized systems for human use (Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong & Verplank, 2009).

**Intellectual Disability (ID)** is a term used when a person's ability to learn and function at an expected level is limited (Baldor & O'Brien, 2010).

**Participatory Design (PD)** is the active involvement of users in the assessment, design, and development of technological and organizational systems (Ballegaard, Hansen, Kyng, 2008).

**Randomized Controlled Trials (RCTs)** is a quantitative medical study where individuals are chosen at random to participate in a clinical intervention; the goal is to measure and compare the outcomes of the intervention (Horn & Gassaway, 2007).

**Synchronous communication** occurs when both the sender and receiver have coordinated the flow of data with each other before transmission of information is sent (Huston & Huston, 2000).

**Telemedicine** is the use of modern technology and telecommunications to deliver health care (Alem, Hansen, & Li, 2006).

**Telepresence** is the combination of high definition audio and video technology along with interactive elements that allow individuals to feel or appear as if they were present in a distant location they are not physically in (Harrison, MacFarlane, Murray, & Wallace, 2006; Tachakra, & Rajani, 2002).

**Ubiquitous Computing** is the integration of information processing into our everyday activities; it involves the simultaneous use of computing systems and devices to perform an ordinary activity (Abowd & Hayes, 2006).

## Summary

Individuals with DD/ID may not be able to verbally express their medical concerns to a clinician. Information and communication technologies (ICTs) can be used to provide direct support to caregivers of those with DD/ID. Developing a telemedicine application that presents a written and visual (pictorial) medical history can benefit in the diagnosis of medical conditions

of those with DD/ID and can potentially be a valuable tool for diagnoses and treatment of these particularly challenging individuals.

# Chapter 2

# Review of Literature

## Introduction

This chapter will review relevant literature relating to presence within telemedicine applications and its relationship with diagnosing individuals with DD/IDs. Discussed in this chapter will be the clinical exam, DD/ID individuals, evidence-based care (EBC), EMR, HCI within healthcare, and telemedicine. These areas were studied to establish a framework for developing a telemedicine application that includes a visual, pictorial medical history, primarily to assist clinicians in reaching a diagnosis of cognitively and/or physically disabled individuals.

## The Clinical Exam

To a clinician, sight is important although insight is much more important. This statement is so significant to Georgetown University that medical students are given the opportunity to enroll in an Art Medicine class where they can sharpen their diagnostic skills by enhancing their observational skills through viewing masterpieces of artwork (Virtual Mentor, 2000). Medical students review Rembrandt's Van Rijn's self-portraits that span 27 years and evaluate the painter's health using clinical observation and art technique. Just as art can say things that can't be expressed in any other way and as photographs and captured images help keep precious moments of people's lives vivid in their memories, visual evidence can be a great asset in helping clinicians reach a medical diagnosis. According to Elstein and Schwarz (2002),

mastery of content leads to clinical diagnostic accuracy and a shift in the medical arena from the study of judgment to the study of organization and retrieval of memories is being made. The misperception or misreading of evidence, especially visual cues, can lead to an incorrect diagnosis (Elstein & Schwarz, 2002).

A study of 100 patients in Cook County hospital, Chicago, Illinois, showed that 26 percent of physical examinations performed by physicians' revealed pivotal findings and prompted active collaboration with other physicians resulting in appropriate treatment for the patient (Reilly, 2003). According to Reilly (2003, p.1104), the results of this study lend strong support that "sick patients need careful physical examination, the more skilled the better." In addition, the findings of this study show that although evidence-based medicine can play an important part in making decisions, the clinician's knowledge and skills should be of greater importance.

As of 2004, the US National Board of Medical Examiners has instituted that all medical students be required to demonstrate their competency in performing a physical examination before they can be licensed (Reilly, 2003). The United States Medical Licensing Examination (USMLE) consists of three steps (Step 1, Step 2, and Step 3) that measure a physician's ability to deliver safe and effective patient care. Physicians are assessed on their ability to apply knowledge, concepts, and principles and whether they are able to demonstrate fundamental patient-centered skills (United States Medical Licensing Examination, 2012). Step 2 of the USMLE, specifically assesses a physician's ability to gather information from patients, perform physical exams, and whether the physician can communicate their findings to patients and colleagues (United States Medical Examination, 2012). Each examiner will encounter 12 patients with common symptoms and complaints. The USMLE lasts eight hours and is

specifically designed to test the physician's ability to analyze a patient's medical history and develop a reasonable diagnosis.

**Developmental/Intellectual Disabled (DD/ID) Individuals**

It is reported that those with DD/ID have significant health risks and/or problems as well as experience a greater chance of dying from preventable causes than the general population (Hanna, Taggart & Cousins, 2011). In addition, individuals with ID are less likely to receive quality healthcare or participate in health awareness programs. Those with DD/ID are not as informed about cancer screenings (Reynolds, Stanistreet, & Elton, 2008; Peate & Maloret, 2007), or given proper medical care for conditions such as epilepsy (Bowley & Kerr, 2000) and other chronic conditions (Janicki, Davidson, Henderson, McCallion, Taets, Force, Sulkes, Frangenberg & Ladrigan, 2002). Weight management (Rimmer & Yamaki, 2006), poor vision (Woodhouse, Adler, & Duignan, 2004), and mental health problems (Holden & Gitlesen, 2004) are also great concerns overlooked.

Care-givers of those with ID may misinterpret behavioral and physical changes and think those changes are a manifestation of the disability rather than something that may be causing the individual discomfort or pain (Lindsey, 2002). Clinicians who care for those with DD/ID not only need to be aware of the individual's communication difficulties but must be open to a progressive form of consultation, systematic surveys and screenings possibly accompanied by more specific medical surveillance especially for those with severe conditions (Hogg, 2001).

According to the World Health Organization (2010), one barrier to receiving quality health care for people with disabilities is the communication and information barrier—it may be difficult for an individual to communicate his/her symptoms to a health care worker (e.g.,

because of an intellectual impairment). As a result of the United Nations Convention on Rights of Persons with Disabilities (CRPD), which states that people with disabilities have the "right to the enjoyment of the highest attainable standard of health without discrimination" (United Nations, 2006, p.18), the World Health Organization developed Community Based Rehabilitation (CBR) programs to offer support to those with disabilities in achieving their greatest level of health (World Health Organization, 2010). The concept of CBR combines the efforts of disabled persons, their families and communities, health, education, vocational and social services in order to develop strategies for the rehabilitation, equalization of opportunities, and social integration of disabled persons. The CBR guidelines suggest that health care professionals "use a variety of media and technologies when planning and developing health information programs for people with disabilities" (World Health Organization, 2010, p.22) in hopes that clinicians will be aware of and be able to meet the special needs of those with disabilities. Thus, this research design supports the mission of the World Health Organization.

As determined by the National Science Foundation (NSF) cluster group, Human-Centered Computing, within the Division of Information and Intelligent Systems, emerging research opportunities lie within the following areas (Sears, Lazar, Ozok, & Meiselwitz, 2008):

- developing intelligent user interfaces that interact with information technologies, including interactions of speech, eye-tracking, and electrophysiological data;
- focusing on universal design with the center of attention on cognitive impairments such as autism, visual, physical, and hearing impairments, including brain-computer interfaces for those with severe impairments;
- implementing ubiquitous computing which includes mobile, embedded, and location-aware technologies (e.g., home monitoring systems).

Computer-Supported Cooperative Work (CSCW) settings use technology to maintain or enhance the health, functioning, and independence of individuals who require assistance, such as the elderly or disabled individuals. Beach, Schulz, Downs, Matthews, Barron, and Seelman (2009) report that individuals with disabilities, such as those who need help with Activities of Daily Living (ADL) (bathing, dressing, grooming, eating, or transferring) are more willing to have their daily activities recorded via video, sound, and/or video with sound, and are willing to have their health-related information shared with health professionals. It was proposed that health-care professionals become the trusted liaisons for such individuals allowing the professional to monitor and review recorded data in order to reach acceptable decisions as to the care of the disabled individual (Beach et. al., 2009). Based on these findings, one might argue that if a disabled individual with cognitive ability trusts the recording of their activities to benefit their health care, then cognitively disabled individuals would also welcome this benefit.

Those with developmental disabilities have a higher occurrence of health problems. Coupled with inequalities in receiving health care, receiving regular health assessments is most effective in detecting and treating the health needs of those with learning disabilities (Drummond & Marsh, 2008; McGrath, 2010). Research also suggests that health assessment tools should be designed specifically for this group of people and that the assessment tool should include a combination of pictures, symbols, and photographs as well as educating and training care givers in recognizing specific health needs of this particular group (Drummond & Marsh, 2008). In addition to specialized health assessment tools, annual health checks are encouraged (McGrath, 2010). Cooper, Melville, and Morrison state that health problems, such as epilepsy, sensory impairments, or congenital heart disease, for individuals within this population differ from most and can be directly related to their disability and these health problems can go unnoticed (as cited

in McGrath, 2010, p. 35). Symptoms may be overlooked simply because DD/ID individuals may not recognize them and/or may have problems communicating their illness or pain. In some cases, the illness may be gradual, and indications of illness may not be obvious to family members or care givers. Unfortunately, people with disabilities may not seek medical attention until the illness takes a negative effect on their life (Drummond & Marsh, 2008). It is evident from the research that clinicians could benefit from guidelines or a framework to help make health care decisions for individuals with DD/ID (McGrath, 2010) and is one of the justifications for this research and for developing a telemedicine application specific to the needs of those with DD/ID.

**Evidence-based Care (EBC)**

Hallet (2008) suggests that since medical histories can be very complex and extensive, leaving the clinician to traverse through much data, pure text is not the best medium for presenting a patient's medical history. Rather having a multi-modal visualization architecture that integrates written, graphical and natural language into one system called a chronicle is more useful (Hallet, 2008). Although this multi-modal system of presenting medical histories incorporates various elements other than written text, this system does not incorporate still pictures or videos of the patient. The graphics incorporated were to help reduce the mundaneness of traversing a patient's medical history not for assisting the clinician in determining a diagnosis such as that presented in this research.

Adowd and Hayes (2006) studied the various ways technology could either help or hinder the practice of EBC. The focus was on capturing audio and video footage of children with special needs for the purpose of assessing their educational and health needs. Their focus,

however, was on privacy analysis and designing socially appropriate tools for evidence-based care and not on designing appropriate EBC methods for assisting clinicians in medical diagnosis.

Numerous components, such as evidence based medicine, in the form of literature, image, and video, along with diagnostic tools and decision support systems, collectively form a medical informatics system (Templeton, 2010). Lowery, Jin, Kagioglou, and Aouad have shown, prior work has used simulators to determine the effectiveness of medical informatics systems prior to implementation (as cited in Templeton, 2010, p. 32). This research made use of a simulated environment to test effectiveness of presence on medical diagnosis. In addition, statistical analysis of data from questionnaires was conducted in this study. Questionnaires to determine user perception with the effectiveness of the telemedicine application for a particular healthcare domain, similar to that found in Larcher et al. (2003), were utilized.

According to Westfall, random controlled trials may be valuable in determining a conclusion however they are not always as effective in real day-to-day practice (as cited in Horn and Gassaway, 2007, p. 50). Although randomized controlled trials (RCTs) are vital in determining the effects and causes of new treatments, they are not the solution in discovering the best methods and interventions needed for effective and efficient routine care (Horn & Gassaway, 2007). As stated in Porter and Teisberg (2004), research has shown that the medical arena should move toward specialized treatments and diagnosis for specific types of patients with specific conditions. If the medical field grouped the competition by more specific disease and/or condition levels, the results may be a more focused approach in developing the best treatment for the specific group as well as reduce the time and cost it takes to administer the proper treatment (Porter & Teisberg. 2004). In keeping with these suggestions, this study

focused on a specialized population in order to develop a unique approach to treating this specialized population.

**Electronic Medical Records**

Healthcare professionals use various forms of resources to help them determine the best way to provide care for a patient. Traditionally, printed educational materials (PEMs) such as journals, periodicals, clinical manuals, and drug reference books were used not only to provide awareness and knowledge, but were seen as a source to improve patient health care outcomes (Farmer, 2008). However, the result from 23 studies conducted to determine the effectiveness of PEMs in process and patient outcomes suggest otherwise. When PEMs are the sole resource used by clinicians, although process outcomes improve slightly, PEMs have no beneficial effect on patient outcome (Farmer, 2008).

Technology has made various forms of medical information more readily accessible. Electronic forms, such as databases, CD-ROMS, and the Internet, allow clinicians to instantly access medical information. McGowan, Grad, Pluye, Hannes, Deane, Labrecque, Welch, and Tugwell (2010) studied the effectiveness of electronic retrieval of health information to healthcare providers. Although a comparison of access to electronic resources and access to enhanced electronic retrieval of information in standard practices was conducted, changes in patient outcomes or costs were not assessed. Specific implications of the research suggest future studies should be conducted to prove or disprove any connections between clinicians' knowledge and patient outcomes and costs, the usage of the electronic resource, and the type of electronic resource used as well as how, where, and when it is used (McGowan et al., 2010).

In 2004, the United States set a goal for American health-care. By 2014 all citizens are mandated to have access to an electronic medical record, and to help facilitate this, the federal government made $20 billion in stimulus money available to health-care providers in order for them to implement this goal (Hoffman, 2009). Health information systems are moving away from a paper-based approach of storing and processing patient data and are moving towards a digital solution for managing patient data (Nisanbayev, Na, Lim & Ko, 2009). The use of EMRs within the healthcare industry has increased since the Institute of Medicine recommended its use, and EMRs are now viewed as a tool to easily store, retrieve, and share patient data across different levels of the healthcare organization (Karunakaran et al., 2012). For patients, EMRs offer convenient, portable, and efficient access to health-related information; for clinicians, EMRs offer computerized decision support systems and the reduction of clerical errors. Research conducted by DIATOM, a medical scientific and technological enterprise, has shown some interesting results on the effects of using EMRs in hospitals: considerable reduction of both time and duplication of data occurs since patient data is entered once into the system; increase in time is spent treating patients rather than documenting; and reduction of time and effort retrieving records from various departments and laboratories (Nisanbayey et al., 2009).

According to the results of a National Ambulatory Medical Care Survey (NAMCS) conducted in 2007, the use of electronic medical records (EMRs) by office-based physicians increased 19.2 percent since 2006 and increased 91.2 percent since 2001 (Hing & Hsiao, 2010). Although the number of clinicians and institutions using EMRs has grown, clinicians believe scribbling notes may sometimes be faster than logging information electronically. In light of this, HCI specialists are working to better understand a clinician's daily workflow in order to design and develop systems that are easier and more efficient (Hoffman, 2009).

**Human-Computer Interaction within Health Care**

According to the ACM SIGCHI Curricula for Human-Computer Interaction (HCI), the definition of HCI is "a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them" (Hewett, Baecker, Card, Carey, Gasen, Mantei, Perlman, Strong & Verplank, 2009, p.5). Bannon (2011) argues, however, that the original meaning of HCI should be re-evaluated since technology has become much more complex as well as a real part of our everyday lives. The reality is the focus of HCI today is more than human-computer interaction; it is human-centered computing. Changing the title of HCI is not the concern; however, changing the focus of study is. Humans no longer just *use* computers; technology today produces information based on the inputs of a human, for example, human skills and judgment are being used to manage automated and knowledge-based systems. Understanding this, humans should be more of an active participant in designing and developing computerized systems that already "augment the existing skills and expertise of human beings" (Bannon, 2011, p.53). One area of study HCI researchers have become increasingly interested in is the medical field since the technologies being developed to deliver healthcare are becoming helpful to both patient and clinician, in particular the area of ambient intelligence and healthcare (Bannon, 2011). Technologies are being developed and installed in homes of the elderly to help support them in living independent lives at home rather than being placed in assisted living facilities. The concern of HCI researchers is that the technologies being developed are being tested in labs where real life problems of daily living are not experienced.

According to Hochheiser and Shneiderman (2011), designing effective medical records requires the expertise of users including their contextual inquiry and ethnography. In addition,

evaluations of successes and failures are necessary. In this study, an application that benefits healthcare providers was designed and developed. In addition, users of the system were involved and their inputs and suggestions were incorporated into the design of the system making it most beneficial for their needs.

Patient care is evolving from a single unit of care to multiple-person teams offering collaborative professional healthcare. A patient's "clinical picture" (their recent course, therapies administered, or pending diagnostics) can determine the patient's progress and an unclear picture can result in an increase in both the number of lab exams and hospital stays (Cheung et al., 2009). For this reason, HCI is making the connection between cognition and medical informatics by developing adaptive user interfaces that facilitate decision making and reasoning (Alpay, Toussaint, Zwetsloot-Schonk, 2004).

Hand-overs, or the exchange of patient information to attending health care providers between shifts, are inevitable. When comprehensive patient information is transferred properly between health care team members, continuity of patient care essential to the best care possible for the patient is obtained (Mueller, Kethers, Alem & Wilkinson, 2006). Unfortunately, due to time constraints and limited access to resources, the transfer of comprehensive patient information can be limited. According to Cheah, Amott, Pollard and Watters (2005), the lack of critical patient information passed between workers is a major risk to the patient especially when urgent care is needed. According to emergency room clinicians interviewed, designing a more efficient method of hand-overs, one where design concepts include the transfer of intuition and gut instinct, that translate into explicit knowledge is needed (Mueller, Kethers, Alem & Wilkinson, 2006). Clinicians conveyed a strong desire for a visualization tool to capture,

visualize and support intuition transfer to quickly determine the state of the patient (Mueller, Kethers, Alem & Wilkinson, 2006).

**Telemedicine**

Telemedicine, the use of electronic information and communication technologies to provide healthcare, aids the collaborative process of delivering healthcare via a virtual setting in order to deliver quality healthcare and lowering costs (Paul, 2010). Along with various delivery methods, telemedicine is being integrated into various locations such as hospitals and physicians' offices.

With advancements in technology, telemedicine applications can now employ complex procedures and information flows as well as provide sophisticated user interfaces (Alem et al., 2006). According to Alem et al., when a telehealth system incorporating video conferencing was applied to a clinical setting, it was found that presence played an important role in the positive collaboration of clinicians.

In Agency for Health Care Research and Quality (AHRQ)—a funded health Information Technology project conducted in Rochester, New York—a digital camera attachment was used with a telehealth system to perform medical exams on inner city children, and the transmission of their results was sent to primary care physicians for remote consultations. Telehealth assistants scanned eyes, ears, nose, throat and skin and transmitted data to a primary care physician where the physician, through the use of a video camera, saw and even talked to the patient to assess his/her condition (US Department of Health and Human Services, 2011). Results showed that in only 4% of the cases physicians suggested an in-office visit was needed, and 83% of physicians

were confident that the telemedicine consultation was as proficient as if done in person. This research, however, will use comparative video and/or pictures.

When telemedicine, in the form of tele-consultation is done, being able to provide good quality visual and acoustical views, such as body language and facial expressions, can enhance communication between individuals. According to Ling, Nefs, Brinkman, Heynderickx, and Qu (2010), much research has been done on how different display technologies have greatly affected user interaction and has increased the level of presence felt by the user. Interestingly, studies conducted on tele-consulting left Short and Christie doubtful that video-mediated communication made no real contribution over voice-only communication except for achieving a sense of social presence (as cited in Tachakra & Rajani, 2002, p. 226).

Video-mediated telemedicine can be beneficial for those patients who find it difficult to find specialists. Visiting a specialist can be as easy as connecting to the Internet. Such was the case for an elderly woman who suffered with Parkinson's disease. She was able to consult with a specialist 350 miles from her home via telemedicine (Shute, 2011). Although the tele-checkup was limited to a computer monitor, the specialist was still able to detect certain physical attributes of the patient, a quivering chin, which clued the specialist in to what was happening with the patient. As a result, the specialist instructed her to see her internist and told her what questions to ask (Shute). Using video-mediated telemedicine proved to be helpful not only to the clinician in diagnosing the problem but for the patient as well in resolving concerned issues with her physical health.

Other devices such as smartphones are currently being used to monitor and treat chronic conditions such as PD. The portability of smartphones and the ability to embed medical features into the smartphone, allow subjective and objective data to be collected and sent via a privileged

user-doctor communication channel (Correia de Barros, Cevadad, Bayes, Alcaine & Mestre, 2013). According to Correia de Barros et al., more accurate diagnoses can be made if medical doctors had access to patients' daily symptoms; if technology can be used for this purpose, a patients' quality of life could be improved.

Information technology supports the creation of knowledge and art which allows individuals to be more creative at more times, having profound effects in every area where information technology is used (Shneiderman, 2000). The medical field is one area where information technology can have a profound effect in that it can be seen as the "shift from applying standard treatments to tailoring treatments for each patient" (Shneiderman, 2000, p.115). The contributions made by doctors and medicine are considered to be evolutionary acts of creativity, and the work done impacts lives for the good and is accessible to the public for continued use and improvement. According to Shneiderman, evolutionary creativity coupled with software tools can bring about revolutionary breakthroughs. One technology-related creative design presented by Hook (2008) is the Affective Diary. This personal diary does not log a person's inner thoughts via a pen; however, it records his/her emotional and bodily experiences via a body sensor armband. The sensor captures every movement the person makes and every emotion he/she feels is recorded, uploaded through a mobile phone, and represented in an abstract assortment of colors, patterns, and shapes. Using the mobile phone features such as text and MMS messages, and photographs, the output graphically reveals the individual's bodily and emotional state. Affective computing seeks to determine an individual's emotional state by capturing and measuring skin, voice, and facial and body movement (Picard, 2003) and is used to advance the fields of artificial intelligence (AI) and human computer interaction (HCI). Applying Kort, Reilly, and Picard's emotion model, affective computing improves student

learning through the use of a learning companion system which keeps track of the emotional state of a student (as cited in Hook, 2008, p. 254). The system detects through biophysical signals the students' emotional state allowing the student and teachers to know when a student does or does not understand a particular topic.

One avenue to revolutionary breakthroughs may be through the doorway of innovated web-based user interfaces. Shneiderman (2000) suggests developing integrated creativity support tools that may include some or all of the following activities: searching and browsing digital libraries, visualizing data and processes, consulting with peers and mentors, thinking by free associations, exploring solutions, composing artifacts and performances, reviewing and replaying session histories. The telemedicine framework proposed by the author has incorporated these activities.

Although a national survey of private hospitals has reported that the adoption of electronic medical records is less than 15% (Butler, Brennan, Shneiderman & Zhang, 2011), a demand for skilled Health Information Technology (HIT) professionals to implement and use information and communication technologies in the health care industry is needed (Zhang, Reichgelt, Rutherfoord, Brown & Wang, 2012).

ICT's are used to integrate intelligent systems to support clinical and management decisions in healthcare and telemedicine has been defined as one of HIT's applications that will transform and improve the quality and delivery of health care (Llahi, Ghannouchi & Martinho, 2014). With the advances of technology, the potentials of HIT include automatic monitoring of patients, automated systems that help with intervention in medical situations, reduction in location-bound doctor-patient contact, and the transfer to decision-support systems for monitoring health care practices and performances (Llahi, Ghannouchi & Martinho).

Telemedicine and/or tele-health are defined by the Health Resources and Services Administration (HRSA), an agency of the US Department of Health and Human Services (HHS), as the use of electronic information and telecommunications systems to support and deliver health care remotely. One goal of the HRSA is to improve access to health care for those who are medically vulnerable (Bonvissuto, 2010). Although telemedicine is not intended to replace a clinical visit, according to a PricewaterhouseCoopers survey, 50% of respondents indicated that they would prefer a telemedicine consultation over a face-to-face medical consultation (Bonvissuto).

Ballegaard, Hansen, and Kyng (2008) argue that users must be considered and should have a voice in the development and design of healthcare technology for it to be successful. In order for a healthcare technology to be useful in a specific realm, experience with that specific type of health condition and the functions of an individual with that condition is crucial. Ballegaard et al. suggest that specialists and users in an area should not only be involved in the decision making process but the creative process as well in order to identify realistic settings, use, and problems that may be encountered. This concept of participatory design (Ballegaard et al., 2008; Shneiderman, 2000) allows the user to define what is needed and focuses on evaluating and creating use experiences in realistic settings. This study employs participatory design and includes clinicians who interact with DD/ID individuals on a regular basis in the design of a telemedicine application.

The focus of many of these studies was on the aspects of the technological device, its sensory components, and the individuals' experience with the technology. The desired use of the technology was researched rather than the need for the technology. Research has paid little attention to the relationship between presence and the usefulness in the diagnosis of the DD/ID

individuals. Further research in this area can help develop methods, necessary to conduct assessments of comprehensive medical exams, and of social, family, and educational history (Reynolds, Zupanick &Dombeck, 2011), which will aid clinicians in the diagnosis of medical conditions of individuals with DD/ID. Given the unique demands and constraints of the cognitively disabled individual, existing human-computer interaction (HCI) techniques must be adapted and carefully considered for use.

**Summary**

This chapter discussed the importance of clinical exams, the special medical needs of DD/ID individuals, the significance of evidence-based care (EBC), EMR, and HCI within healthcare, as well as the advancement of telemedicine in healthcare. A framework for developing a telemedicine application that includes a visual, pictorial medical history, primarily to assist clinicians in reaching a diagnosis of cognitively and/or physically disabled individuals has been built based upon the information researched.

# Chapter 3

# Methodology

## Overview

This research developed a technology-based approach to patient care for the cognitively and/or physically disabled individual where clinicians are able to diagnose, treat, and manage conditions through the use of a telemedicine application. The focus of this research is not on building another type of electronic medical records application. Rather the focus is to improve upon a medical electronic records application in order to facilitate clinicians in providing a better method for treating a particular patient population where determining medical symptoms can be rather challenging and/or absent.

As stated earlier, the hypothesis of the research is to determine if presence, in the form of a visual or pictorial representation of a patient's medical history, can assist in delivering correct or more accurate diagnosis of cognitively disabled individuals and the following questions have been addressed by this research:

1. Can presence, in the form of a visual medical history, beginning with a baseline measurement and periodic updates, updates taken each time the patient visits the clinician within a three month period, provide a more direct medical assessment or diagnosis than a purely written medical history?

2. Does the perceived content of the medical information (i.e., visual medical history) presented to the clinician have a significant impact on the cost effectiveness (time and money) of delivering health care via a telemedicine application?
3. Can the design elements (i.e., how the site is displayed or represented to the clinician) of the telemedicine system have significant impacts on the perceived usefulness (i.e., quicker and/or more informative method of delivering healthcare) of the telemedicine application?

In order to properly answer the research questions and to support or reject the hypothesis proposed, a secure telemedicine application that closely mirrors an electronic medical records application that some clinicians currently use was developed. This telemedicine application has an additional component; it includes still images and/or video of the patient and/or area of body being examined.

As stated earlier, the following is being hypothesized: that presence, in the form of a visual or pictorial representation of a patient's medical history, can assist in delivering correct or accurate diagnosis of cognitively disabled individuals. The following sub-hypotheses have been derived:

H1: Presence, in the form of a video medical history beginning with a baseline visual measurement and periodic visual updates within a three month period will be preferred by clinicians over non-presence.

H2: The design elements (i.e., visual content) of the telemedicine application will have significant impact on the perceived usefulness (i.e., quicker and/or more informative method of delivering healthcare) of the telemedicine application.

H3: The content of medical information (i.e., video medical such as full length captured video of the patient as well as close-up video of injured area of body) presented to the clinician will enable more immediate diagnosis and less need to refer patients to an emergency room (ER).

H4: Presence will have a significant cost savings impact over no-presence as measured by physician cost.

This research explored the clinician's perspectives on the value of a visual medical history included with a patient's written medical history. Clinicians examined the telemedicine application and their perspectives were taken into consideration in developing a serviceable best-practice framework. The research methodology that was used included a combination of qualitative and quantitative research for collecting data and methodological triangulation for verification of results. A questionnaire for subject matter experts (SMEs) along with interviews was used to collect measurable data.

Following the systems development life cycle (SDLC) method, a structured approach to software design was taken where the development of a system was organized into phases. Structured analysis relies heavily on written documentation and iteration of phases, utilizing a set of process models to graphically represent or describe a system (Shelly & Rosenblatt, 2012). Although the SDLC (Shelly & Rosenblatt, 2012) method is typically five separate phases, this research combined some phases and used a total of three phases: Planning and Analysis, Design, and Implementation and Testing.

**First Phase: Planning and Analysis**

In the Planning and Analysis phase, a desired change for an information system, a system that combines information technology, people, and data to assist in everyday operations of the

business, which will improve upon an existing service (Shelly & Rosenblatt, 2012), has been identified. A preliminary investigation was conducted to evaluate the request for change and to understand the business operations. The purpose and mission of the organization requesting the change as well as its organizational strategies, goals, and resources was also considered.

The preliminary investigation revealed the mission, goals, and business operations of the New York State Office for People with Developmental Disabilities (OPWDD). The Taconic DDSO, Valatie, NY location is one of OPWDD's facilities. The business operations include management of various services for over 126,000 NY residents with DD/ID's (Burke, 2012). The main purpose of the OPWDD is to provide DD/ID individuals the ability to live more independently within their community; their vision is to help people with developmental disabilities develop meaningful relationships and participate fully in their community. Services, which are provided through a network of nonprofit and state-run agencies, include Medicaid funded long-term habilitation and clinical care, residential community support services, support services for families caring for DD/ID individuals at home, employment support, vocational training, on-the-job coaching, and job matching (Burke, 2012).

It was determined that a web-based telemedicine application that incorporates a video component for storing medical history should be developed to improve upon the service of providing medical care for individuals with DD/ID. The video component provided the primary care physician with up-to-date health-related information of the patient.

A requirements or design document was generated. This document included requirements modeling, fact-finding techniques to identify how the current system operates and what requirements, such as inputs, outputs, processes, and performances, are necessary for the improved system. Interviews and questionnaires and/or surveys were conducted with the SMEs

either by phone, email, Internet, or in person. Once the design document was complete the document was presented to two SMEs who are clinicians that work closely with DD/ID patients to offer suggestions, recommendations for modification, and to verify the accuracy of the framework.

**Second Phase: Design**

In the Design Phase a model of the website was developed based upon the information gathered in the first phase. A web-based telemedicine application was constructed based on existing electronic medical records applications, the literature review, and recommendations of the SMEs. The homepage explains the purpose of the application and provides a link to a secure logon to the EMR-based interface. Only those with a valid username and password are able to access the EMR-based interface. The application was developed by the researcher using Adobe Dreamweaver and MySQL for the creation of the database. Included in this phase is a sitemap that provided any page layout information, including the navigational structure of the website. Figure 1 is the template of that structure.

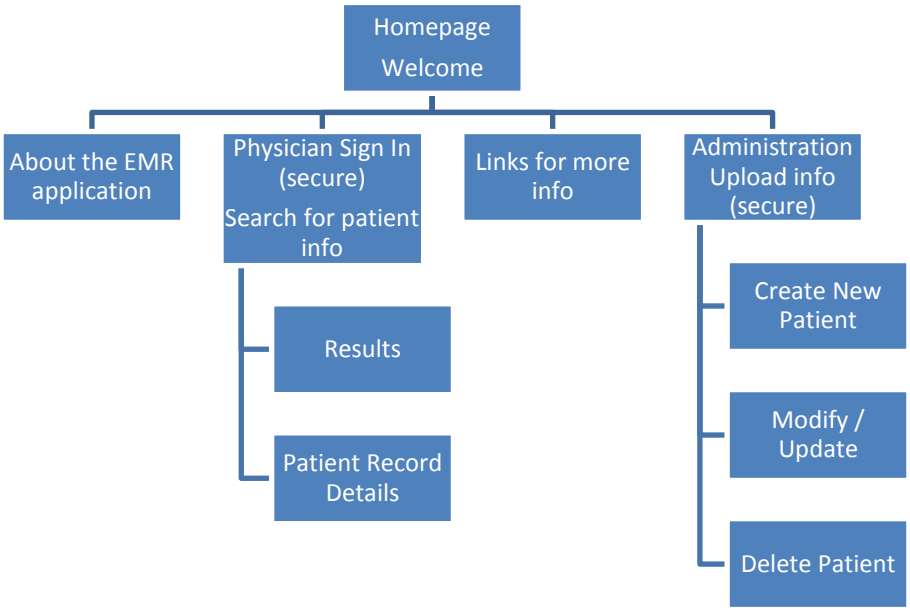



Figure 1. Application Sitemap. This figure illustrates the structure of the telemedicine application.

A web-based telemedicine application that has the basic elements of a typical EMR application which lists patient information in written format was developed however an additional element of a visual medical history was added to the application. The researcher consulted with the two SMEs in person. A document was presented to the SMEs before any meetings were conducted detailing the framework of the application so that any questions or concerns about the framework were voiced before development.

The purpose was to allow the clinicians to use an environment that integrates a written and visual representation of a patient's medical history and physical findings to aid the clinician in determining a better medical diagnosis. Medical experts were used to help test and develop the model to validate its usefulness. This simulated environment allowed the clinician to perform a medical exam as usual with the necessary patient information along with additional variables that will hopefully prove to play a significant role in answering the questions posed by this research. Clinicians reviewed an initial prototype of the website to isolate specific factors

that were beneficial in diagnosing a cognitively disabled patient. These factors helped build a framework for a telemedicine application with presence.

Figure 2 is the proposed framework that was built from the literature review and preliminary input from SMEs. This framework was developed based on the Technology Acceptance Model (TAM) (Davis, 1989) and the extended Technology Acceptance Model (TAM2) (Chismar & Wiley-Patton, 2002).

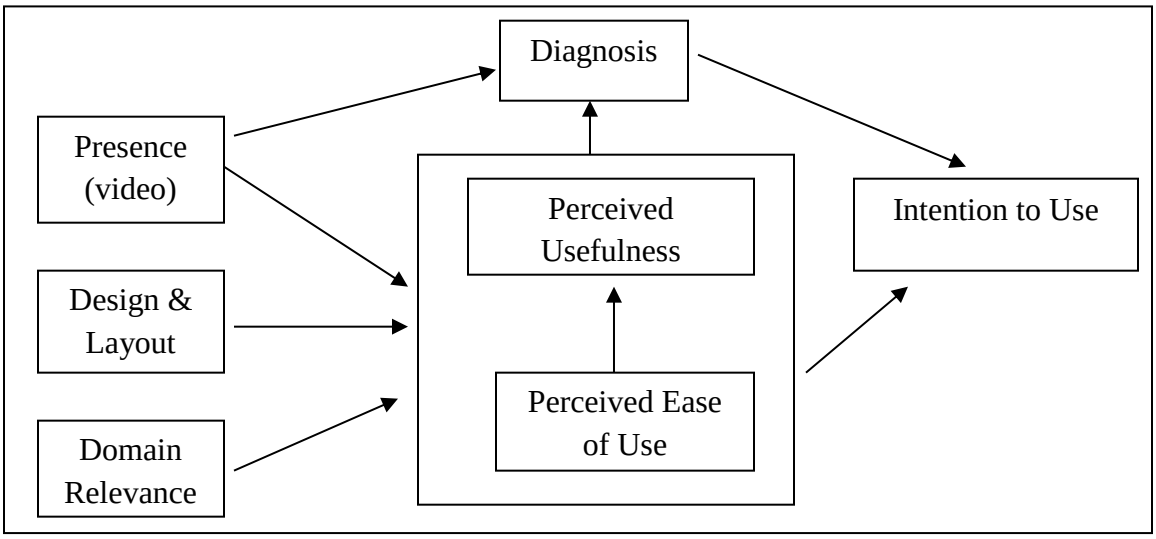



Figure 2. Proposed Telemedicine Framework. This is the telemedicine framework being proposed and tested for validity.

**Third Phase: Implementation and Testing**

A working telemedicine application was established in the implementation and testing phase. A website-based telemedicine application with a visual medical history component was created and SMEs, clinicians who treat patients with DD/ID, reviewed the application to ensure the accuracy of content and its functionality. Any suggestions or change requests made by the

SMEs were implemented and made ready to perform the required functions and contain the attributes defined by the framework.

The application was tested and validated by 22 clinicians and five DSAs for validity of content and design. Since the clinicians and DSAs chosen to test the validity of the telemedicine application work with and deliver healthcare to DD/ID patients on a daily basis, these clinicians better understand the importance of, or lack of, using such an application in determining a diagnosis for individuals with DD/ID. Using the simulated environment gave insight into the effectiveness of a visual form of a patient's medical history and tested the validity of the framework. After testing the simulated environment, a comprehensive survey was distributed to the clinicians to determine the effectiveness of the environment and help answer the primary questions proposed by this research.

**Research Methods**

The researcher developed a telemedicine application that was used for treating persons with DD/IDs who reside or are treated medically at the NYS Valatie DDSO facility. DD/IDs were selected due to the unique profile of these individuals and the challenge clinicians experience in treating this patient class. The telemedicine application resided on a private web server, preventing the disclosure of personal information and could only be accessed by individuals who have a valid user account and password. In addition, to ensure the privacy of all patients, all personal identifiable information was removed from each patient record.

The specific steps required in the design of the telemedicine framework are:

1. Simulated Interactions
    a. Application with written and visual medical history

2. Experts and evaluators utilized
    a. Group 1: Two experts, with graphic design degrees and life experience in developing websites, evaluated the web and visual content. Digital media experts were consulted as to the best format of capturing/displaying presence.
    b. Group 2: Two clinicians (who have three or more years' experience working directly with individuals with DD/ID) evaluated the telemedicine application.
3. Research Phase
    a. An exhaustive literature review has been conducted focusing on the human computer interaction (HCI) area of the dynamics of visual content within a web-based application.
    b. The researcher sought both NSU and NYS IRB approval.
    c. A review of existing telemedicine models for best practices and standards has been conducted by attending American Telemedicine Association (ATA) conventions, researching Journal and Conference Proceeding papers, and/or participating in Special Interest Group discussions.
    d. A framework was established from existing standards found.
    e. A small group of testers, two clinicians, were used to pilot test the telemedicine application for errors.
    f. A controlled study was conducted via a website (http://www.telemedpresence.com). Twenty-two clinicians and five DSAs tested the website containing a fully functional telemedicine application based upon medical care for those with DD/ID.

g. A survey of perceived benefits was developed and completed by testers of the telemedicine application to confirm/reject the importance of presence.

h. Responses to the survey were examined and metrics were utilized to see clear distinctions between the current method of treating patients and the use of the telemedicine application. The hypothesis should indicate a clear distinction between the telemedicine application with visual medical history and the current system that uses just written documentation. Data was collected and processed through a statistical based software package, Microsoft Excel, to analyze the results.

i. The researcher's hypotheses were either accepted or rejected.

j. The final dissertation report was prepared, submitted, and defended.

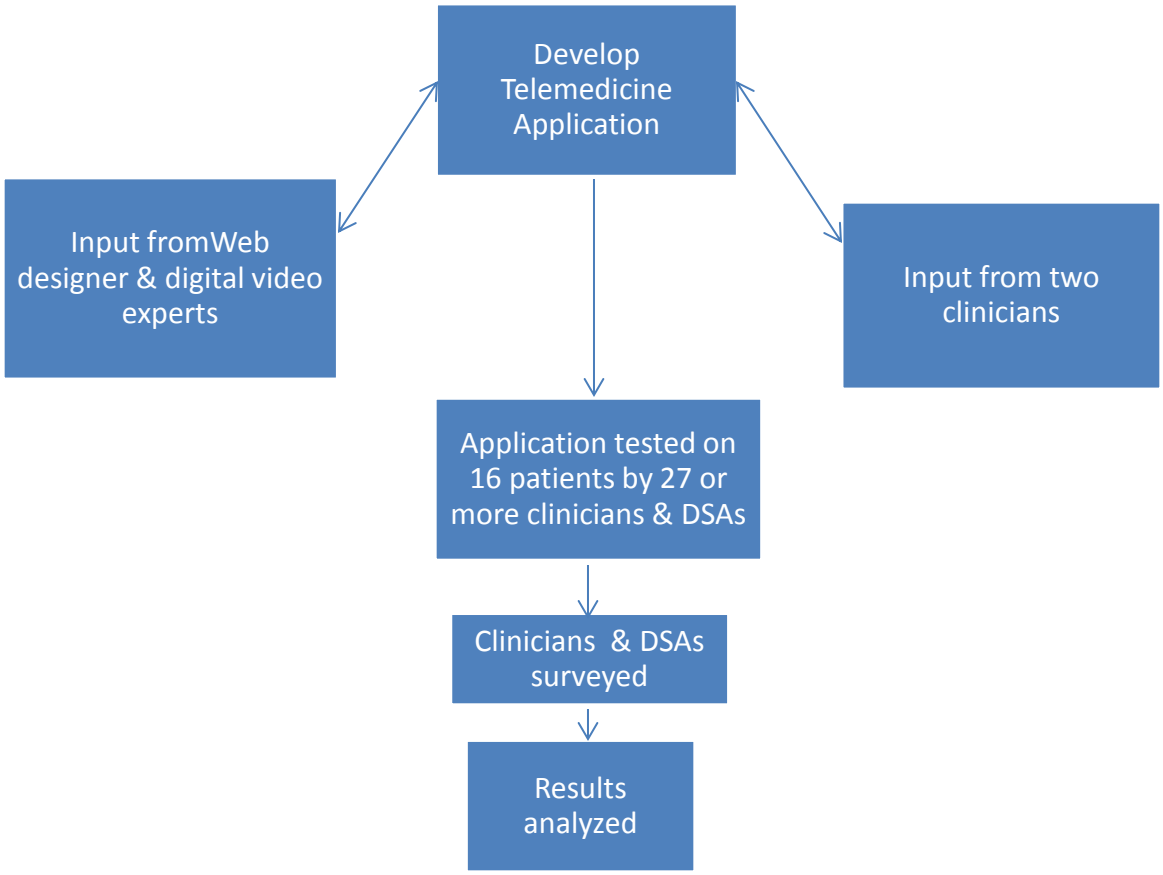



Figure 3. Research Work Flow Diagram. This outlines the steps of this research.

**Instrument Development and Validation**

This study took place at two residential homes in the Columbia County location of the New York State Taconic Developmental Disabilities Services Office (DDSO), Valatie, NY. The DDSO is a facility that provides services and support to those with developmental disabilities and to their families. They provide residential and day programs as well as clinical services. This location provides care for up to 24 cognitively disabled patients, many who are non-verbal.

All patients were studied in the same way. In order to reduce or eliminate any possible biases on the clinician end, all clinicians were available to examine all patients whenever needed. In order to reduce or eliminate any additional biases on the patient end, all patients were video-

taped. This was done so that all patients felt they were being treated the same at all times and to minimize all other influences on the patients' behavior. All clinicians used the telemedicine application with both textual and visual medical history as reference. All variables that influenced the impact of this study were documented, such as the main characteristics of each patient as well as any treatments, visits by clinicians, and on average, visits to the emergency room. Variables collected before the study and after were compared for any significant change or difference.

**Formats for Presenting the Results**

Quantitative and qualitative analysis was used to measure H1, H2, H3 and H4. All clinicians used the telemedicine application as reference instead of their traditional hardcopy/paper medical history as reference when examining patients. Clinicians were asked to review the EMR records and complete a survey as to the usefulness of the telemedicine application and the effectiveness of the video component.

Since the data collected from the questionnaires consisted of categories or frequencies, nominal data, a chi-square test was used. This non-parametric test measures the difference between an actual, or observed, result and a statistically generated expected result to see if there is a statistically significant difference between them. Statistical analysis was performed on the data retrieved from the surveys. The surveys were based on a five-point scale where 1 indicates a strong agreement, 3 is neutral, and 5 is strongly disagree. Research proved that presence in the form of a visual medical history has a strong impact on a clinician's medical diagnosis.

The researcher collected the statistical information and presented the results in a table format. Microsoft Excel was used to load and calculate the statistical information. The outcome

of the research supports presence in the form of a visual medical history and is seen to have a strong impact on a clinician's medical diagnosis.

**Resources & Tools**

The author utilized a variety of tools, experts, and subjects to conduct and complete the research. Communication was established with all prospective resources.

The researcher utilized various medical electronic records software and applications to create and deliver the application within this research. A web hosting company was used by the researcher to manage the application and database for electronic medical records. The domain name www.telemedpresence.com housed the Web application, containing established elements of the telemedicine framework. A private unlisted registration was created which means personal information was shielded from public display. All personal identifiable information was redacted as to preserve the privacy of the patient. Personal information about each patient such as name, address, birth date, and social security number, was eliminated from the Web application database ensuring that all personal identifiable health information was not recorded on the Web server. In addition, visual content was edited and any identifiable information was obscured (e.g., graying out of one's face) so that a patient cannot be visually recognized. A unique reference code was assigned to each patient record entered into the database. Only the clinician was given the unique reference code and knew the relation to the patient they were examining.

**Table 1: Tools Required for Dissertation Research**

| Title | Manufacturer | Purpose |
|---|---|---|
| Excel 2013 | Microsoft | Statistical/spreadsheet |
| Word 2013 | Microsoft | Word Processor |
| Acrobat Professional | Adobe | PDF delivery |
| Premier | Adobe | Photo and Image Software |
| Easy HTML5 Video | Avangate | Video converter |
| My SQL | Windows | Database Application |
| Dreamweaver CS5 | Adobe | Web Application |
| PHP | PHP Group | Scripting Language |

**Experts**

The researcher approached and asked the experts listed in Table 2 to assist with this research. Their expertise was used to validate the approach and foundations of this research. Both a clinical and technical perspective was established. Clinicians from the following areas of medical expertise were included: internal medicine and nursing. In addition, experts from the fields of statistics, human computer interaction, digital media, and pervasive computing were also utilized. Guidance from these experts contributed to the research methodology and development and design of the simulator, surveys, questionnaires, and telemedicine framework.

**Table 2: Experts to Validate Research Methodology**

| | |
|---|---|
| Eric Keller, CWS, RPAC<br>NYS DDSO, Valatie, NY<br>8 years working with NYS DDSO<br>10 years total working with persons with DD/ID | Renee MacGowan, Senior LPN<br>NYS DDSO, Valatie, NY<br>28 years working NYS DDSO and persons with DD/ID |
| Raymond Giles<br>Associate Professor, Office Technologies/ Digital Media<br>The College of Westchester, White Plains, NY<br>MS, Polytechnic University<br>BA, University of Massachusetts<br>Certifications: Macromedia Flash, Microsoft Excel | James Lines<br>Assistant Chairperson & Instructor, Digital Media<br>The College of Westchester, White Plains, NY<br>BFA, Pratt Institute<br>MFA Candidate, Savannah College of Art & Design |

**Summary**

The methodology of this study examined whether a telemedicine application that incorporates still images and/or video of patient exams into an electronic medical records system aids clinicians in diagnosing, treating, and managing conditions of cognitively and/or physically disabled individuals. By examining the results of use, the researcher hoped to gain insight as to whether a video-enhanced medical history component within the EMR assisted clinicians in reaching a more appropriate and effective diagnosis.

The study was conducted on 16 DD/ID patients examined by various clinicians. The study was conducted in an actual clinician-patient environment. Once data was collected, statistical analysis guided the researcher to accept or reject the hypotheses of this research.

# Chapter 4

# Results

## Overview

This chapter details the results of the research study outlined in Chapter 3, the Methodology chapter. This chapter has three sections specifying and detailing the data collected and the findings of this research. The first section will describe the process of gathering the data, inspecting the data for the purpose of discovering useful information, and the design elements of the telemed application. The second section will detail the findings discovered after investigating the data. The third section will state whether the data from the research supported/did not support the hypotheses stated in Chapter 3.

## Data Analysis

### *Gathering the Data*

This researcher attended several ATA conferences as well as investigated several electronic medical record (EMR) applications and reviewed the existing medical record system used at the Valatie, NY homes to finalize the design for the telemed application. Although each EMR application seen at the conferences and software reviewed personally by this researcher had unique interface designs, all shared similar features essential in documenting a medical history. The common thread seen in all the EMR applications was the vast history, listing multiple screens of information, for each patient. Although for some visits to the medical doctor this extensive background information may be important, conversely for other visits it may be

excessive, even unnecessary when treating a current condition unrelated to past medical history. One feature all systems lacked, however, was that of a pictorial or visual medical history of a patient.

Taking all this into consideration, the telemed application was designed using some features of each application reviewed. In addition, understanding the importance of participatory design and to "avoid counter-productive efforts and resistance to change" (Shneiderman & Plaisant, 2010, p.116), the input of healthcare professionals who care for and document the medical needs of DD/ID patients was solicited. The telemed application was then developed, to best meet the needs of the clinicians caring for the residents of the Valatie homes.

In the two homes, a total of 16 residents with DD/ID participated in this study. The first task this researcher was presented with was to retrieve the written medical history of each resident. Since NYS DDSO had not yet converted to an electronic system for documenting medical notes, all the medical history retrieved was of hard copy/paper copy. Past medical history was read and documented electronically into the telemed database (see Appendix G).

Two digital cameras with video capability were purchased and left at the two Valatie homes. The cameras were used to document and record visual medical history and left in the homes for clinicians or direct service aids to photo or video record any medical concern that would be helpful to this study. The video recording began in June 2014, when this researcher followed the resident Physician Assistant (PA) and video recorded his clinical exam of each patient, developing a baseline visual medical history for each patient. Thereafter, from June 2014 to November 2014, this researcher visited the Valatie homes once a week and followed the PA, nurse or direct service aid (DSA) when attending to a patient. In addition, on those weekly visits supplementary written medical notes were recorded into the EMR database and the digital

video recordings were transferred from the camera and saved to external storage where editing of the recordings were done to remove all identifiable information. Adobe Premier was used to edit each video recording, graying out facial features when necessary to protect the security of the patients participating in the study. Once the videos were edited, Easy HTML5 Video editor software was used to convert the MOV files into HTML5 format, allowing the video to be seen via any web browser using any device. The HTML5 formatted video was then uploaded to the EMR database on a secure web server.

Once the telemed application was complete with written and visual medical data for all participating patients, the clinicians and direct service aids (DSAs) were asked to use the telemed application to view the medical records of each participating patient. Each clinician and DSA that viewed the application was given a questionnaire (see Appendix E & F) consisting of five questions that elicited their responses about the telemed application.

Two different questionnaires were designed; one for clinicians, those individuals who had the clinical expertise to either treat, assess, or diagnosis a medical problem, and one for DSAs, those who could determine the type and/or quality of care an individual might need. This researcher chose questions for the questionnaires that would specifically address the sub-hypotheses listed in Chapter 3. Table 3 shows the four sub-hypotheses and which questions from the two questionnaires relate to those hypotheses.

**Table 3: Survey Questions Related To Sub-Hypotheses**

| Sub-Hypotheses | Clinician Questionnaire # | DSA Questionnaire # |
|---|---|---|
| **H1:** Presence, in the form of a video medical history beginning with a baseline visual measurement and periodic visual updates within a three month period will be preferred by clinicians over non-presence. | #4, #5 | #1,#3, #5 |
| **H2:** The design elements (i.e., visual content) of the telemedicine application will have significant impact on the perceived usefulness (i.e., quicker and/or more informative method of delivering healthcare) of the telemedicine application. | #1, #3, #4, #5 | #2, #3, #5 |
| **H3:** The content of medical information (i.e., video medical such as full length captured video of the patient as well as close-up video of injured area of body) presented to the clinician will enable more immediate diagnosis and less need to refer patients to an emergency room (ER). | #1 #,2, #3, #4 | #4 |
| **H4:** Presence will have a significant cost savings impact over no-presence as measured by physician cost. | #2 | |

*Inspecting the Data*

The chi-square test was used to analyze the frequency of results to each question. Chi-square is used to find the relationship between two categorical values and the frequency of those events. It is used to compare what was actually observed with theoretical data to determine the variation of random chance between the categories. Since the null hypothesis, $H_0$, tests to see if there is no difference between the expected value and the observed value (Salkind, 2010), the null hypothesis was tested in this study.

The categories used to determine the degrees of freedom (df) were the Likert responses in the questionnaire, 1- Strongly Agree, 2 – Agree, 3 – Neutral, 4 – Disagree, 5 – Strongly Disagree. These totaled five categories (n) and since the degrees of freedom (df) is calculated as

n-1, the degrees of freedom used was four (4). A total (N) of 27 individuals completed the questionnaires; 22 clinicians and five direct service aids. For questions #1 - #4 of the clinicians questionnaire, N = 22; for the DSAs questionnaire, N = 5. Since Question #5 was the same in both questionnaires, N = 27 for Question #5. The value needed for rejecting the null hypothesis was taken from the appropriate table of critical values for the chi-square test, so with a 95% level of significance, error probability or P-value of .05, with degrees of freedom (df) equaling four (4), the chi-square test values are: $X^2(4, N = 22; N = 5; N = 27) = 9.49, p <= 0.05$. The data was analyzed several ways and results explained in the findings section.

*Design Elements of Telemed Application*

This researcher discovered that both homes used a special format for documenting medical issues and concerns. Each medical record was documented as a S.O.A.P. note. This is the traditional method used by clinicians when evaluating and recording a clinical record and is primarily used to assist all, clinicians and DSAs, who are involved in caring for a patient (Shoolin, Ozeran, Hamann & Bria, 2013). Typically, the Subjective (S) section documents the symptoms the patient is verbally expressing, however in the case of patients with DD/ID, this section consisted of the clinician's observations of the present condition of the patient. The Objective (O) section includes vital signs, such as temperature or pulse, and other observed and measured symptoms the clinician is aware of either by sight, touch, and hearing or smelling. This section included results of diagnostic tests. The Assessment (A) section is the clinician's diagnosis included several diagnosis possibilities. The last section, the Plan (P) section is the clinicians' recommendations on treatment. It included various lab or radiological tests, medications, surgeries, referrals, and any follow-up directions.

In consulting with the subject matter experts (SME) in the design and layout of the telemed application, it was determined that some modifications to the original design should be made. Chapter 1 suggested that the telemed application would display a list of such information:

- Patient name
- Date of birth
- Chief complaint (CC)
- History of present illness (HPI)
- Past medical history (PMH)
- Past surgical history (PSH)
- Family history (FH)
- Allergies (Medication/Food)
- Social History (SocHx)
- Review of System (ROS)
- Physical Exam Section
- Assessment & Plan

Although many of the fields listed above are beneficial to medical records, this researcher discovered these particular fields did not fit the day-to-day medical recordings for the residents in the NYS DDSO homes. In order to build a more applicable interface for the clinicians of the homes to use, the following fields were created in the telemed database and displayed on the telemed application:

- Subjective – includes Chief Complaint (CC).
- Objective - includes in the baseline record Past Medical History (PMH). This section also includes a link(s) to the patients' visual medical record.
- Vital Signs - includes Pulse, Blood Pressure, Respiratory, Oxygen, and Temperature.
- Assessment
- Plan

The telemed application was reviewed and tested for any errors or ambiguities in the use of the interface before the clinicians used it. Two clinicians tested the interface displayed in Figure 4; changes were suggested and those changes were implemented.

Since the telemed application was a web-based EMR application, Adobe Dreamweaver CS5 and PHP, a scripting language for web development, was used to design and create the web-based telemed application. The MySQL database tool was used to create a database that housed two tables. One table held the user accounts for clinicians to logon and use the secure telemed application, as seen in Figure 5. The second table held the patients' written medical history. All code used to create the telemed application was stored on a web server and the web application was accessed via the Internet domain address of http://telemedpresence.com.


Figure 4. Telemedpresence.com Interface

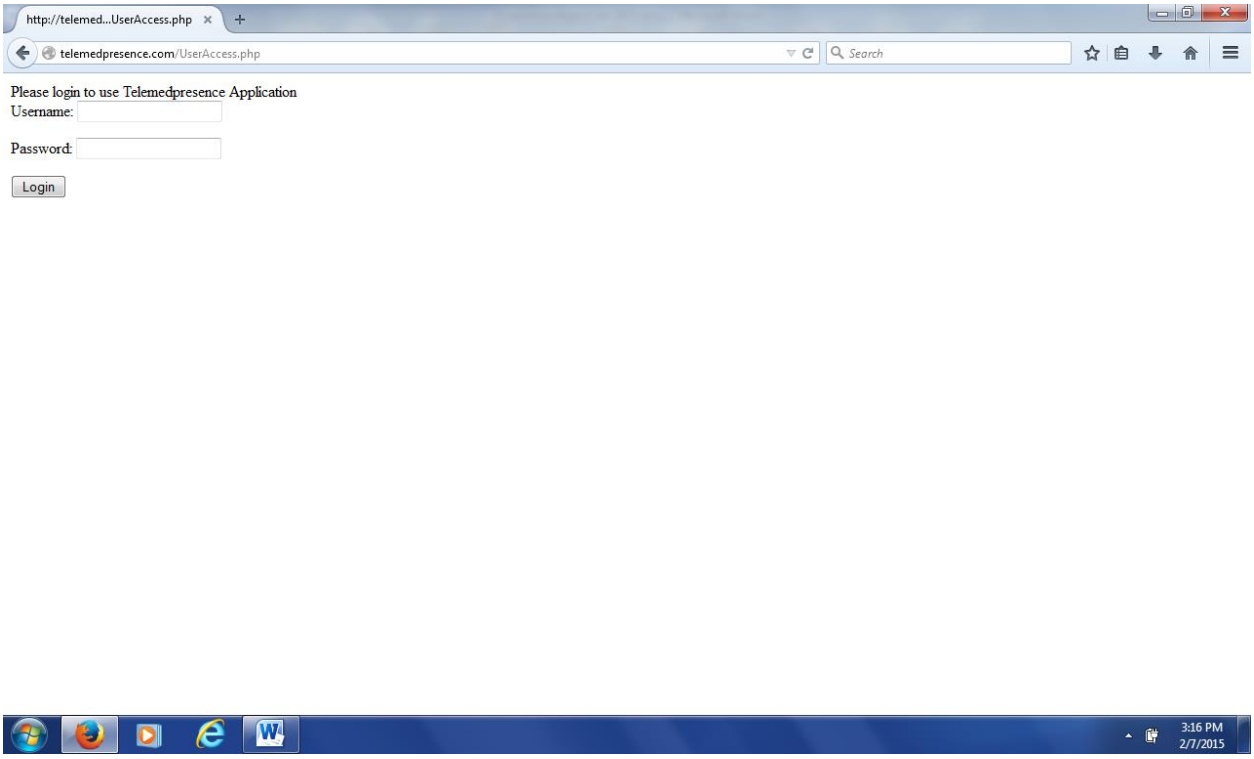



Figure 5. Telemed Application Logon Interface

No identifiable information was included in the medical records; each patient was given a Patient ID or number. Sixteen patients participated in the study and each patient was assigned a number from one to sixteen. Once an authorized user was authenticated to logon, the user was presented with a screen requesting the Patient ID or number. Once a number was entered, the database was searched for that Patient ID and a drop down list of all dates of medical exams for that particular patient were listed, with the first date always being the baseline record for the patient. The user could then choose to view one or all the dates of medical exams for the patient searched. For each date viewed, a S.O.A.P note was displayed with the written medical history. A sample S.O.A.P note is displayed in Figure 6. On that page, within the O (Objective) section of the S.O.A.P. note was one to many web-links (depending on the patient) to visual medical history.

Clicking on that web-link opened a separate window which played the HTML5 formatted video of the patient, with options to pause or replay the video, if needed.

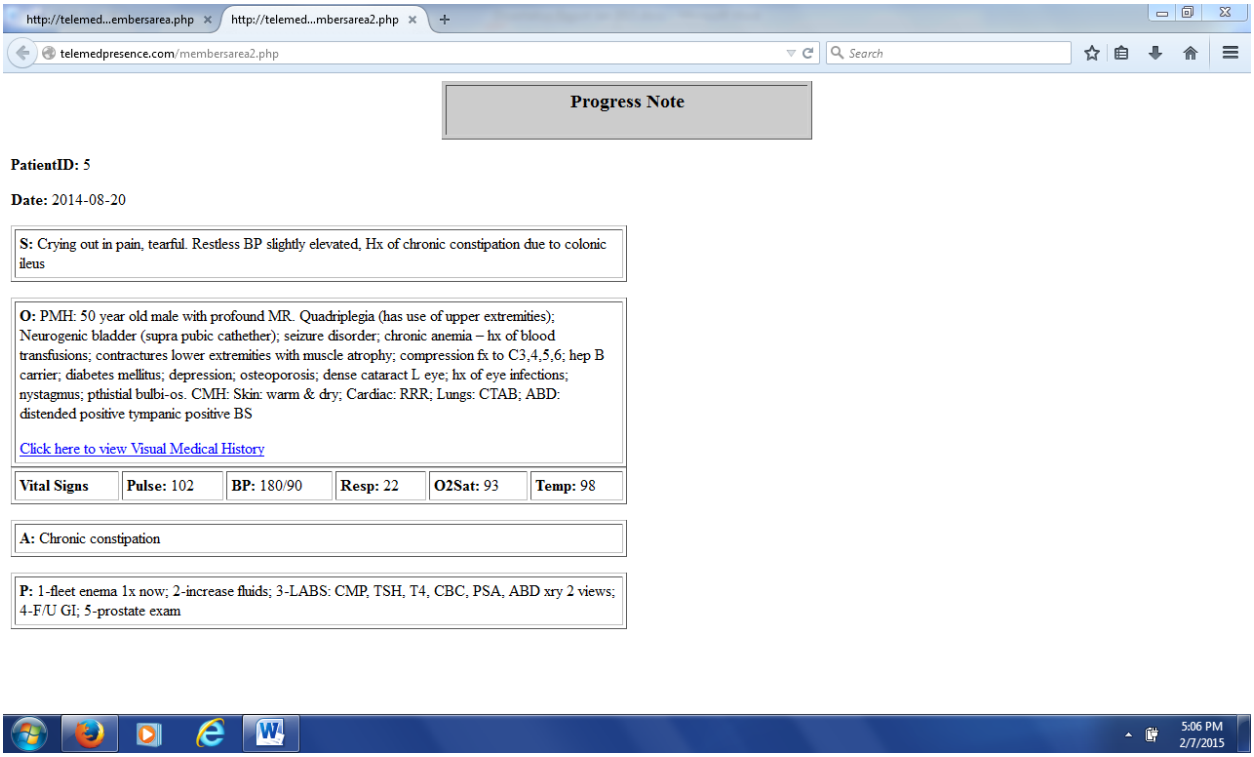



Figure 6. Example S.O.A.P. Progress Note

## Findings

The data was analyzed in different ways. First, the responses to each question in the questionnaires were analyzed individually and secondly, the responses were filtered based on different criteria.

### *Factual & Counterfactual Data*

This section will focus on the findings from the individual questions in the questionnaire. There were two separate questionnaires distributed to 27 participants. One questionnaire was designed for those with clinical expertise and one designed for those with no clinical expertise,

the DSAs. Twenty-two individuals with clinical expertise completed the clinician's questionnaire and five DSAs completed the DSAs questionnaire. The first four questions of both questionnaires asked different questions; the fifth and last question however was the same question in both questionnaires. In order to perform a goodness of fit test, a contingency table was created which consisted of the actual observed values from the questionnaires and an assumed group of values referred to as the counterfactual values. The counterfactual values are what the results would've been if all results were totally neutral; that all clinicians and DSAs felt neither positive nor negative about the benefits of the telemed app. To prove/disprove the robustness of the study, three sets of counterfactual values were tested with the observed values per question. The strongest of the three counterfactual values assumed all clinicians and DSAs responded neutral to every question asked; all chose #3 neutral in the questionnaire. The weaker counterfactual value spanned amongst the options 1-Strongly Agree, 2-Agree, 3-Neutral, 4-Disagree, 5-Strongly Disagree with a higher response for #3 neutral. The weakest counterfactual value spanned more evenly amongst all five options.

Clinician Question #1

Question #1 in the clinician questionnaire asks if "*the use of the web-based Telemedicine application enables a timely and an accurate diagnosis*"; the following was tested for Question #1:

$H_0$ = *The use of the web-based Telemedicine application does not enable a timely and an accurate diagnosis.*

$H_1$ = *The use of the web-based Telemedicine application enables a timely and an accurate diagnosis.*

Out of 22 clinicians, 21 responded “Yes” and one (1) responded “No” to Question #1. Table 4 rates the responses of the 22 clinicians.

**Table 4: Clinician Q1 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 11 | Yes |
| 2. Agree | 10 | Yes |
| 3. Neutral | 1 | No |
| 4. Disagree | | |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #1, with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from table 5 that in all counterfactual distributions of the test, the result was greater than the critical value, thus the null hypothesis was rejected. It is also evident from the robust results that the results were not skewed. All results were greater than the critical value of 9.49, there was a 95% confidence level that the use of the web-based Telemedicine application enabled a timely and an accurate diagnosis.

**Table 5: Q1 Counterfactual**

| **Clinician Questionnaire** | **Strongest Counterfactual $\sum(O-E)^2/E=$** | **Weak Counterfactual $\sum(O-E)^2/E=$** | **Weakest Counterfactual $\sum(O-E)^2/E=$** |
|---|---|---|---|
| 1. The use of the web-based Telemedicine application enables a timely and an accurate diagnosis | 40.17391 | 22.16583 | 17.40952 |

After each question, the responder was asked to list two reasons for their response. Table 6 lists the comments made for Question #1. The two columns to the right of each comment identifies whether the individual choose a response that was strongly agree, agree, neutral,

disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 6: Clinicians Comments to Question#1**

| **Comments** | **Rating** | **Regularly See Patient** |
|---|---|---|
| Documentation is completed in an ordered way; typed and with a visual. | Strongly Agree | Yes |
| You could see a visual change | Strongly Agree | Yes |
| Good base for medical information | Strongly Agree | Yes |
| Visual representation increases "input" and allows for intangible feedback (i.e. posture, levels of distress, vocalizations/contents). Note: unfortunately facial expressions could not be used due to privacy "blurring" of these features | Strongly Agree | Yes |
| Video allows for sharing with colleagues and review of what was already seen and being interpreted | Strongly Agree | Yes |
| Nursing staff will be able to utilize the program immediately | Strongly Agree | Yes |
| The consumer will potentially having a quicker diagnosis and/or treatment plan | Strongly Agree | Yes |
| All medical facts are current and in one place | Strongly Agree | Yes |
| No need to wait for medical information from numerous doctors | Strongly Agree | Yes |
| Shows decline or progress in evaluating a situation | Strongly Agree | Yes |
| Gives another person insight on issue or problem | Strongly Agree | Yes |
| This explains from beginning to end of the diagnosis & treatment & shows exactly what has been done. | Strongly Agree | Yes |
| With this you not only see the problem & health issues; you see the progression of treatment and the outcome. | Strongly Agree | Yes |
| Visual/video enable practitioner see the area of concern | Strongly Agree | No |
| Real time information. | Strongly Agree | No |
| Because it contains a history for each individual; which saves time from collecting. | Strongly Agree | No |
| Because it is helpful to see what the individual's body frame looks like | Strongly | No |

| | | |
|---|---|---|
| (baseline) for comparison. | Agree | |
| Aids to a quick reference to patient appointments. | Strongly Agree | No |
| Saves time the patient is assessed. | Strongly Agree | No |
| We can visualize the clinical finding and the F/U of treatment. | Strongly Agree | No |
| It is easier with clear visual instrument to diagnose medical condition. | Strongly Agree | No |
| Video/pictures of earlier deculoitus were helpful in making a diagnoses and starting early treatment or referral. | Agree | No |
| Not sure if acute abdomen or neurological condition can be diagnosed accurately. | Agree | No |
| We can see the liaisons and we can decide the medical diagnosis. | Agree | No |
| Through visualization you can easily rule out other suspect diagnoses & therefore make a more accurate diagnosis without delay | Agree | No |
| Overall status of individual could be seen | Agree | No |
| A picture says a thousand words; when I physically examine a person many times is very different than description given. | Agree | No |
| As an RN, I cannot make a diagnosis; I recognize the value of adding photo/video to the description of clinical presentation to assist physicians, NP and PA to make a diagnosis. | Agree | No |
| Some of the video did reflect the written portion of individuals; it gave you a clear understanding. For example the rash and g-tube placement | Agree | No |
| Telemedicine can happen anywhere or anytime so timeliness is greater than going to a doctor or ER. Accurate diagnosis with practitioners who are well versed in telemed but hands on is missing. | Agree | No |
| An immediate diagnosis can be made rather than waiting for Dr. appointment to be available. | Agree | Yes |
| I could see how it would but in conjunction with regular nursing notes I think that the videos especially in regard to specific concerns such as the rash with #8, to see how the rash started & progressed as well as regressed in say a video once a week or another day or even daily would make it much easier to enable prompt and accurate diagnosis & treatment | Agree | Yes |
| Also the distension noted in abdomen area of #14. the extent of the distension being viable would make it easier to show from staff to staff especially if it is a new staff or on deployed in who would not necessarily know the individual or their baseline or concerns. A nurse or DSA just coming into the home may not see it as distension but just a tummy (extra weight) and therefore would not be monitoring for additional concerns. such as the increase in agitation noted from discomfort. | Agree | Yes |
| As an LPN, I can document findings, make nurses notes, etc. but I am not qualified to diagnose patients. | Neutral | Yes |
| Nurses have (strong intuition and that is helpful) but lots of observation's that may be presented in their notes which can in turn work with the | Neutral | Yes |

| | | |
|---|---|---|
| telemed app for treatment as recommended by an RPA or Dr. | | |

Clinician Question #2

Question #2 in the clinician questionnaire asks if "*this Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital*"; the following hypothesis was tested:

$H_0$ = *The Telemedicine application was not effective in preventing the unnecessary transfer of patients out of facility to hospital.*

$H_1$ = *The Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital.*

Out of 22 clinicians, 17 responded "Yes", two responded "No", one added their own response of "n/a", and another added their own response of "probably" to Question #2. Table 7 rates the responses of the 22 clinicians.

**Table 7: Clinician Q2 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 12 | Yes |
| 2. Agree | 6 | 5 Yes; 1 No |
| 3. Neutral | 2 | 1 Possibly (written in by clinician);<br>1 Left blank (no Yes or No chosen) |
| 4. Disagree | 2 | 1 No; 1 N/A (written in by clinician) |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #2, with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from table 8 that in all counterfactual distributions of the test, the result is greater than the critical value, thus the null hypothesis can be rejected. It is also evident from the robust results that the results were not skewed. All results were greater than the critical value of

9.49, there is a 95% confidence level that the Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital.

**Table 8: Q2 Counterfactual**

| **Clinician Questionnaire** | **Strongest Counterfactual $\sum(O-E)^2/E=$** | **Weak Counterfactual $\sum(O-E)^2/E=$** | **Weakest Counterfactual $\sum(O-E)^2/E=$** |
|---|---|---|---|
| 2. This Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital. | 36.66667 | 15.54286 | 11.06667 |

Table 9 lists the reasons for their response and whether the individual chose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 9: Clinicians Comments to Question#2**

| **Comments** | **Rating** | **Regularly See Patient** |
|---|---|---|
| All usual records would be readily available in house | Strongly Agree | Yes |
| All non-emergent situations can be dealt with accordingly rather than exposing elderly/frail to weather/disease at hospital | Strongly Agree | Yes |
| Potentially I can determine if a condition is "trending" to better or worse. Often I will decide on keeping someone home if they are "trending" toward getting better | Strongly Agree | Yes |
| I can get a 2nd opinion by simply sharing video vs actual transfer for face-to-face (i.e. ER) | Strongly Agree | Yes |
| We had knowledge of condition (how it happened) | Strongly Agree | Yes |
| Treatable in house | Strongly Agree | Yes |
| Dr. or provider can access via program | Strongly Agree | Yes |

| | | |
|---|---|---|
| Provider can see problem via computer vs speaking to provider not seeing patient (they can view) | Strongly Agree | Yes |
| I can see where this could definitely assist in preventing unnecessary transfer to hospitals, although there was only rashes, possible seizures with a patient found on floor @ program the video's showed there was no need to send out to urgent or hospital for eval | Strongly Agree | Yes |
| I also think especially in case such as #14's possible fall as she was found on floor @ program it shows there were no immediate concerns so if bruising were to occur it would have a better timeline. | Strongly Agree | Yes |
| Patients most of the time do not like change and keeping them in their own environment helps better to deal with them and plus they are used to the staff members of their house. | Strongly Agree | Yes |
| This also is a great way for them also to know that the same people will be with them and lessens the anxiety of what to expect. | Strongly Agree | Yes |
| Lay staff come from a diverse background which can mislead the doctor when describing symptoms/signs. | Strongly Agree | No |
| Medical practitioner uses vision sense/hearing to determine plan of care. | Strongly Agree | No |
| Individual with rash did not have to go out for initial treatment plan or follow up yet was successful. | Strongly Agree | No |
| Practitioner can directly assess patient. No reliance on paraprofessional/nonclinical staff information. | Strongly Agree | No |
| Timely assessment at residence by clinical staff via the telemedicine application would allow for diagnosis and treatment without having to leave the residence. | Strongly Agree | No |
| The individuals were evaluated at the residence so that the presenting problems could be evaluated then an appropriate course of action taken. | Strongly Agree | No |
| Fitting wheelchair with alarming device was taken care of at residence with the fact that his history was available on the EMR. | Strongly Agree | No |
| Allows visual assessment. | Strongly Agree | No |
| Alleviates unnecessary transfer of patient & staff to unnecessary appointment. | Strongly Agree | No |
| So patient does not need to go to hospital. | Strongly Agree | No |
| Early diagnosis can be made and treatment can be isolated. | Strongly Agree | No |
| If the note and visual is completed and placed into the computer system, then the information can be evaluated by an RN/PA/MD to facilitate treatment within the home setting rather than sending the patient to the ER. | Agree | Yes |
| The MD can be made aware of a non-hospital issue via a visual web visit. | Agree | Yes |
| Again, I have personally picked up on problems when I see a person. | Agree | No |
| Baseline helps determine deliration (means mental derangement or delirium) | Agree | No |

| | | |
|---|---|---|
| Based on utilizing the visual history, the clinician could adjust decision to send an individual out using comparison of baseline vs acute presentation. | Agree | No |
| I am not directly aware that any individual was/was not transferred following data review from the telemedicine application. | Agree | No |
| It gave you an idea of their progress from beginning to end. | Agree | No |
| It also help identify the current problem at hand. | Agree | No |
| In some cases, minor problems can be diagnosed and treated without sending patient to hospital. | Agree | No |
| A patient having acute behavioral outbursts, hallucinations, delusion, telemedicine was of little help. | Agree | No |
| In this instance, most of the cases observed were beneficial for treatment and care & learning but @ our state facility we are bound by protocols of emergent care based upon standing parameters and rules that state in certain instances we must send our people out (just to rule out deeper concerns) etc. | Neutral | Yes |
| Distended abdomen - so many causes and unable to palpate (no feeling eq. any mass, tenderness, or rigidity, etc.) | Neutral | No |
| This was not evident to me (neutral) | Disagree | No |
| this would depend on the specific situation with the consumer | Disagree | Yes |
| If reoccurring issue arose with a consumer and we had it documented via the telemed presence app, we may be able to treat the issue immediately, thus potentially avoiding transfer to a hospital setting | Disagree | Yes |

Clinician Question #3

Question #3 in the clinician questionnaire asks if "*the textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient*"; the following hypothesis was tested:

$H_0$ = *The textual medical content and visual medical content of the site do not support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient.*

$H_1$ = *The textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient.*

Out of 22 clinicians, all 22 responded "Yes" to Question #3. Table 10 rates the responses of the 22 clinicians.

**Table 10: Clinician Q3 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 13 | Yes |
| 2. Agree | 9 | Yes |
| 3. Neutral | | |
| 4. Disagree | | |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #3, with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from table 11 that in all counterfactual distributions of the test, the result is greater than the critical value, thus the null hypothesis can be rejected. It is also evident from the robust results that the results were not skewed. All results were greater than the critical value of 9.49, there was a 95% confidence level that the textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient.

**Table 11: Q3 Counterfactual**

| **Clinician Questionnaire** | **Strongest Counterfactual $\sum(O-E)^2/E=$** | **Weak Counterfactual $\sum(O-E)^2/E=$** | **Weakest Counterfactual $\sum(O-E)^2/E=$** |
|---|---|---|---|
| 3. The textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient. | 44 | 25.98974 | 20.68778 |

Table 12 lists the reasons for their response and whether the individual chose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 12: Clinicians Comments to Question#3**

| **Comments** | **Rating** | **Regularly See Patient** |
|---|---|---|
| Nursing staff would have access to previous documentation through visual aid & text in helping with a new or old condition/illness/episode | Strongly Agree | Yes |
| The SOAP format makes the program very user friendly | Strongly Agree | Yes |
| Could assess the problem | Strongly Agree | Yes |
| Start a treatment | Strongly Agree | Yes |
| All medical records are readily available | Strongly Agree | Yes |
| All parts of the treatment plan are visually available | Strongly Agree | Yes |
| Visual vs non-visual very important in diagnosis and less ER visits | Strongly Agree | Yes |
| Much easier to see and have provider visualize what the problem is instead of us trying to get the info from staff who may not give good descriptive of info | Strongly Agree | Yes |
| In many cases the text explained what nursing notes may have but I think increased notes written as in charts would be more beneficial. The VS as it stands now is listed for that date but I think a baseline set as well as the vs from that date would be helpful. For instance, if on a day the patient is agitated their visual may offer some insight (especially on someone who is none verbal). As in case of rash it would be very helpful for assessment with treatment post diagnosis. | Strongly Agree | Yes |
| The program gives a visual of both medical symptoms and changes with behavior patterns. | Strongly Agree | Yes |
| This is a process that you always have to not only see in notes but see the video from beginning treatment to the healing process | Strongly Agree | Yes |
| Referring back to the video when something else of the same type of illness happens. Much more helpful with a video. | Strongly Agree | Yes |
| In reviewing video from baseline and comparing it to an acute episode it is clear that change could be assessed when added to written data. | Strongly Agree | No |
| For certain individuals/conditions, it was easier to view changes on the | Strongly | No |

| | | |
|---|---|---|
| video component than it was for other individuals. | Agree | |
| Written (text) content is most available but adding the visual component helps determine what better/worse is and what a 3/5 or 1/5 is (measuring method in a neurologic exam of muscle strength; 1/5 = muscle twitching, 3/5 indicates able to lift a limb against gravity only. The scale of 0-3 usually is used for qualifying reflexes) | Strongly Agree | No |
| Medical history and content (SOAP note) provides needed baseline and current information to perform an accurate assessment and/or evaluation of treatment. | Strongly Agree | No |
| The visual content enhances the process and contributes to an accurate assessment. | Strongly Agree | No |
| Especially with individual with mega colon requiring g-tube | Strongly Agree | No |
| As a nurse, if I had to assess any of these individuals having this info is very helpful, as I do not know anything about their medical conditions. | Strongly Agree | No |
| Allows for quick visual reference. | Strongly Agree | No |
| Increases accuracy of assessment. | Strongly Agree | No |
| We can see tremor and leaning to one side | Agree | No |
| Tremors and affect could be visualized. | Agree | No |
| The textual help to put a full picture together. | Agree | No |
| The picture I imagined of the person from the textual differs from the visual. | Agree | No |
| For example, 1 - agitation; 5 increase of psych medication to tapering down of medication | Agree | No |
| To confirm the diagnosis diagnostic - evidence based. | Agree | No |
| It gives clear picture in front of us | Agree | No |
| Good to have a text background/history of the patient as it cuts down on gathering history to determine plan of care. | Agree | No |
| On a deeper level this could be especially effective for new trainees or a new healthcare worker to watch and observe a variety of procedures/techniques that would enable them to be more confident for future uses of those same techniques as needed. | Agree | Yes |
| The sessions show that over time really knowing your patient (& their baseline) is key to noting/observing important changes or dealing with a difficult personality or behavior. | Agree | Yes |

Clinician Question #4

Question #4 in the clinician questionnaire asks if "*the picture/video component identified whether a medical concern existed or not*"; the following hypothesis was tested:

$H_0$ = *The picture/video component did not identify whether a medical concern existed or not.*

$H_1$ = *The picture/video component identified whether a medical concern existed or not*

Out of 22 clinicians, 19 responded "Yes" and 3 responded "No" to the question. Table 13 rates the responses of the 22 clinicians.

**Table 13: Clinician Q4 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 12 | Yes |
| 2. Agree | 7 | Yes |
| 3. Neutral | 1 | No |
| 4. Disagree | 2 | No |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #4, with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from table 14 that in all counterfactual distributions of the test, the result was greater than the critical value, thus the null hypothesis can be rejected. It was also evident from the robust results that the results were not skewed. All results were greater than the critical value of 9.49, there is a 95% confidence level that the picture/video component identified whether a medical concern existed or not.

**Table 14: Q4 Counterfactual**

| **Clinician Questionnaire** | **Strongest Counterfactual $\sum(O-E)^2/E=$** | **Weak Counterfactual $\sum(O-E)^2/E=$** | **Weakest Counterfactual $\sum(O-E)^2/E=$** |
|---|---|---|---|
| 4. The picture/video component identified whether a medical concern existed or not. | 40.17391 | 17.99134 | 13.05628 |

Table 15 lists the reasons for their response and whether the individual chose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 15: Clinicians Comments to Question#4**

| **Comments** | **Rating** | **Regularly See Patient** |
|---|---|---|
| The visual component greatly helps with backing up text documentation | Strongly Agree | Yes |
| It's very helpful to have a "video diary" of each consumer, both for current diagnosing and treatment, as well as, a historical significance | Strongly Agree | Yes |
| Based on education, medical personnel can make an educated determination in a quick manner | Strongly Agree | Yes |
| The video component gives an accurate picture whereas someone's words (i.e. nurses notes) can be mistaken | Strongly Agree | Yes |
| Dr. here could see problem | Strongly Agree | Yes |
| In house assessment | Strongly Agree | Yes |
| Specific to rashes or skin changes, a visual is always superior to a written description | Strongly Agree | Yes |
| Referencing the video at a later time clearly reflects if a medical condition is resolved, resolving, or worsening | Strongly Agree | Yes |
| Like the idea we could send video with a concern to Dr. and get answer back in regards to our questions | Strongly Agree | Yes |
| The picture or the video is a great idea if we have a question or problem | Strongly Agree | Yes |
| For example, with one 76 year old male his distended stomach & the RPA discussing his mega colon issue, and the possibility of ascites and his continued digestive issues which eventually led to the need for enteral feeding & a g-tube insertion. | Strongly Agree | Yes |
| After this was done, it was observable on video his significant improvements but some remaining issues that needed to be dealt with. | Strongly Agree | Yes |
| You cannot have any type of conflict of what started as a diagnosis or ended in their healing process especially when it’s right there in front of your eyes with pictures. | Strongly Agree | Yes |
| This is so much more efficient of the care of any individual and the process of healing. | Strongly Agree | Yes |
| The program allows the provider or nurse to view the current medical condition and compare the symptoms to the baseline presentation and | Strongly Agree | Yes |

| | | |
|---|---|---|
| previous notes. | | |
| This process allows the provider to view the progression of symptoms as well. | Strongly Agree | Yes |
| Assessing via verbal is much different than the visual. | Strongly Agree | No |
| Visual gives an immediate knowledge of urgency. | Strongly Agree | No |
| For most cases viewed, it was stated that a baseline view was being obtained. | Strongly Agree | No |
| For some individuals dialogue in the video directed the viewer to particular physical symptoms for which the change was being documented. | Strongly Agree | No |
| The clinician can visualize if there is a medical concern in real-time. | Strongly Agree | No |
| The video component eliminates reliance on nonclinical staff for descriptions. | Strongly Agree | No |
| Two staff may have a different take on issue. | Strongly Agree | No |
| Prevents staff from having to assess patient. | Strongly Agree | No |
| Although more videos in certain cases would be much more beneficial such as the 2 cases of stomach distension showing instances of each w/o distension and with worse cases of distension. Showing these so the difference can be noted and prove there is something medical involved. Or the conversations with the 2 individuals with psychological concerns showing the confusion and catching the nuances in their answers which are difficult to put into writing. | Agree | Yes |
| Well yes because you can see and hear readily what is going on. | Agree | Yes |
| It is visible. | Agree | No |
| We can coordinate with history provided. | Agree | No |
| Lay staff come from a diverse background which can mislead the doctor when describing symptoms/signs. | Agree | No |
| Medical practitioner uses vision sense/hearing to determine plan of care. | Agree | No |
| I suggest that maybe the video eval last longer in order to give a better sense of the situation. | Agree | No |
| At least one that I viewed was blurry until it (video) ended so I couldn't get a good idea of the situation. | Agree | No |
| What is (are) problem(s) in the mouth (Patient #4) | Disagree | No |
| What kind of procedures, eq. mouth cleaning or smearing for bacteria culture. | Disagree | No |
| Patient 4 - if I was a doctor would have been able to point out and search for clues the individual need a g-tube | Disagree | No |
| No being a MD, this would not have stood out. | Disagree | No |
| The picture/video did not identify the medical concerns but did CLARIFY the medical concern. | Disagree | No |

Clinician/DSA Question #5

Question #5 in both the clinician and DSA questionnaires asks the same question, "*the images and videos contained on the site instill a sense of presence (more real or relevant)*"; the following hypothesis was tested:

$H_0$ = *The images and videos contained on the site do not instill a sense of presence (more real or relevant).*

$H_1$ = *The images and videos contained on the site instill a sense of presence (more real or relevant).*

Out of a total response of 27, 22 clinicians and five DSAs, all 27 responded "Yes" to the question. Table 16 rates the responses of the 22 clinicians and five DSAs.

**Table 16: Clinician Q5 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 18 | Yes |
| 2. Agree | 8 | Yes |
| 3. Neutral | 1 | Yes |
| 4. Disagree | | |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #5, with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from table 17 that in all counterfactual distributions of the test, the result was greater than the critical value, thus the null hypothesis can be rejected. It was also evident from the robust results that the results were not skewed. All results were greater than the critical value

of 9.49, there is a 95% confidence level that the images and videos contained on the site instill a sense of presence (more real or relevant).

**Table 17: Q5 Counterfactual**

| **Clinician Questionnaire** | **Strongest Counterfactual $\sum(O-E)^2/E=$** | **Weak Counterfactual $\sum(O-E)^2/E=$** | **Weakest Counterfactual $\sum(O-E)^2/E=$** |
|---|---|---|---|
| 5. The images and videos contained on the site instill a sense of presence (more real or relevant). | 50.14286 | 27.73993 | 22.54013 |

Table 18 lists the reasons for their response and whether the individual chose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 18: Clinicians & DSAs Comments to Question#5**

| **Comments** | **Rating** | **Regularly See Patient** |
|---|---|---|
| The images are very accurate pictures of the patient's condition | Strongly Agree | Yes |
| Images are more "real" as words can be understood differently by each reader | Strongly Agree | Yes |
| You could see change | Strongly Agree | Yes |
| See area when healed | Strongly Agree | Yes |
| Through cliché, a "picture does tell a thousand words". Subtleties are evident and reviewable. Size and location are instantly reviewable (for comparison; better or worse) | Strongly Agree | Yes |
| The patient becomes more 3 dimensional and there is correlation of what can actually be seen between exam, patient feedback and current medical condition | Strongly Agree | Yes |

| | | |
|---|---|---|
| The video offers aspects of a patient that would typically not be readily documented (i.e. patient singing, etc.) | Strongly Agree | Yes |
| The images and videos are instrumental in helping diagnose and treat the consumers | Strongly Agree | Yes |
| It is very helpful and beneficial to be able to see the issue at hand | Strongly Agree | Yes |
| Looking at the pictures make it feel as though the patient was right there | Strongly Agree | Yes |
| If at providers office they could obtain video & watch changes up to present | Strongly Agree | Yes |
| For instance, the fungal rash in the notes it may be under stated until you actually see the image of how red & irritated looking it really was. | Strongly Agree | Yes |
| You cannot misrepresent pictures (videos) from the stage 1 to end result of care and cure. | Strongly Agree | Yes |
| This is absolutely the best way to view and treat any individual when it comes to an illness and see not only the healing and results. This is definitely a great step to the future. | Strongly Agree | Yes |
| The information given regarding patient#4 to see the distension in his stomach or the honey comb look on his legs these are things that having the visual makes it more real and gives the viewer a better sense of the concerns. | Strongly Agree | Yes |
| Even though the patient/clients faces are blurred out for their privacy, the remaining image of them gives the observer a feel for their demeanor, their sense of awareness (or lack of) to response to date, location, alertness level of confusion or of consciousness, etc. | Strongly Agree | Yes |
| The visual and video allows the provider to view how a client responds in real time. | Strongly Agree | Yes |
| Allows the provider to see if the symptoms correspond with the typed note. | Strongly Agree | Yes |
| You can see for yourself instead of someone else's words or phone message | Strongly Agree | Yes |
| The videos on site are in there own environment | Strongly Agree | Yes |
| More real better to see person physically | Strongly Agree | Yes |
| You can record physical bruises and deformities not emotions | Strongly Agree | Yes |
| As stated above, just should be a little longer for better picture of the problem. Otherwise images added an additional presentation of the problem other than the written component. | Strongly Agree | No |
| Images and visual give a much greater sense of presence. | Strongly Agree | No |
| It is very useful, much better than just text. | Strongly Agree | No |
| In the ID/DD population, it is extremely important to have a good understanding of what baseline presentation is. Given the multitude of physical and mental handicaps; each individual manifests "baseline" in a | Strongly Agree | No |

| | | |
|---|---|---|
| different way. | | |
| Likewise, a change from baseline can be very subtle or be exhibited in an unexpected way that may or may not be an indicator of a particular acute or chronic condition. By cataloging an individual's specific responses or physical symptoms it could be possible to then predict certain symptom clusters which might assist the clinician in making an accurate decision about referral or treatment. | Strongly Agree | No |
| The images were focused on the condition with interaction of staff and patient. | Strongly Agree | No |
| The ability to see progression of treatment via multiple video enables the clinician to monitor and measure the effectiveness of the treatment. | Strongly Agree | No |
| Visual assessment ability. | Strongly Agree | No |
| Increases confidence in correct assessment. | Strongly Agree | No |
| Clearly we can view the patient. | Strongly Agree | No |
| we can also feel the presence when patient can show s full emotions - while singing etc. | Strongly Agree | No |
| Yes it does, but an appointment is always the best. | Agree | Yes |
| This surely will cut costs, I feel. | Agree | Yes |
| For decubitus, rashes, pictures were very helpful in making a diagnoses and further management. | Agree | No |
| We can see decubitus (an ulceration of tissue) | Agree | No |
| Video gave an overview of individuals' diagnosis, condition, and stability. | Agree | No |
| We can be in the persons home regular routine to see more accurately | Agree | No |
| We can decide (or not) the procedures (treatment). | Agree | No |
| Visual - easier to diagnose | Agree | Yes |
| Physical - easier to access files on individuals in question | Agree | Yes |
| The proof is visible through pictures and/or videos | Agree | Yes |
| Must take into consideration when the picture or videos were taken a resident may be more alert in the am versus the evening. You may get 2 different responses. | Agree | Yes |
| Not sure what you mean - if you are intending the patient feeling more secure, confident having a video verse the actual presence of a doctor, then no. If you are intending that the video allows the doctor to have a feeling of presence, then yes. | Disagree | No |

DSA Question #1

Question #1 in DSA questionnaire asks the question, "*the use of graphics and updated visuals on the web-based Telemedicine application provides appropriate information for necessary follow-up visits*"; the following hypothesis was tested:

$H_0$ = *The use of graphics and updated visuals on the web-based Telemedicine application does not provide appropriate information for necessary follow-up visits.*

$H_1$ = *The use of graphics and updated visuals on the web-based Telemedicine application provides appropriate information for necessary follow-up visits.*

Out of five DSAs, all five responded "Yes" to the question. Table 19 rates the responses of the five DSAs.

**Table 19: DSA Q1 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 3 | Yes |
| 2. Agree | 2 | Yes |
| 3. Neutral | | |
| 4. Disagree | | |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #1 with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from Table 20 that in only the strongest counterfactual distribution the result was greater than the critical value, thus the null hypothesis can be rejected. Conversely, for the other instances, the chi-square result was less than the critical value of 9.49, this test failed to reject the null hypothesis. One very important note to mention however is that for a chi-square to yield accurate inferences, a sample size of five or more should be present in each cell of a

contingency table. Thus, the amount of data from the DSA questionnaire may not be enough to yield accurate results.

**Table 20: DSA Q1 Counterfactual**

| DSA Questionnaire | Strongest Counterfactual $\sum(O-E)^2/E=$ | Weak Counterfactual $\sum(O-E)^2/E=$ | Weakest Counterfactual $\sum(O-E)^2/E=$ |
|---|---|---|---|
| 1. The use of graphics and updated visuals on the web-based Telemedicine application provides appropriate information for necessary follow-up visits. | 10 | 7.333333 | 4.333333 |

After each question, the responder was asked to list two reasons for their response. Table 21 lists the comments made for Question #1. The two columns to the right of each comment identifies whether the individual choose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 21: DSAs Comments to Question#1**

| Comments | Rating | Regularly See Patient |
|---|---|---|
| You can see it visually | Strongly Agree | Yes |
| Help the doctors to see what goes on | Strongly Agree | Yes |
| For necessary post treatment | Strongly Agree | Yes |
| For employees to refer back to on records making it easier to care for them | Strongly Agree | Yes |
| For patient#8 I strongly agree; it showed that the rash healed completely in a few weeks | Strongly Agree | Yes |
| I believe that visual is better; seeing is believing | Strongly | Yes |

| | | |
|---|---|---|
| | Agree | |
| The use of pictures/videos actually let you see the change | Agree | Yes |
| Some pictures/videos were dark & more difficult to see the change | Agree | Yes |

DSA Question #2

Question #2 in DSA questionnaire asks the question does, "*the use of the web-based Telemedicine application makes the quality of care better*"; the following hypothesis was tested:

$H_0$ = *The use of the web-based Telemedicine application does not make the quality of care better.*

$H_1$ = *The use of the web-based Telemedicine application makes the quality of care better.*

Out of five DSAs, all five responded "Yes" to the question. Table 22 rates the responses of the five DSAs.

**Table 22: DSA Q2 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 3 | Yes |
| 2. Agree | | |
| 3. Neutral | 2 | Yes |
| 4. Disagree | | |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #2 with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from Table 23 that in all counterfactual distributions the results was less than the critical value, thus this test failed to reject the null hypothesis. Once again, for a chi-square to yield accurate inferences, a sample size of five or more should be present in each cell of a

contingency table. Thus, the amount of data from the DSA questionnaire may not be enough to yield accurate results.

**Table 23: DSA Q2 Counterfactual**

| DSA Questionnaire | Strongest Counterfactual $\sum(O-E)^2/E=$ | Weak Counterfactual $\sum(O-E)^2/E=$ | Weakest Counterfactual $\sum(O-E)^2/E=$ |
|---|---|---|---|
| 2. The use of the web-based Telemedicine application makes the quality of care better. | 4.285714 | 5.2 | 4.33333 |

Table 24 lists the reasons for their response and whether the individual chose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 24: DSAs Comments to Question#2**

| Comments | Rating | Regularly See Patient |
|---|---|---|
| Because when seeing visually you can take care of the person | Strongly Agree | Yes |
| You can see how the client responds | Strongly Agree | Yes |
| It is educational | Strongly Agree | Yes |
| Caring is easier when you know the individuals | Strongly Agree | Yes |
| Being able to physically see progression or baseline. | Strongly Agree | Yes |
| Being able to witness "normal" or "abnormal" behaviors. | Strongly Agree | Yes |
| It allows you to see what works | Neutral | Yes |
| However, quality of care overall is very good at our homes | Neutral | Yes |
| It can make it better | Neutral | Yes |
| You can look at the video which can take longer than reading a piece of paper | Neutral | Yes |

DSA Question #3

Question #3 in DSA questionnaire asks the question does, "*the visual content of the application made reviewing the patient's problems easier*"; the following hypothesis was tested:

$H_0$ = *The visual content of the application did not make reviewing the patient's problems easier.*

$H_1$ = *The visual content of the application made reviewing the patient's problems easier.*

Out of five DSAs, all five responded "Yes" to the question. Table 25 rates the responses of the five DSAs.

**Table 25: DSA Q3 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 2 | Yes |
| 2. Agree | 3 | Yes |
| 3. Neutral | | |
| 4. Disagree | | |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #3 with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from Table 26 that in only the strongest counterfactual distribution the result was greater than the critical value, which would suggest the null hypothesis can be rejected. Conversely, for the other instances, the chi-square result was less than the critical value of 9.49, which would suggest this test failed to reject the null hypothesis. Since there was an inconsistency in the results, the conclusion drawn was that there is not enough data to either accept or reject the null hypothesis. One very important note to mention is that for a chi-square

to yield accurate inferences, a sample size of five or more should be present in each cell of a contingency table. Thus, the amount of data from the DSA questionnaire may not be enough to yield accurate results.

**Table 26: DSA Q3 Counterfactual**

| DSA Questionnaire | Strongest Counterfactual $\sum(O-E)^2/E=$ | Weak Counterfactual $\sum(O-E)^2/E=$ | Weakest Counterfactual $\sum(O-E)^2/E=$ |
|---|---|---|---|
| 3. The visual content of the application made reviewing the patient's problems easier. | 10 | 7 | 4.333333 |

After each question, the responder was asked to list two reasons for their response. Table 27 lists the comments made for Question #3. The two columns to the right of each comment identifies whether the individual choose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 27: DSAs Comments to Question#3**

| Comment | Rating | Regularly See Patient |
|---|---|---|
| I can see what the clinician was talking about | Strongly Agree | Yes |
| By visually seeing watching I can make my own decision | Strongly Agree | Yes |
| Seeing is believing | Strongly Agree | Yes |
| Physical | Strongly Agree | Yes |
| Treatment easier | Agree | Yes |
| Faster treatment | Agree | Yes |
| You can observe the kind of discomfort they are having | Agree | Yes |
| You can see the improvements or worsening of the problem | Agree | Yes |

DSA Question #4

Question #4 in DSA questionnaire asks the question, "*the picture/video component was relevant in helping to reach a solution for treatment*"; the following hypothesis was tested:

$H_0$ = *The picture/video component was not relevant in helping to reach a solution for treatment.*

$H_1$ = *The picture/video component was relevant in helping to reach a solution for treatment.*

Out of five DSAs, four responded "Yes" and one responded "No" to the question. Table 28 rates the responses of the five DSAs.

**Table 28: DSA Q4 Responses**

| | | |
|---|---|---|
| 1. Strongly Agree | 1 | Yes |
| 2. Agree | 2 | Yes |
| 3. Neutral | 1 | Yes |
| 4. Disagree | 1 | No |
| 5. Strongly Disagree | | |

Applying the chi-square test on Question #4 with the critical value of 0.05 and d.f. (4) = 9.49, it can be seen from Table 29 below that in all counterfactual distributions the results were less than the critical value, thus this test failed to reject the null hypothesis. The same was true as before, for a chi-square to yield accurate inferences, a sample size of five or more should be present in each cell of a contingency table. Thus, the amount of data from the DSA questionnaire may not be enough to yield accurate results.

**Table 29: DSA Q4 Counterfactual**

| DSA Questionnaire | Strongest Counterfactual $\sum(O-E)^2/E=$ | Weak Counterfactual $\sum(O-E)^2/E=$ | Weakest Counterfactual $\sum(O-E)^2/E=$ |
|---|---|---|---|
| 4. The picture/video component was relevant in helping to reach a solution for treatment. | 6.666667 | 2.333333 | 1.333333 |

After each question, the responder was asked to list two reasons for their response. Table 30 lists the comments made for Question #4. The two columns to the right of each comment identifies whether the individual choose a response that was strongly agree, agree, neutral, disagree, or strongly disagree and whether the individual was a regular care taker of the patient or not.

**Table 30: DSAs Comments to Question#4**

| Comments | Rating | Regularly See Patient |
|---|---|---|
| I could hear noises & speaking from the patient which helps the decision process | Strongly Agree | Yes |
| I could hear the doctor describe some of his findings. It's easier for me then reading it. | Strongly Agree | Yes |
| Visualization is easier for some people to learn from | Agree | Yes |
| Seeing rather than hearing the individuals condition is easier to make a quick decision on what treatment to do | Agree | Yes |
| You can definitely see the change through before & after pictures | Agree | Yes |
| If occurrence repeats you can go back & see what was used to get the issued resolved | Agree | Yes |
| Video was just to have on file | Neutral | Yes |
| Video doesn't diagnose | Neutral | Yes |

*Filtered Data*

This section will focus on the variations of the filtered data. Firstly, the data was filtered based on clinician expertise (i.e., MD, PA, RN, LPN); secondly, on whether the clinician/DSA was familiar or not familiar with the patients participating in the study and their medical needs.

Clinician Expertise

In order to perform a test of independence, a contingency table was created for each question in the clinician questionnaire. The rows in the table consisted of the options from the Likert scale (1.Strongly Agree, 2.Agree, 3.Neutral, 4.Disagree, 5.Strongly Disagree) and the columns consisted of the clinician expertise (MD, PA, RN, LPN). The actual observed values were entered into the table and the expected values for each cell were calculated. With a total of twenty-two responses and degrees of freedom = 4, the critical value is 9.49.

Table 31 displays the chi-square results for each question in the clinicians' questionnaire. Using the same $H_0$ as earlier, it is evident from the results that the null hypothesis for each question can be rejected.

**Table 31: Chi-Square Results MD/PA/RN/LPN**

| **Q#** | **$H_0$** | **MD/PA/RN/LPN $\sum(O-E)^2/E=$** |
|---|---|---|
| 1. | The use of the web-based Telemedicine application does not enable a timely and an accurate diagnosis | 22.20095 |
| 2. | This Telemedicine application was not effective in preventing the unnecessary transfer of patients out of facility to hospital. | 19.62083 |
| 3. | The textual medical content and visual medical content of the site does not support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient | 27.86667 |
| 4. | The picture/video component did not identify whether a medical concern existed or not. | 24.1396 |
| 5. | The images and videos contained on the site do not instill a sense of presence (more real or relevant). | 22.97087 |

Regularly See Patient/Do Not Regularly See Patient

In order to perform a test of independence, a contingency table was created for each question in the clinician questionnaire. The rows in the table consisted of the options from the Likert scale (1.Strongly Agree, 2.Agree, 3.Neutral, 4.Disagree, 5.Strongly Disagree) and the columns consisted of whether the respondents were familiar with the patients or not; whether they care for the patients on a regular basis or not. The actual observed values were entered into the table and the expected values for each cell were calculated. There were eleven clinicians who regularly see the patients and eleven who do not. With a total of twenty-two responses and the degrees of freedom = 4, the critical value is again 9.49.

Table 32 displays the chi-square results for each question in the questionnaire. Once again using the same $H_0$ as earlier, the results for questions #1, #3, #4, and #5 in table 32 show that the null hypothesis can be rejected. Conversely, since the chi-square result for Question #2 is less than the critical value, the $H_0$ for Question #2 failed to reject the null hypothesis.

**Table 32: Chi-Square Results RSP/DNRSP**

| **Q#** | **$H_0$** | **Regularly See Patient/ Do Not Regularly See Patient $\sum(O-E)^2/E=$** |
|---|---|---|
| 1. | The use of the web-based Telemedicine application does not enable a timely and an accurate diagnosis | 24.96797 |
| 2. | This Telemedicine application was not effective in preventing the unnecessary transfer of patients out of facility to hospital. | 7.45679 |
| 3. | The textual medical content and visual medical content of the site do not support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient | 26.70085 |
| 4. | The picture/video component does not identify whether a medical concern existed or not. | 20.58145 |
| 5. | The images and videos contained on the site do not instill a sense of presence (more real or relevant). | 26.91614 |

**Summary of Results**

According table 3, which maps the questions in the questionnaires to each sub-hypothesis, and the chi-square results observed from each test, the results of the test of all clinicians (MD, PA, RN, LPN), those who regularly care for and do not regularly care for the patients of the Valatie, NY homes, show the following sub-hypotheses to be true:

> **H1:** Presence, in the form of a video medical history beginning with a baseline visual measurement and periodic visual updates within a three month period will be preferred by clinicians over non-presence.
>
> **H2:** The design elements (i.e., visual content) of the telemedicine application will have significant impact on the perceived usefulness (i.e., quicker and/or more informative method of delivering healthcare) of the telemedicine application.
>
> **H3:** The content of medical information (i.e., video medical such as full length captured video of the patient as well as close-up video of injured area of body) presented to the clinician will enable more immediate diagnosis and less need to refer patients to an emergency room (ER).

Although the results from the test of all clinicians (MD, PA, RN, LPN) show that sub-hypothesis

> **H4:** Presence will have a significant cost savings impact over no-presence as measured by physician cost.

to be true, the results of the test of those who regularly care for and do not regularly care for the patients of the Valatie, NY homes, show it is not true.

In addition according to the results from the DSA questions, in particular Question #2, sub-hypothesis **H3** is shown to be not true. However, as stated earlier, due to the small sample size the results may not be accurate. In fact, according to the responses and comments made by the DSAs, it is evident that they feel the visual medical information is helpful to clinicians. Three DSAs responded with strongly agree. Two DSAs responded with neutral, however even

the comments of the neutral responses were positive, i.e., “It allows you to see what works” and “It can make it better.”

# Chapter 5

## Conclusions, Implications, Recommendations, Summary

This chapter has four sections; the first section discusses all conclusions drawn from the analysis executed and results attained in chapter 4 and which objectives were accomplished. This section highlights any strengths, weaknesses, and limitations of this study. The second section discusses what contributions of knowledge this study has made to the medical profession and suggestions for future research. The third section details recommendations for future research and possible changes in procedures and practices for those who provide care to individuals with DD/ID. The last section summarizes the contents of this research paper.

### Conclusions

From the results of the questions in the questionnaires given to both the clinicians and DSAs, one strength revealed is that at least 80%, and for some questions 90% and 100%, of the responses were "yes" to each question asked. At least 80% of the respondents agreed that the visual component of the telemedicine application was beneficial and helpful to clinicians in aiding them in assessing, diagnosing, or delivering a plan of treatment for individuals with DD/ID. In addition, the positive comments shared by the respondents showed that they felt that the visual component was useful and helpful in making the patients' medical issues more relevant or real; just a few comments to support this strength: "subtleties are evident and reviewable," "the ability to see progression of treatment via multiple video enables the clinician

to monitor and measure the effectiveness of the treatment," "you cannot misrepresent pictures (videos) from the stage 1 to end result of care and cure."

One weakness of the study was that the population studied and the number of clinicians and DSAs completing the questionnaires was a small number. Although individuals with DD/ID suffer from medical issues on a more frequent basis than those who do not have disabilities, a five month study may not have been enough time to produce more solid results. Even though the period of the study was extended from its original time frame of a three month period, a time period longer than five months to study the importance of presence in diagnosing individuals with disabilities should be conducted. In addition, in order to protect and secure the identity of the patients in the study, facial features had to be grayed out. However in many medical cases, facial features and expressions are extremely helpful in determining if there is a problem or not. To simplify the video recording process, basic digital cameras were used which may not have produced exceptional quality video, which in turn may have resulted in negative opinions towards the effectiveness of the visual component of the telemedicine application.

Some limitations may have occurred in this study; table 33 will list possible limitations. This researcher visited the two Valatie, NY homes regularly over a five month period however this researcher had no relationship with the employees or residents of the Valatie, NY homes prior to this research and will not meet them again now that the research is complete. Although this researcher recognizes doing what was needed to reduce biases, possible biases may have still transpired. Table 33 addresses the steps in administering the questionnaires and any possible biases that may have occurred and how this researcher controlled those biases.

**Table 33: Steps in Administering Questionnaire**

| Steps in Administering Questionnaire | Possible Biases | How Biases Were Controlled |
|---|---|---|
| Ten clinicians & five DSAs from the Valatie NY houses, two or three at a time, viewed the telemed app.<br><br>Each group of clinicians/DSAs received a paper copy of the questionnaire from this researcher. | Some clinicians/DSAs may have reviewed patient records in different order than others.<br><br>Researcher was present and handed clinicians/DSAs the questionnaire. | Clinicians/DSAs chose the patient records and the order they were viewed.<br><br>Each clinician/DSA left the room and completed the questionnaire in private. When completed, the questionnaire was returned to this researcher. |
| Three clinicians in Kingston NY viewed the telemed app in their respective offices.<br><br>Each clinician received a paper copy of the questionnaire from this researcher. | Clinicians may have reviewed patient records in different order than others.<br><br>Researcher was present and handed clinicians the questionnaire. | Clinicians chose the patient records and the order they were viewed.<br><br>This researcher left the clinicians offices to allow them to complete the questionnaire in private. The clinicians returned the completed questionnaires to this researcher. |
| Three clinicians in Poughkeepsie NY viewed the telemed app.<br><br>Each clinician received a paper copy of the questionnaire from this researcher. | Clinicians may have reviewed patient records in different order than others.<br><br>Researcher was present and handed clinicians the questionnaire. | Clinicians chose the patient records and the order they were viewed.<br><br>One clinician left room to complete questionnaire that same day and returned the questionnaire when done. This researcher returned several days later to pick up the other two completed questionnaires. |
| Four clinicians in Amenia, NY viewed the telemed app.<br><br>Each clinician received a paper copy of the questionnaire from this researcher. | Clinicians may have reviewed patient records in different order than others.<br>Researcher was present and handed clinicians the questionnaire. | Clinicians chose the patient records and the order they were viewed.<br>This researcher left the room to allow the clinicians to fill out the questionnaire |

| | | |
|---|---|---|
| | | in private; clinicians left questionnaires in a pile on a table before leaving the room. |
| Two clinicians received directions on how to view the telemed app and the questionnaire via email. | It is possible clinicians did not view the telemed app before taking questionnaire. | Clinicians responses on questionnaire specifically refer to particular patient records verifying they viewed the telemed app. |

**Implications**

After a detailed review of existing literature, it was discovered that no research was conducted on whether presence in the form of a pictorial and visual medical history had any benefits in caring for individuals with DD/ID before this study. Although this study was executed on a small population, the various filtered results of the study has shown that presence is helpful to clinicians when used in delivering medical assessment, diagnosis, and/or treatment to individuals who cannot communicate their healthcare needs to their clinician. It thus suggests that developing a visual medical history of a patient, beginning with a baseline measurement and capturing visual medical exams over time, should be implemented and practiced in medical facilities that care for individuals with DD/ID and should accompany their written medical history.

**Recommendations**

Although the results of this study revealed clinicians had positive feelings about presence when reviewing patient EMRs, a similar study is recommended to be done on a larger population and over a greater time period. Another reflection to be made, many of the residents in the Valatie, NY homes are, at times, seen by medical doctors who are not employed by the NYS Office for People With Developmental Disabilities (OPWDD). Since IRB approval of this study

specifically stated that the study was to be conducted within Region 4 of the NYS DDSO (a sub-division of OPWDD), the study did not include the local clinicians residents are sent to for additional medical concerns. Another recommendation would be to extend the study to include clinicians who care for individuals with DD/ID and who work outside of the OPWDD.

In addition, in order to solidify the results of this study, it is suggested to extend the study to other patient groups who are not able to communicate their health needs to clinicians; patient groups such as infants or those with dementia.

**Summary**

The purpose of this study was to determine whether clinicians felt a pictorial/visual medical history was helpful in determining healthcare options for individuals with DD/ID. This study was conducted in two NYS residential homes for developmentally disabled individuals. During a five month period, written and visual medical history of 16 participants/residents was recorded into a specifically designed electronic medical records database. Centered on the EMR database, a web-based telemedicine application was created according to the specificity of a medical note used by clinicians employed by and who care for the residents/patients of the NYS homes. The content of each patient record, which is displayed via the telemedicine application, included both written medical notes and video recorded encounters or medical exams of the patient. The eleven clinicians and five DSAs who provide medical care for the 16 residents of the Valatie homes on a regular basis and eleven clinicians who provide medical care for individuals with DD/ID but are not regular care givers of the residents of the Valatie homes reviewed the telemedicine application and completed questionnaires pertaining to the telemedicine application. The results of the questionnaires were then evaluated.

Each question of the questionnaires was written to specifically relate to one of the four sub-hypotheses. As displayed in table 3, the results of questions #4 and #5 from the clinicians' questionnaire and questions #1, #3, and #5 from the DSAs questionnaire report whether sub-hypotheses #1 (**H1:** Presence, in the form of a video medical history beginning with a baseline visual measurement and periodic visual updates within a three month period will be preferred by clinicians over non-presence) is true or not. According to each filtered chi-square test performed on the specific questions relating to sub-hypotheses #1, the results show that presence in the form of a video medical history is preferred by clinicians rather than having just a written medical history of the patient.

The results of questions #1, #3, #4, and #5 from the clinicians' questionnaire and questions #2, #3, and #5 from the DSAs questionnaire report whether sub-hypotheses #2 (**H2:** The design elements (i.e., visual content) of the telemedicine application will have significant impact on the perceived usefulness (i.e., quicker and/or more informative method of delivering healthcare) of the telemedicine application) is true or not. According to each filtered chi-square test performed on the specific questions relating to sub-hypotheses #2, the results show that the clinicians felt the visual medical history component of the telemedicine application was useful and informative for delivering healthcare to individuals with DD/ID.

The results of questions #1, #2, #3, and #4 from the clinicians' questionnaire and questions #4 from the DSAs questionnaire report whether sub-hypotheses #3 (**H3:** The content of medical information (i.e., video medical such as full length captured video of the patient as well as close-up video of injured area of body) presented to the clinician will enable more immediate diagnosis and less need to refer patients to an emergency room (ER)) is true or not. Although the results of the chi-square test performed on the questions from the clinicians

questionnaire showed that the video medical content enabled clinicians in diagnosing a patient and need to transfer patients to ER was lessened, the results from the DSAs question showed that this was not so. Professionally and medically speaking however, clinicians are the ones to make the final determination whether a patient should be transferred to the ER or not, so the results from the clinicians' questionnaire should be considered over the results from the DSAs question. Additionally, as mentioned before, the sample size of DSAs participating in the study was a small number so the results may be an objective indicator of whether the sub-hypotheses is true or not.

Only the results of Question #2 from the clinicians' questionnaire report whether sub-hypotheses #4 (**H4:** Presence will have a significant cost savings impact over no-presence as measured by physician cost) is true or not. Interesting note to make on the results of the questions relating to sub-hypotheses #4, when the chi-square test was conducted for all clinicians, those who regularly provide medical care for the residents of the Valatie homes and those who do not, the results of the test show that all clinicians felt the presence feature of the telemedicine application had a significant cost savings. Conversely, when the data was filtered and a chi-square test was conducted between what clinicians who regularly provide medical care for the residents of the Valatie homes and those who do not, the results showed that this sub-hypothesis was not true. In addition, in the methodology chapter it was stated that the cost for transferring patients out to the ER would be obtained and the total cost of transfers six months prior to the study and the costs at the end of the study would be compared for any cost differences. Due to NYS limitations, this information was not obtained.

This research revealed and highlighted the opinions and feelings of medical experts towards presence, in the form of a pictorial medical history, in the assistance of diagnosing

individuals with DD/ID. Although overall the results were positive, future research should be conducted to solidify these results and promote advancements in the area of telemedicine.

# Appendix A

Letter to Research Participants (Patients and Clinicians)

Grace Bonanno
48 Rosemere St
Rye, NY 10580
gbonanno@nova.edu

January 18, 2014

Dear Participant,

My name is Grace Bonanno and I am a graduate student at Nova Southeastern University conducting research on the elements of presence in telemedicine. The focus of the research will be to determine if presence in the form of a visual and/or pictorial medical history will be of benefit to clinicians in the diagnosis of medical conditions of individuals with developmental disabilities (DDs) and/or intellectual disabilities (IDs), in particular those who cannot, because of their cognitive and/or physical disabilities, verbally relate their illness to a clinician. I am developing an application for clinicians to use as well as survey questionnaire as to the usefulness of the application. This information will help build a framework for a successful telemedicine system. I am hoping that you will join me in this exciting and important research study.

The study will be conducted during a twelve-week period between February 7, 2014 and April 30, 2014. For each participant, the entire study should take about 30 minutes to complete. NSU's Institutional Review Board (IRB) has approved this research. Please note that at no time will any personally identifiable data be collected on any participant.

If you are interested in participating in this research study, additional information can be found at www.telemedpresence.com. Please feel free to visit the web site for a more detailed explanation of the study design and research.

Thank you very much for your support and participation in this research. Your participation is very important to me and to the advancement of the body of knowledge in this area.

Sincerely,

Grace Bonanno

# Appendix B

## CONSENT TO PARTICIPATE IN RESEARCH
## (Clinicians Only)

**Title of Research Project: The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach**

**Principal Investigator (PI):** Grace Bonanno, Graduate Student, Nova Southeastern University, 325 Central Ave, White Plains, NY 10606
(914) 481-1616
gbonanno@nova.edu

**Co-Investigator(s) (or Sponsor if Principal Investigator is a research fellow or student):**
Dr. Maxine Cohen
Nova Southeastern University
3301 College Ave.
Fort Lauderdale, FL 33314
(954) 262-2072; cohenm@nova.edu

You are being asked to take part in a research study of **The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach.** We are asking you to take part in this research because you are an employee of the New York State Developmental Disabilities Services Office (NYS DDSO) facility. Administration of NYS OPWDD Region 4 DDSOO is in support of this research. Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

**What the study is about:** The purpose of this study is to learn if a visual medical history will better aid clinicians in determining a medical diagnosis of individuals who cannot otherwise communicate their medical concerns. Currently, a patient's medical history is in a written format. Typically a patient will tell the clinician what is wrong with them and the clinician will make notes on the conversation between themselves and the patient. If a patient is unable to communicate what is wrong with them, the clinician has little on which to base a diagnosis. If the clinician had a video and/or picture of how the patient looked before being injured or sick, the clinician may be better equipped to conclude what is wrong with the patient. In this study, physicians of the NYS OPWDD Region 4 DDSOO will be asked to use an electronic medical records application when examining patients over a three month period. This application will include both a written and visual medical history of each patient. The visual medical history component of the electronic medical records will include the videos/pictures taken of the patient. You will be given an Instructions hand-out to work with the telemedicine application. After 3 months of working with the telemedicine application, and taking the videos, you will be given a questionnaire (which will be available online at a password-protected website) to survey the effectiveness of this new protocol. Completing the questionnaire should require about 30 minutes. The completed questionnaires will then be analyzed by Ms. Bonanno to determine if the

"presence protocol" does make a difference in clinicians' assessments and recommendations for this or that medical situation. If Ms. Bonanno's conclusions are positive, the clinical staff expects to incorporate the protocol into their clinical practice of treating the participants' (patient participants) medical complaints utilizing the "presence" protocol. You must be an employee of the NYS OPWDD Region 4 DDSOO facility to take part in this study. As mentioned in the "Protocol Disposition Form or PDF," staff time for participation will be limited to the routine course of daily duties."

**What will happen in the research project:** If you agree to be in this study, we are asking that you assist in taking a digital video of a patient(s) and/or the area of their body that is being examined. Depending on the extent of an injury and/or condition of the patient, the video recordings may be of entire body. The digital video will take 5 – 10 minutes to complete. With your permission, we would like to ask you to assist in video- and audio-recording a portion of patients' interaction during examination. All video recordings will be deleted once the research is complete.

PLEASE INITIAL ON THE APPROPRIATE LINE
Yes, _____ (initials) I consent to assist in taking audiotape, videotape and/or photographs for professional presentations or publications.
No,_ _____ (initials) I do not consent to assist in taking audiotape, videotape and/or photographs for professional presentations or publications.

**Risks and benefits:** There is no greater than minimal risk to you when participating in this study. As mentioned below "The records of this study will be kept private by using password-protected computer files and/or locking filing cabinets." There may be a benefit to individuals with I/DD if results show that presence is beneficial in diagnosing individuals with I/DD, you (a clinician) will be better equipped in determining a medical diagnosis should there be need of medical attention in the future.

**Ending Participation:** Ending participation would not affect any other aspect your employment at the NYS OPWDD Region 4 DDSOO. To end participation, please write to the Institutional Review Board (IRB) Chair (mentioned below who will inform the PI in writing and who will in turn be informed by the PI that your withdrawal from participation in the study has been carried out.

**Compensation:** Although NYS OPWDD Region 4 DDSOO staff members will be asked to complete assessments, the State is not funding this research; not in a conventional sense (i.e. There are no funds being directly received from NYS to initiate, maintain, or continue this study).

**Your answers will be confidential.** The records of this study will be kept private by using password-protected computer files and/or locking filing cabinets. In any sort of report we make public we will not include any information that will make it possible to identify you or the research participants. Research records will be kept in a secure location; only the researchers will have access to the records. If we video-record the medical consultation, we will edit the video so

no facial identification can be made. There are legal advocacy groups that may be authorized by State Law to examine research records, but they cannot disclose any personal information without your permission.

**Taking part is voluntary:** Taking part in this study is completely voluntary. If you decide not to take part, you are free to withdraw at any time.

Alternatives to Participation and Contact Information: You do not have to participate in this research. If you have any questions about this study, please contact Grace Bonanno at 914-672-7673 (gbonanno@nova.edu) or Dr. Maxine Cohen at 954-262-2072 (cohenm@nova.edu). If you have any questions about your rights, please contact Dr. Edmund Jenkins at 718-494-5236. (Dr. Jenkins is the Chair of the Institutional Review Board, which oversees research with people to assure their well-being.)

**Statement of Consent:** I have read the above consent form and have had all of my questions answered to my satisfaction.

I _____(Insert Name of Participant), agree to participate in the study described above, and I give my consent to record video sessions between patient and physician. I have been given a copy of this informed consent.

Printed Name/Signature Date

I have fully explained the above including any risks or benefits, and believe this person understands the nature and purposes of the study with sufficient capacity to consent. I also offered to answer any questions relating to the study and have fully and completely answered all such questions.

_____

Name of person obtaining consent (print)

_____

Signature of person obtaining consent (Date)

# Appendix C

**CONSENT TO PARTICIPATE IN RESEARCH**
**[Legally Authorized Representative (LAR)]**

**Title of Research Project: The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach**

**Principal Investigator (PI):** Grace Bonanno, Graduate Student, Nova Southeastern University, 325 Central Ave, White Plains, NY 10606
Phone: (914) 481-1616
gbonanno@nova.edu

**Co-Investigator(s) (or Sponsor if Principal Investigator is a research fellow or student):**
Dr. Maxine Cohen
Nova Southeastern University
3301 College Ave
Fort Lauderdale, FL 33314
(954) 262-2072; cohenm@nova.edu

The participant is being asked to take part in a research study of **The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach.** We are asking the participant to take part because he or she is a resident of a New York State Developmental Disabilities Services Office (NYS DDSO) facility. Administration of NYS OPWDD Region 4 DDSOO is in support of this research. Please read this form carefully and ask any questions you may have before agreeing to allow the participant to take part in the study.

**What the study is about:** The purpose of this study is to learn if a visual medical history will better aid clinicians in making a medical diagnosis of individuals who cannot otherwise communicate their medical concerns. Currently, a person's medical history is solely in a written format. Typically an individual will tell the clinician what is wrong with them and the clinician will make notes on the conversation between themselves and the participant. If an individual is unable to communicate what is wrong with them, the clinician has little on which to base a diagnosis on. If the clinician had a video and/or picture of how the participant looked before being injured or sick, the clinician may be better equipped to determine what is wrong with the person. In this study, physicians of the NYS OPWDD Region 4 DDSOO will be asked to use an electronic medical records application when examining participants over a three month period. This application will include both a written and visual medical history of each participant. The visual medical history component of the electronic medical records will include the videos/pictures taken of the individual/person/participant. The participant must be a resident of the NYS OPWDD Region 4 DDSOO facility to take part in this study.

**Confidentiality:** If you agree to allow the participant to be in this study, we will need to access the participant's medical history and we will need to take a digital video of the participant and/or the area of their body that is being examined by the clinician. A nurse or another person of the same sex will be present as appropriate when the video is taken during their routine medical visit. The area of the body being video recorded will depend upon the clinician's recommendation and the extent of injury and/or condition of the participant; the video recordings may be of the entire body, including the face. When images are shown in presentations or publications, no names or other identifiers will be used, faces will not be shown and any images with the participant disrobed will not be shown. The digital video will take 5 – 10 minutes to complete. If any of these procedures causes any type of discomfort, you may withdraw from the study at once and there will be no penalty or loss of benefits to which the subject is otherwise entitled. With your permission, we would like to access the participant's medical records as well as to video-record a portion of their interaction with the clinician. All video recordings will be deleted once the research is complete. More than one visit may be necessary for video documentation, depending on the clinical situation.
PLEASE INITIAL ON THE APPROPRIATE LINE
Yes, _____ (initials) I consent to the use of a portion of this audiotape, videotape and/or photographs in professional presentations or publications.
No, _____ (initials) I do not consent to the use of a portion of this audiotape, videotape and/or photographs in professional presentations or publications.

Alternatives to Participation: The participant does not have to participate in this research. The decision to participate in this program, whether positive or negative, will have no effect on any services provided currently or in the future.

**Risks and benefits:** There is no greater than minimal risk to the participant. The risk to a breach in confidentiality will be minimized, as mentioned below, by keeping records in password-protected computer files as well as in locked filing cabinets. As mentioned above "All video recordings will be deleted once the research is complete." If it is found that "presence," in the form of a pictorial medical history is beneficial in diagnosing individuals with I/DD, then your clinician will be better equipped in determining a medical diagnosis for you should you need medical attention in the future. The same protocols for confidentiality will be practiced as they are for any clinical/medical procedure. All material used for the research project will be destroyed after completion of the project but will be stored securely either in locked filing cabinets or in password-protected files online,

Alternatives to Participation and Contact Information: The human subject does not have to participate in this research. The decision to participate in this program, whether positive or negative, will have no effect on any services provided to the participant either currently or in the future. If you have any questions about this study please contact Grace Bonanno or Dr. Maxine Cohen (contact information at top of first page). If you have any question about the rights of the participant as a human subject, please contact Dr. Edmund Jenkins at (718) 494-5236. Dr. Jenkins is Chair of the Institutional Review Board, which oversees research with people to assure their well-being.

**Ending Participation:** Ending participation would not affect any other aspect of the health care provided to the participant by the NYS OPWDD Region 4 DDSOO. To end participation, please write to the Institutional Review Board (IRB) Chair (mentioned above) who will inform the PI in writing and who will in turn be informed by the PI of the participant's withdrawal from participation in the study has been carried out.

**Compensation:** There will be no cost or compensation for participating in this study.

**Your answers will be confidential.** The records of this study will be kept private by using password-protected computer files and/or locking filing cabinets. In any sort of report we make public we will not include any information that will make it possible to identify the participant. Research records will be kept in a secure location; only the researchers will have access to the records. If we video-record the medical consultation, we will edit the video so no facial identification can be made. There are legal advocacy groups that may be authorized by State Law to examine research records, but they cannot disclose any personal information without your permission."

**Taking part is voluntary:** Taking part in this study is completely voluntary. If you decide to allow the participant to take part, the participant is free to withdraw at any time.

**Statement of Consent to Research Participation:**
I have read the above consent form and have had all of my questions answered to my satisfaction.

I agree to allow_____ (Print the name of the participant) to participate in the study described above, and I give my permission for physicians and any other care providers to release medical and other records to the PI, Grace Bonanno, or designated staff (clinician subjects) at the NYS OPWDD Region 4 DDSOO. I understand that all information gathered as part of this program will be kept strictly confidential, and that it will be used only for research. I have been given a copy of this informed consent.

Print Name/Signature of the LAR Date
I have fully explained the above including any risks or benefits, and believe this person understands the nature and purposes of the study with sufficient capacity to consent. I also offered to answer any questions relating to the study and have fully and completely answered all such questions.

_____
Name of person obtaining consent (print)

_____
Signature of person obtaining consent (Date)

**NYS OPWDD Region 4 DDSOOO**
**Authorization to Use or Disclose Health Information during a Research Study**

**Protocol Number:** 502 **Principal Investigator:** Grace Bonanno, Graduate Student

**Name of Study: The Importance of a Pictorial Medical History, in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities; A Telemedicine Approach**

For use in the above study (the "Research"), you agree to allow the following individuals and entities to create, use and disclose Health Information about you as described below:

The participant's doctors and other health care providers, if any, and The Principal Investigator and his/her staff (together "Researchers"). Researchers may include staff of the New York State Office for Persons With Developmental Disabilities (OPWDD), Research Foundation for Mental Hygiene, Inc. (RFMH), provided such staff is a part of the study.

The Health Information that may be used and disclosed for this Research includes:
☒ All information collected during the Research as told to you in the Informed Consent Form.
☒ Health Information in the participant's research record which includes the results of physical exams, medical history, laboratory or diagnostic tests, or Health Information relating to a particular condition that is related to the Research.
☐ Additional information may include:
The Health Information listed above may be used or disclosed to:
☐ Researchers at IBR who are involved in the study.
☒ Researchers and their staff at the following organizations involved with this Research: NYS OPWDD Region 4 DDSOO.
☒ The Sponsor of the Research, NYS OPWDD Region 4 DDSOO, and its agents and contractors (together, "Sponsor"); and
☒ Representatives of regulatory and government agencies, institutional review boards, representatives of the Researchers and their institutions to the level needed to carry out their responsibilities related to the conduct of the research.
☐ Other (family members or significant others, study buddies, outside agencies etc.)
Specify:

By giving permission to release your participant's Health Information as described above, you understand that this information may be disclosed to individuals or entities which are not required to comply with the federal and state privacy laws which govern the use and disclosure of personal Health Information by Region 4 DDSOO (e.g., a drug company, the Sponsor of the research). While your participant's health information may no longer be protected under the HIPAA or NYS Mental Hygiene Law requirements it continues to be subject to the terms of the consent form and may be subject to other state or federal privacy laws or regulations.

4. Please note that:

You do not have to sign this Authorization form. You may change your mind at any time and for any reason. If you do so, your ward may no longer be allowed to participate in the study. If you withdraw this Authorization the research staff and the Sponsor, if this is sponsored research, may still use or disclose Health Information they already have collected about you as needed to maintain the reliability of the research. Any request to withdraw this Authorization must be made in writing to (enter name and contact information below):
(PI): Grace Bonanno, Graduate Student, Nova Southeastern University
Phone: (914) 481-1616
gbonanno@nova.edu

This Authorization does not have an end date.

You will be given a copy of this form after you have signed it.

I agree to the use and disclosure of Health Information about me as described above:

_____ _____
Signature of Participant/ LAR Date

_____
Printed Name of Participant

_____
Relationship of LAR to Participant (if applicable)

We also ask you or your legal representative to initial the statements below:

☐ I have received a copy of the IBR Notice of Privacy Practices.

# Appendix D

**CONSENT TO PARTICIPATE IN RESEARCH**
**(Participant)**

**Title of Research Project: The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach**

**Principal Investigator (PI):** Grace Bonanno, Graduate Student, Nova Southeastern University, 325 Central Ave, White Plains, NY 10606

**Co-Investigator(s) (or Sponsor if Principal Investigator is a research fellow or student**):
Dr. Maxine Cohen
Nova Southeastern University
3301 College Ave.
Fort Lauderdale, FL 33314
(954) 262-2072; cohenm@nova.edu

You are being asked to take part in a research study of **The Importance of a Pictorial Medical History in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities: A Telemedicine Approach.** We are asking you to take part because you receive services from a New York State Developmental Disabilities Services Office (NYS DDSO) facility. Administration of NYS OPWDD Region 4 DDSOO is in support of this research. Please read this form carefully and ask any questions you may have before agreeing to take part in the study.

**What the study is about:** The purpose of this study is to learn if a visual medical history will better aid clinicians in determining a medical diagnosis for individuals who cannot otherwise communicate their medical concerns. Currently, a patient's medical history is only in a written format. Typically a patient will tell the clinician what is wrong with them and the clinician will make notes on the conversation between themselves and the patient. If a patient is unable to communicate what is wrong with them, the clinician has little on which to base a diagnosis. If the clinician had a video and/or picture of how the patient looked before being injured or sick, the clinician may be better equipped to conclude what is wrong with the patient. In this study, physicians of the NYS OPWDD Region 4 DDSOO will be asked to use an electronic medical records application when examining patients over a three-month period. This application will include both a written and visual medical history of each patient. The visual medical history component of the electronic medical records will include the videos/pictures taken of the patient. You must be a participant of the NYS OPWDD Region 4 DDSOO facility to take part in this study.

**What will happen in the research project:** If you agree to be in this study, we will need to access your medical history and we will need to take a digital video of you and/or the area of your body that is being examined by the clinician. A nurse or another person of the same sex will

be present at the videotaping of the participant's/patient's routine medical visit. Depending on the extent of an injury and/or condition, the video recordings may be of entire body, including your face. The digital video will take 5 – 10 minutes to complete. If any of these procedures causes any type of discomfort, you may withdraw from the study at once and there will be no penalty or loss of benefits to which the subject is otherwise entitled. With your permission, we would like to access your medical records as well as to video-record a portion of your interaction with the clinician. All video recordings will be deleted once the research is complete. More than one visit may be necessary for video documentation, depending on the clinical situation.
PLEASE INITIAL ON THE APPROPRIATE LINE
Yes, _____ (initials) I consent to the use of a portion of this audiotape, videotape and/or photographs in professional presentations or publications.
No,_ _____ (initials) I do not consent to the use of a portion of this audiotape, videotape and/or photographs in professional presentations or publications.

**Risks and benefits:** There is no greater than minimal risk to you when participating in this study. The risk for a breach of confidentiality has been minimized although by the steps taken below under "Confidentiality" and because "Research records will be kept in a secure location" and will be stored in password-protected computer files and/or in locked filing cabinets. There may be a benefit to individuals with I/DD if the results of this study show that "presence" is beneficial in diagnosis, your clinician will be better equipped in determining a medical diagnosis should you need medical attention in the future.

Alternatives to Participation and Contact Information: You do not have to participate in this research. The decision to participate in this program, whether positive or negative, will have no effect on any services provided to you either currently or in the future. If you have any questions about this study, please contact Grace Bonanno at 914-672-7673 (gbonanno@nova.edu) or Dr. Maxine Cohen at 954-262-2072 (cohenm@nova.edu). If you have any questions about your rights as a human subject, please contact Dr. Edmund Jenkins at 718-494-5236. (Dr. Jenkins is the Chair of the Institutional Review Board, which oversees research with people to assure their well-being.)

**Ending Participation:** Ending participation would not affect any other aspect of the health care provided to you by the NYS OPWDD Region 4 DDSOO. To end participation, please write to the Institutional Review Board (IRB) Chair (mentioned above) who will inform the PI in writing and who will in turn be informed by the PI that your withdrawal from participation in the study has been carried out.

**Compensation:** There will be no cost or compensation for participating in this study.

**Confidentiality:** The records of this study will be kept private. In any sort of report we make public we will not include any information that will make it possible to identify you. Research records will be kept in a secure location; only the researchers will have access to the records. When images are shown in presentations or publications, no names or other identifiers will be used, your face will not be shown and any images of you disrobed will not be shown.. There are legal advocacy groups that may be authorized by State Law to examine research records, but they cannot disclose any personal information without your permission.

**Taking part is voluntary:** Taking part in this study is completely voluntary. If you decide to take part, you are free to withdraw at any time.

**Statement of Consent:**

I have read the above consent form and have had all of my questions answered to my satisfaction.

I _____(Insert Name of Participant), agree to participate in the study described above, and I give my permission for physicians and any other care providers to release medical and other records to the PI of this study, Grace Bonanno at the NYS OPWDD Region 4 DDSOO. I have been given a copy of this informed consent.

Printed Name/Signature Date

I have fully explained the above including any risks or benefits, and believe this person understands the nature and purposes of the study with sufficient capacity to consent. I also offered to answer any questions relating to the study and have fully and completely answered all such questions.

_____

Name of person obtaining consent (print)

_____

Signature of person obtaining consent (Date)

**NYS OPWDD Region 4 DDSOOO**
**Authorization to Use or Disclose Health Information during a Research Study**

**Protocol Number:** 502 **Principal Investigator:** Grace Bonanno, Graduate Student

**Name of Study: The Importance of a Pictorial Medical History, in Assisting Medical Diagnosis of Individuals with Intellectual Disabilities; A Telemedicine Approach**

For use in the above study (the "Research"), you agree to allow the following individuals and entities to create, use and disclose Health Information about you as described below:

Your doctors and your other health care providers, if any, and The Principal Investigator and his/her staff (together "Researchers"). Researchers may include staff of the New York State Office for Persons With Developmental Disabilities (OPWDD), Research Foundation for Mental Hygiene, Inc. (RFMH), provided such staff is a part of the study.

The Health Information that may be used and disclosed for this Research includes:
☒ All information collected during the Research as told to you in the Informed Consent Form.
☒ Health Information in your research record which includes the results of physical exams, medical history, laboratory or diagnostic tests, or Health Information relating to a particular condition that is related to the Research.
☐ Additional information may include:
The Health Information listed above may be used or disclosed to:
☐ Researchers at IBR who are involved in the study.
☒ Researchers and their staff at the following organizations involved with this Research: NYS OPWDD Region 4 DDSOO.
☒ The Sponsor of the Research, , and its agents and contractors (together, "Sponsor"); and
☒ Representatives of regulatory and government agencies, institutional review boards, representatives of the Researchers and their institutions to the level needed to carry out their responsibilities related to the conduct of the research.
☐ Other (family members or significant others, study buddies, outside agencies etc.)
Specify:

By giving permission to release your Health Information as described above, you understand that this information may be disclosed to individuals or entities which are not required to comply with the federal and state privacy laws which govern the use and disclosure of personal Health Information by IBR (e.g., a drug company, the Sponsor of the research). While your health information may no longer be protected under the HIPAA or NYS Mental Hygiene Law requirements it continues to be subject to the terms of the consent form and may be subject to other state or federal privacy laws or regulations.

4. Please note that:

You do not have to sign this Authorization form, but if you do not, your ward may not be able to participate in the study or receive study related care. You may change your mind at any time and for any reason. If you do so, your ward may no longer be allowed to participate in the study. If you withdraw this Authorization the research staff and the Sponsor, if this is sponsored research, may still use or disclose Health Information they already have collected about you as needed to maintain the reliability of the research. Any request to withdraw this Authorization must be made in writing to (enter name and contact information below):
Grace Bonanno, Graduate Student and PI, Nova Southeastern Universtiy
Phone: (914) 481-1616
gbonanno@nova.edu

This Authorization does not have an end date.

You will be given a copy of this form after you have signed it.

I agree to the use and disclosure of Health Information about me as described above:

_____ _____
Signature of Participant/ LAR Date

_____
Printed Name of Participant

_____
Relationship of LAR to Participant (if applicable)

We also ask you or your legal representative to initial the statements below:

☐ I have received a copy of the IBR Notice of Privacy Practices.

# Appendix E

## Questionnaire for Clinicians

**Definitions:**
Presence = visible representation of patient, past or present, through photos and/or videos

Visual content/visual medical content = photos and/or video

Medical information/content of medical information = pertaining to the specific events and findings within the physical examination sections (i.e., illnesses, injuries, vital signs, etc.)

**Computer/Technology Competency**

1. How would you rank your computer/online literacy (select one)?
    a. expert
    b. proficient
    c. sufficient
    d. novice

**Demographic Information**

2. What is your age (Select one)?
    a. 18-25
    b. 26-35
    c. 36-45
    d. 46-55
    e. 56-65
    f. >65

3. Gender (Select one)?
    a. Male
    b. Female

4. Education:
    a. MD
    b. DO
    c. RN
    d. PA
    e. NP (Nurse Practitioner)
    f. Direct Service Aid (DSA)

1. The use of the web-based Telemedicine application enables a timely and an accurate diagnosis.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

2. This Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

3. The textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

4. The picture/video component enabled identified whether a medical concern existed or not.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

5. The images and videos contained on the site instill a sense of presence (more real or relevant).

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

# Appendix F

## Questionnaire for Direct Service Aids (DSA)

**Definitions:**

Presence = visible representation of patient, past or present, through photos and/or videos

Visual content/visual medical content = photos and/or video

Medical information/content of medical information = pertaining to the specific events and findings within the physical examination sections (i.e., illnesses, injuries, vital signs, etc.)

**Computer/Technology Competency**

1. How would you rank your computer/online literacy (select one)?
    a. expert
    b. proficient
    c. sufficient
    d. novice

**Demographic Information**

1. What is your age (Select one)?
    a. 18-25
    b. 26-35
    c. 36-45
    d. 46-55
    e. 56-65
    f. >65

2. Gender (Select one)?
    a. Male
    b. Female

3. Education:
    a. MD
    b. DO
    c. RN
    d. PA
    e. NP (Nurse Practitioner)
    f. Direct Service Aid (DSA)

1. The use of graphics and updated visuals on the web-based Telemedicine application provides appropriate information for necessary follow-up visits.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

2. The use of the web-based Telemedicine application makes the quality of care better.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

3. The visual content of the application made reviewing the patient's problems easier.

a. Yes
b. No

On a scale from 1 to 5, rate your response:

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

4. The picture/video component was relevant in helping to reach a solution for treatment.
a. Yes
b. No

On a scale from 1 to 5, rate your response:
1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

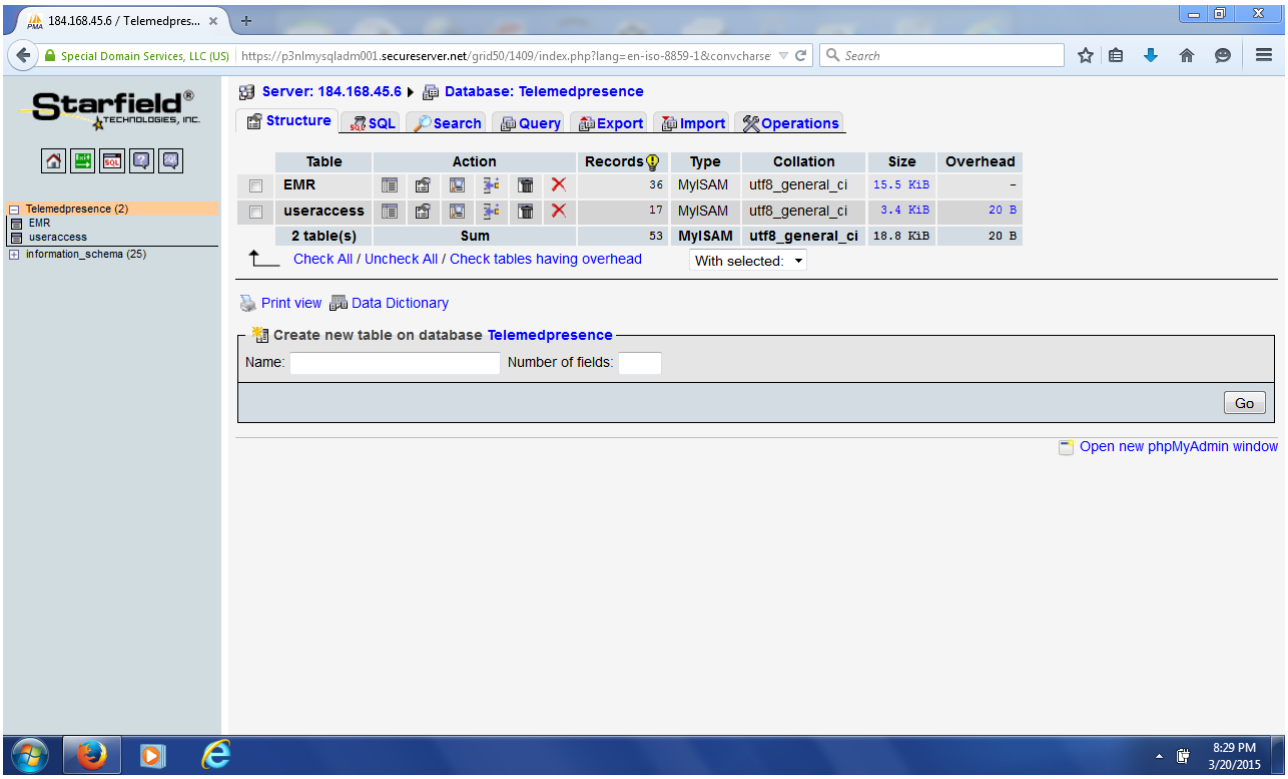
List two (2) reasons for your response:

5. The images and videos contained on the site instill a sense of presence (more real or relevant).
a. Yes
b. No

On a scale from 1 to 5, rate your response:
1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly Disagree

List two (2) reasons for your response:

# Appendix G


184.168.45.6 / Telemedpres...
Special Domain Services, LLC (US)
https://p3nlmysqladm001.secureserver.net/grid50/1409/index.php?lang=en-iso-8859-1&convcharse
Search
Starfield TECHNOLOGIES, INC.
Telemedpresence (2)
EMR
useraccess
information_schema (25)
Server: 184.168.45.6
Database: Telemedpresence
Structure
SQL
Search
Query
Export
Import
Operations
Table
Action
Records
Type
Collation
Size
Overhead
EMR
36
MyISAM
utf8_general_ci
15.5 KiB
-
useraccess
17
MyISAM
utf8_general_ci
3.4 KiB
20 B
2 table(s)
Sum
53
MyISAM
utf8_general_ci
18.8 KiB
20 B
Check All / Uncheck All / Check tables having overhead
With selected:
Print view
Data Dictionary
Create new table on database Telemedpresence
Name:
Number of fields:
Go
Open new phpMyAdmin window
8:29 PM
3/20/2015

# Appendix H

**Contingency Table - Clinician's Q#1**

**Observed (O)**

| | Actual Responses | Counterfactual Responses | Total |
|---|---|---|---|
| **SA** | 11 | 0 | 11 |
| **A** | 10 | 0 | 10 |
| **N** | 1 | 22 | 23 |
| **D** | 0 | 0 | 0 |
| **SD** | 0 | 0 | 0 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | Actual Responses | Counterfactual Responses |
|---|---|---|
| **SA** | 5.5 | 5.5 |
| **A** | 5 | 5 |
| **N** | 11.5 | 11.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | | Actual Responses | Counterfactual Responses |
|---|---|---|---|
| **SA** | **SA** | 5.5 | 5.5 |
| **A** | **A** | 5 | 5 |
| **N** | **N** | 9.5869565 | 9.58695652 |
| **D** | **D** | 0 | 0 |
| **SD** | **SD** | 0 | 0 |
| **Total** | **Total** | **20.086957** | **20.0869565** |

**$\sum(O-E)^2/E=$ 40.17391**

**Observed (O)**

| | Actual Responses | Counterfactual Responses | Total |
|---|---|---|---|
| **SA** | 11 | 4 | 15 |
| **A** | 10 | 4 | 14 |
| **N** | 1 | 6 | 7 |
| **D** | 0 | 4 | 4 |
| **SD** | 0 | 4 | 4 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | Actual Responses | Counterfactual Responses |
|---|---|---|
| **SA** | 7.5 | 7.5 |
| **A** | 7 | 7 |
| **N** | 3.5 | 3.5 |
| **D** | 2 | 2 |
| **SD** | 2 | 2 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | | Actual Responses | Counterfactual Responses |
|---|---|---|---|
| **SA** | **SA** | 1.6333333 | 1.63333333 |
| **A** | **A** | 1.2857143 | 1.28571429 |
| **N** | **N** | 1.7857143 | 1.78571429 |
| **D** | **D** | 2 | 2 |
| **SD** | **SD** | 2 | 2 |
| **Total** | **Total** | **8.7047619** | **8.7047619** |

**$\sum(O-E)^2/E=$ 17.40952**

**Observed (O)**

| | Actual Responses | Counter factual Responses | Total |
|---|---|---|---|
| **SA** | 11 | 2 | 13 |
| **A** | 10 | 4 | 14 |
| **N** | 1 | 10 | 11 |
| **D** | 0 | 4 | 4 |
| **SD** | 0 | 2 | 2 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | Actual Responses | Counter factual Responses |
|---|---|---|
| **SA** | 6.5 | 6.5 |
| **A** | 7 | 7 |
| **N** | 5.5 | 5.5 |
| **D** | 2 | 2 |
| **SD** | 1 | 1 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | | Actual Responses | Counter factual Responses |
|---|---|---|---|
| **SA** | **SA** | 3.1153846 | 3.11538462 |
| **A** | **A** | 1.2857143 | 1.28571429 |
| **N** | **N** | 3.6818182 | 3.68181818 |
| **D** | **D** | 2 | 2 |
| **SD** | **SD** | 1 | 1 |
| **Total** | **Total** | **11.082917** | **11.0829171** |

**$\sum(O-E)^2/E=$ 22.16583**

# Appendix I

**Contingency Table - Clinician's Q#2**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 12 | 0 | 12 |
| **A** | 6 | 0 | 6 |
| **N** | 2 | 22 | 24 |
| **D** | 2 | 0 | 2 |
| **SD** | 0 | 0 | 0 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 6 | 6 |
| **A** | 3 | 3 |
| **N** | 12 | 12 |
| **D** | 1 | 1 |
| **SD** | 0 | 0 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 6 | 6 |
| **A** | 3 | 3 |
| **N** | 8.333333 | 8.333333 |
| **D** | 1 | 1 |
| **SD** | 0 | 0 |
| **Total** | **18.3333** | **18.3333** |

**$\sum(O-E)^2/E=$ 36.66667**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 12 | 4 | 16 |
| **A** | 6 | 4 | 10 |
| **N** | 2 | 6 | 8 |
| **D** | 2 | 4 | 6 |
| **SD** | 0 | 4 | 4 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 8 | 8 |
| **A** | 5 | 5 |
| **N** | 4 | 4 |
| **D** | 3 | 3 |
| **SD** | 2 | 2 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 2 | 2 |
| **A** | 0.2 | 0.2 |
| **N** | 1 | 1 |
| **D** | 0.333333 | 0.333333 |
| **SD** | 2 | 2 |
| **Total** | **5.53333** | **5.53333** |

**$\sum(O-E)^2/E=$ 11.06667**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 12 | 2 | 14 |
| **A** | 6 | 4 | 10 |
| **N** | 2 | 10 | 12 |
| **D** | 2 | 4 | 6 |
| **SD** | 0 | 2 | 2 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 7 | 7 |
| **A** | 5 | 5 |
| **N** | 6 | 6 |
| **D** | 3 | 3 |
| **SD** | 1 | 1 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 3.571429 | 3.571429 |
| **A** | 0.2 | 0.2 |
| **N** | 2.666667 | 2.666667 |
| **D** | 0.333333 | 0.333333 |
| **SD** | 1 | 1 |
| | **7.77142** | **7.77142** |
| **Total** | **9** | **9** |

**$\sum(O-E)^2/E=$ 15.54286**

# Appendix J

**Contingency Table - Clinician's Q#3**

| | Observed (O) | | | Expected (E) | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | T | Counter factual | Total | | E(T) | E(Count) | | E(T) | E(Count) | $\sum(O-E)^2/E=$ 44 |
| SA | 13 | 0 | 13 | SA | 6.5 | 6.5 | SA | 6.5 | 6.5 | |
| A | 9 | 0 | 9 | A | 4.5 | 4.5 | A | 4.5 | 4.5 | |
| N | 0 | 22 | 22 | N | 11 | 11 | N | 11 | 11 | |
| D | 0 | 0 | 0 | D | 0 | 0 | D | 0 | 0 | |
| SD | 0 | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | |
| Total | 22 | 22 | 44 | Total | 22 | 22 | Total | 22 | 22 | |

| | Observed (O) | | | Expected (E) | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | T | Counter factual | Total | | E(T) | E(Count) | | E(T) | E(Count) | $\sum(O-E)^2/E=$ 20.68778 |
| SA | 13 | 4 | 17 | SA | 8.5 | 8.5 | SA | 2.382353 | 2.382353 | |
| A | 9 | 4 | 13 | A | 6.5 | 6.5 | A | 0.961538 | 0.961538 | |
| N | 0 | 6 | 6 | N | 3 | 3 | N | 3 | 3 | |
| D | 0 | 4 | 4 | D | 2 | 2 | D | 2 | 2 | |
| SD | 0 | 4 | 4 | SD | 2 | 2 | SD | 2 | 2 | |
| Total | 22 | 22 | 44 | Total | 22 | 22 | Total | 10.34389 | 10.34389 | |

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 13 | 2 | 15 |
| **A** | 9 | 4 | 13 |
| **N** | 0 | 10 | 10 |
| **D** | 0 | 4 | 4 |
| **SD** | 0 | 2 | 2 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 7.5 | 7.5 |
| **A** | 6.5 | 6.5 |
| **N** | 5 | 5 |
| **D** | 2 | 2 |
| **SD** | 1 | 1 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 4.033333 | 4.033333 |
| **A** | 0.961538 | 0.961538 |
| **N** | 5 | 5 |
| **D** | 2 | 2 |
| **SD** | 1 | 1 |
| **Total** | **12.99487** | **12.99487** |

**$\sum(O-E)^2/E=$ 25.98974**

# Appendix K

**Contingency Table - Clinician's Q#4**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 12 | 0 | 12 |
| **A** | 7 | 0 | 7 |
| **N** | 1 | 22 | 23 |
| **D** | 2 | 0 | 2 |
| **SD** | 0 | 0 | 0 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 6 | 6 |
| **A** | 3.5 | 3.5 |
| **N** | 11.5 | 11.5 |
| **D** | 1 | 1 |
| **SD** | 0 | 0 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 6 | 6 |
| **A** | 3.5 | 3.5 |
| **N** | 9.586957 | 9.586957 |
| **D** | 1 | 1 |
| **SD** | 0 | 0 |
| **Total** | **20.08696** | **20.08696** |

**$\sum(O-E)^2/E=$ 40.17391**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 12 | 4 | 16 |
| **A** | 7 | 4 | 11 |
| **N** | 1 | 6 | 7 |
| **D** | 2 | 4 | 6 |
| **SD** | 0 | 4 | 4 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 8 | 8 |
| **A** | 5.5 | 5.5 |
| **N** | 3.5 | 3.5 |
| **D** | 3 | 3 |
| **SD** | 2 | 2 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 2 | 2 |
| **A** | 0.409091 | 0.409091 |
| **N** | 1.785714 | 1.785714 |
| **D** | 0.333333 | 0.333333 |
| **SD** | 2 | 2 |
| **Total** | **6.528139** | **6.528139** |

**$\sum(O-E)^2/E=$ 13.05628**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 12 | 2 | 14 |
| **A** | 7 | 4 | 11 |
| **N** | 1 | 10 | 11 |
| **D** | 2 | 4 | 6 |
| **SD** | 0 | 2 | 2 |
| **Total** | **22** | **22** | **44** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 7 | 7 |
| **A** | 5.5 | 5.5 |
| **N** | 5.5 | 5.5 |
| **D** | 3 | 3 |
| **SD** | 1 | 1 |
| **Total** | **22** | **22** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 3.571429 | 3.571429 |
| **A** | 0.409091 | 0.409091 |
| **N** | 3.681818 | 3.681818 |
| **D** | 0.333333 | 0.333333 |
| **SD** | 1 | 1 |
| **Total** | **8.995671** | **8.995671** |

**$\sum(O-E)^2/E=$ 17.99134**

# Appendix L

**Contingency Table - Clinician's & DSA's Q#5**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 18 | 0 | 18 |
| **A** | 8 | 0 | 8 |
| **N** | 1 | 27 | 28 |
| **D** | 0 | 0 | 0 |
| **SD** | 0 | 0 | 0 |
| **Total** | **27** | **27** | **54** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 9 | 9 |
| **A** | 4 | 4 |
| **N** | 14 | 14 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **27** | **27** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 9 | 9 |
| **A** | 4 | 4 |
| **N** | 12.07143 | 12.07143 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **25.07143** | **25.07143** |

**$\sum(O-E)^2/E=$ 50.14286**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 18 | 5 | 23 |
| **A** | 8 | 5 | 13 |
| **N** | 1 | 7 | 8 |
| **D** | 0 | 5 | 5 |
| **SD** | 0 | 5 | 5 |
| **Total** | **27** | **27** | **54** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 11.5 | 11.5 |
| **A** | 6.5 | 6.5 |
| **N** | 4 | 4 |
| **D** | 2.5 | 2.5 |
| **SD** | 2.5 | 2.5 |
| **Total** | **27** | **27** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 3.673913 | 3.673913 |
| **A** | 0.346154 | 0.346154 |
| **N** | 2.25 | 2.25 |
| **D** | 2.5 | 2.5 |
| **SD** | 2.5 | 2.5 |
| **Total** | **11.27007** | **11.27007** |

**$\sum(O-E)^2/E=$ 22.54013**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 18 | 3 | 21 |
| **A** | 8 | 5 | 13 |
| **N** | 1 | 11 | 12 |
| **D** | 0 | 5 | 5 |
| **SD** | 0 | 3 | 3 |
| **Total** | **27** | **27** | **54** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 10.5 | 10.5 |
| **A** | 6.5 | 6.5 |
| **N** | 6 | 6 |
| **D** | 2.5 | 2.5 |
| **SD** | 1.5 | 1.5 |
| **Total** | **27** | **27** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 5.357143 | 5.357143 |
| **A** | 0.346154 | 0.346154 |
| **N** | 4.166667 | 4.166667 |
| **D** | 2.5 | 2.5 |
| **SD** | 1.5 | 1.5 |
| **Total** | **13.86996** | **13.86996** |

**$\sum(O-E)^2/E=$ 27.73993**

# Appendix M

**Contingency Table - DSA Q1**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 3 | 0 | 3 |
| **A** | 2 | 0 | 2 |
| **N** | 0 | 5 | 5 |
| **D** | 0 | 0 | 0 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 1 | 1 |
| **N** | 2.5 | 2.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 1 | 1 |
| **N** | 2.5 | 2.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$\sum(O-E)^2/E=$ 10**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 3 | 0 | 3 |
| **A** | 2 | 1 | 3 |
| **N** | 0 | 3 | 3 |
| **D** | 0 | 1 | 1 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 1.5 | 1.5 |
| **N** | 1.5 | 1.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 0.166667 | 0.166667 |
| **N** | 1.5 | 1.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **3.666667** | **3.666667** |

**$\sum(O-E)^2/E=$ 7.333333**

**Observed (O)**

| | T | Counterfactual | Total |
|---|---|---|---|
| **SA** | 3 | 1 | 4 |
| **A** | 2 | 1 | 3 |
| **N** | 0 | 1 | 1 |
| **D** | 0 | 1 | 1 |
| **SD** | 0 | 1 | 1 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 2 | 2 |
| **A** | 1.5 | 1.5 |
| **N** | 0.5 | 0.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0.5 | 0.5 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.5 | 0.5 |
| **A** | 0.166667 | 0.166667 |
| **N** | 0.5 | 0.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0.5 | 0.5 |
| **Total** | **2.166667** | **2.166667** |

**$\sum(O-E)^2/E=$** **4.333333**

# Appendix N

**Contingency Table - DSA Q2**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 3 | 0 | 3 |
| **A** | 0 | 0 | 0 |
| **N** | 2 | 5 | 7 |
| **D** | 0 | 0 | 0 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 0 | 0 |
| **N** | 3.5 | 3.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 0 | 0 |
| **N** | 0.642857 | 0.642857 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **2.142857** | **2.142857** |

**$\sum(O-E)^2/E=$** **4.285714**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 3 | 0 | 3 |
| **A** | 0 | 1 | 1 |
| **N** | 2 | 3 | 5 |
| **D** | 0 | 1 | 1 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 0.5 | 0.5 |
| **N** | 2.5 | 2.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 0.5 | 0.5 |
| **N** | 0.1 | 0.1 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **2.6** | **2.6** |

**$\sum(O-E)^2/E=$** **5.2**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 3 | 1 | 4 |
| **A** | 0 | 1 | 1 |
| **N** | 2 | 1 | 3 |
| **D** | 0 | 1 | 1 |
| **SD** | 0 | 1 | 1 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 2 | 2 |
| **A** | 0.5 | 0.5 |
| **N** | 1.5 | 1.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0.5 | 0.5 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.5 | 0.5 |
| **A** | 0.5 | 0.5 |
| **N** | 0.166667 | 0.166667 |
| **D** | 0.5 | 0.5 |
| **SD** | 0.5 | 0.5 |
| **Total** | **2.166667** | **2.166667** |

**$\sum(O-E)^2/E=$** **4.333333**

# Appendix O

**Contingency Table - DSA Q3**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 2 | 0 | 2 |
| **A** | 3 | 0 | 3 |
| **N** | 0 | 5 | 5 |
| **D** | 0 | 0 | 0 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1 | 1 |
| **A** | 1.5 | 1.5 |
| **N** | 2.5 | 2.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1 | 1 |
| **A** | 1.5 | 1.5 |
| **N** | 2.5 | 2.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$\sum(O-E)^2/E=$ 10**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 2 | 0 | 2 |
| **A** | 3 | 1 | 4 |
| **N** | 0 | 3 | 3 |
| **D** | 0 | 1 | 1 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1 | 1 |
| **A** | 2 | 2 |
| **N** | 1.5 | 1.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1 | 1 |
| **A** | 0.5 | 0.5 |
| **N** | 1.5 | 1.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **3.5** | **3.5** |

**$\sum(O-E)^2/E=$ 7**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 2 | 1 | 3 |
| **A** | 3 | 1 | 4 |
| **N** | 0 | 1 | 1 |
| **D** | 0 | 1 | 1 |
| **SD** | 0 | 1 | 1 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1.5 | 1.5 |
| **A** | 2 | 2 |
| **N** | 0.5 | 0.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0.5 | 0.5 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.166667 | 0.166667 |
| **A** | 0.5 | 0.5 |
| **N** | 0.5 | 0.5 |
| **D** | 0.5 | 0.5 |
| **SD** | 0.5 | 0.5 |
| **Total** | **2.166667** | **2.166667** |

**$\sum(O-E)^2/E=$** **4.333333**

# Appendix P

**Contingency Table - DSA Q4**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 1 | 0 | 1 |
| **A** | 2 | 0 | 2 |
| **N** | 1 | 5 | 6 |
| **D** | 1 | 0 | 1 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.5 | 0.5 |
| **A** | 1 | 1 |
| **N** | 3 | 3 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.5 | 0.5 |
| **A** | 1 | 1 |
| **N** | 1.333333 | 1.333333 |
| **D** | 0.5 | 0.5 |
| **SD** | 0 | 0 |
| **Total** | **3.333333** | **3.333333** |

**$\sum(O-E)^2/E=$ 6.666667**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 1 | 0 | 1 |
| **A** | 2 | 1 | 3 |
| **N** | 1 | 3 | 4 |
| **D** | 1 | 1 | 2 |
| **SD** | 0 | 0 | 0 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.5 | 0.5 |
| **A** | 1.5 | 1.5 |
| **N** | 2 | 2 |
| **D** | 1 | 1 |
| **SD** | 0 | 0 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0.5 | 0.5 |
| **A** | 0.166667 | 0.166667 |
| **N** | 0.5 | 0.5 |
| **D** | 0 | 0 |
| **SD** | 0 | 0 |
| **Total** | **1.166667** | **1.166667** |

**$\sum(O-E)^2/E=$ 2.333333**

**Observed (O)**

| | T | Counter factual | Total |
|---|---|---|---|
| **SA** | 1 | 1 | 2 |
| **A** | 2 | 1 | 3 |
| **N** | 1 | 1 | 2 |
| **D** | 1 | 1 | 2 |
| **SD** | 0 | 1 | 1 |
| **Total** | **5** | **5** | **10** |

**Expected (E)**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 1 | 1 |
| **A** | 1.5 | 1.5 |
| **N** | 1 | 1 |
| **D** | 1 | 1 |
| **SD** | 0.5 | 0.5 |
| **Total** | **5** | **5** |

**$(O-E)^2/E$**

| | E(T) | E(Count) |
|---|---|---|
| **SA** | 0 | 0 |
| **A** | 0.166667 | 0.166667 |
| **N** | 0 | 0 |
| **D** | 0 | 0 |
| **SD** | 0.5 | 0.5 |
| **Total** | **0.666667** | **0.666667** |

**$\sum(O-E)^2/E=$ 1.333333**

# Appendix Q

Contingency Table - Clinician's Q#1 - The use of the web-based Telemedicine application enables a timely and an accurate diagnosis.

| Observed (O) | MD | PA | RN | LPN | Total |
|---|---|---|---|---|---|
| SA | 1 | 1 | 4 | 5 | 11 |
| A | 2 | 0 | 6 | 2 | 10 |
| N | 0 | 0 | 0 | 1 | 21 |
| D | 0 | 0 | 0 | 0 | 0 |
| SD | 0 | 0 | 0 | 0 | 0 |
| Total | 3 | 1 | 10 | 8 | 22 |

| Expected (E) | MD | PA | RN | LPN |
|---|---|---|---|---|
| SA | 1.5 | 0.5 | 5 | 4 |
| A | 1.36364 | 0.45455 | 4.54545 | 3.63636 |
| N | 2.86364 | 0.95455 | 9.54545 | 7.63636 |
| D | 0 | 0 | 0 | 0 |
| SD | 0 | 0 | 0 | 0 |
| Total | 5.72727 | 1.90909 | 19.0909 | 15.2727 |

| $(O-E)^2/E$ | MD | PA | RN | LPN |
|---|---|---|---|---|
| SA | 0.16667 | 0.5 | 0.2 | 0.25 |
| A | 0.29697 | 0.45455 | 0.46545 | 0.73636 |
| N | 2.86364 | 0.95455 | 9.54545 | 5.76732 |
| D | 0 | 0 | 0 | 0 |
| SD | 0 | 0 | 0 | 0 |
| Total | 3.32727 | 1.90909 | 10.2109 | 6.75368 |

$\sum(O-E)^2/E=$ 22.201

Contingency Table - Clinician's Q#2 - This Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital.

| Observed (O) | MD | PA | RN | LPN | Total |
|---|---|---|---|---|---|
| SA | 1 | 1 | 5 | 5 | 12 |
| A | 1 | 0 | 4 | 1 | 6 |
| N | 0 | 0 | 1 | 1 | 18 |
| D | 1 | 0 | 0 | 1 | 2 |
| SD | 0 | 0 | 0 | 0 | 0 |
| Total | 3 | 1 | 10 | 8 | 22 |

| Expected (E) | MD | PA | RN | LPN | Total |
|---|---|---|---|---|---|
| SA | 1.63636 | 0.54545 | 5.45455 | 4.36364 | 12 |
| A | 0.81818 | 0.27273 | 2.72727 | 2.18182 | 6 |
| N | 2.45455 | 0.81818 | 8.18182 | 6.54545 | 18 |
| D | 0.27273 | 0.09091 | 0.90909 | 0.72727 | 2 |
| SD | 0 | 0 | 0 | 0 | 0 |
| Total | 5.18182 | 1.72727 | 17.2727 | 13.8182 | 38 |

| $(O-E)^2/E$ | MD | PA | RN | LPN |
|---|---|---|---|---|
| SA | 0.24747 | 0.37879 | 0.03788 | 0.0928 |
| A | 0.0404 | 0.27273 | 0.59394 | 0.64015 |
| N | 2.45455 | 0.81818 | 6.30404 | 4.69823 |
| D | 1.93939 | 0.09091 | 0.90909 | 0.10227 |
| SD | 0 | 0 | 0 | 0 |
| Total | 4.68182 | 1.56061 | 7.84495 | 5.53346 |

$\sum(O-E)^2/E=$ 19.6208

Contingency Table - Clinician's Q#3 - The textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient.

| Observed (O) | MD | PA | RN | LPN | Total |
|---|---|---|---|---|---|
| SA | 0 | 1 | 6 | 6 | 13 |
| A | 3 | 0 | 4 | 2 | 9 |
| N | 0 | 0 | 0 | 0 | 22 |
| D | 0 | 0 | 0 | 0 | 0 |
| SD | 0 | 0 | 0 | 0 | 0 |
| Total | 3 | 1 | 10 | 8 | 22 |

| Expected (E) | MD | PA | RN | LPN |
|---|---|---|---|---|
| SA | 1.772727 | 0.590909 | 5.909091 | 4.727273 |
| A | 1.227273 | 0.409091 | 4.090909 | 3.272727 |
| N | 3 | 1 | 10 | 8 |
| D | 0 | 0 | 0 | 0 |
| SD | 0 | 0 | 0 | 0 |
| Total | 6 | 2 | 20 | 16 |

| $(O-E)^2/E$ | MD | PA | RN | LPN |
|---|---|---|---|---|
| SA | 1.772727 | 0.283217 | 0.001399 | 0.342657 |
| A | 2.560606 | 0.409091 | 0.00202 | 0.494949 |
| N | 3 | 1 | 10 | 8 |
| D | 0 | 0 | 0 | 0 |
| SD | 0 | 0 | 0 | 0 |
| Total | 7.333333 | 1.692308 | 10.00342 | 8.837607 |

$\sum(O-E)^2/E=$ 27.86667

Contingency Table - Clinician's Q#4 - The picture/video component enabled identified whether a medical concern existed or not.

| Observed (O) | | | | | | Expected (E) | | | | | $(O-E)^2/E$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MD | PA | RN | LPN | Total | | MD | PA | RN | LPN | | MD | PA | RN | LPN | $\sum(O-E)^2/E=$ 24.1396 |
| SA | 0 | 1 | 5 | 6 | 12 | SA | 1.636364 | 0.545455 | 5.454545 | 4.363636 | SA | 1.636364 | 0.378788 | 0.037879 | 0.613636 | |
| A | 2 | 0 | 3 | 2 | 7 | A | 0.954545 | 0.318182 | 3.181818 | 2.545455 | A | 1.145022 | 0.318182 | 0.01039 | 0.116883 | |
| N | 0 | 0 | 1 | 0 | 19 | N | 2.590909 | 0.863636 | 8.636364 | 6.909091 | N | 2.590909 | 0.863636 | 6.752153 | 6.909091 | |
| D | 1 | 0 | 1 | 0 | 2 | D | 0.272727 | 0.090909 | 0.909091 | 0.727273 | D | 1.939394 | 0.090909 | 0.009091 | 0.727273 | |
| SD | 0 | 0 | 0 | 0 | 0 | SD | 0 | 0 | 0 | 0 | SD | 0 | 0 | 0 | 0 | |
| Total | 3 | 1 | 10 | 8 | 22 | Total | 5.454545 | 1.818182 | 18.18182 | 14.54545 | Total | 7.311688 | 1.651515 | 6.809512 | 8.366883 | |

Contingency Table - Clinician's Q#5 - The images and videos contained on the site instill a sense of presence (more real or relevant).

| Observed (O) | | | | | | Expected (E) | | | | | $(O-E)^2/E$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | MD | PA | RN | LPN | Total | | MD | PA | RN | LPN | | MD | PA | RN | LPN | $\sum(O-E)^2/E=$ 22.97087 |
| SA | 1 | 1 | 6 | 7 | 15 | SA | 2.045455 | 0.681818 | 6.818182 | 5.454545 | SA | 0.534343 | 0.148485 | 0.098182 | 0.437879 | |
| A | 2 | 0 | 3 | 1 | 6 | A | 0.818182 | 0.272727 | 2.727273 | 2.181818 | A | 1.707071 | 0.272727 | 0.027273 | 0.640152 | |
| N | 0 | 0 | 1 | 0 | 21 | N | 2.863636 | 0.954545 | 9.545455 | 7.636364 | N | 2.863636 | 0.954545 | 7.650216 | 7.636364 | |
| D | 0 | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 0 | D | 0 | 0 | 0 | 0 | |
| SD | 0 | 0 | 0 | 0 | 0 | SD | 0 | 0 | 0 | 0 | SD | 0 | 0 | 0 | 0 | |
| Total | 3 | 1 | 10 | 8 | 22 | Total | 5.727273 | 1.909091 | 19.09091 | 15.27273 | Total | 5.105051 | 1.375758 | 7.775671 | 8.714394 | |

# Appendix R

**Contingency Table - Clinician's Q#1 - The use of the web-based Telemedicine application enables a timely and an accurate diagnosis.**

RSP = Regularly See Patient / NRSP = Do Not Regularly See Patient

| | Observed (O) | | | Expected (E) | | | O-E | | | $(O-E)^2$ | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RSP | NRSP | Total | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | $\sum(O-E)^2/E=$ 24.96797 |
| SA | 8 | 3 | 11 | SA | 5.5 | 5.5 | SA | 2.5 | -2.5 | SA | 6.25 | 6.25 | SA | 1.136364 | 1.136364 | |
| A | 2 | 8 | 10 | A | 5 | 5 | A | -3 | 3 | A | 9 | 9 | A | 1.8 | 1.8 | |
| N | 1 | 0 | 21 | N | 10.5 | 10.5 | N | -9.5 | -10.5 | N | 90.25 | 110.25 | N | 8.595238 | 10.5 | |
| D | 0 | 0 | 0 | D | 0 | 0 | D | 0 | 0 | D | 0 | 0 | D | 0 | 0 | |
| SD | 0 | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | |
| Total | 11 | 11 | 22 | Total | 21 | 21 | Total | -10 | -10 | Total | 105.5 | 125.5 | Total | 11.5316 | 13.43636 | |

**Contingency Table - Clinician's Q#2 - This Telemedicine application was effective in preventing the unnecessary transfer of patients out of facility to hospital.**

RSP = Regularly See Patient / NRSP = Do Not Regularly See Patient

| | Observed (O) | | | Expected (E) | | | O-E | | | $(O-E)^2$ | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RSP | NRSP | Total | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | $\sum(O-E)^2/E=$ 7.45679 |
| SA | 7 | 2 | 9 | SA | 7.363636 | 1.636364 | SA | -0.36364 | 0.363636 | SA | 0.1322314 | 0.132231 | SA | 0.017957 | 0.080808 | |
| A | 0 | 0 | 0 | A | 0 | 0 | A | 0 | 0 | A | 0 | 0 | A | 0 | 0 | |
| N | 1 | 0 | 9 | N | 7.363636 | 1.636364 | N | -6.36364 | -1.63636 | N | 40.4958678 | 2.677686 | N | 5.499439 | 1.636364 | |
| D | 1 | 0 | 1 | D | 0.818182 | 0.181818 | D | 0.181818 | -0.18182 | D | 0.03305785 | 0.033058 | D | 0.040404 | 0.181818 | |
| SD | 0 | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | |
| Total | 9 | 2 | 11 | Total | 15.54545 | 3.454545 | Total | -6.54545 | -1.45455 | Total | 40.661157 | 2.842975 | Total | 5.5578 | 1.89899 | |

**Contingency Table - Clinician's Q#3 - The textual medical content and visual medical content of the site support clinical significance, that is, were or was helpful in the assessment, diagnosis, and/or treatment of the patient.**

RSP = Regularly See Patient / NRSP = Do Not Regularly See Patient

| | Observed (O) | | | Expected (E) | | | O-E | | | $(O-E)^2$ | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RSP | NRSP | Total | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | $\sum(O-E)^2/E=$ 26.70085 |
| SA | 9 | 4 | 13 | SA | 6.5 | 6.5 | SA | 2.5 | -2.5 | SA | 6.25 | 6.25 | SA | 0.96153846 | 0.9615385 | |
| A | 2 | 7 | 9 | A | 4.5 | 4.5 | A | -2.5 | 2.5 | A | 6.25 | 6.25 | A | 1.38888889 | 1.3888889 | |
| N | 0 | 0 | 22 | N | 11 | 11 | N | -11 | -11 | N | 121 | 121 | N | 11 | 11 | |
| D | 0 | 0 | 0 | D | 0 | 0 | D | 0 | 0 | D | 0 | 0 | D | 0 | 0 | |
| SD | 0 | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | |
| Total | 11 | 11 | 22 | Total | 22 | 22 | Total | -11 | -11 | Total | 133.5 | 133.5 | Total | 13.3504274 | 13.350427 | |

**Contingency Table - Clinician's Q#4 - The picture/video component enabled identified whether a medical concern existed or not.**

RSP = Regularly See Patient / NRSP = Do Not Regularly See Patient

| | Observed (O) | | | Expected (E) | | | O-E | | | $(O-E)^2$ | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RSP | NRSP | Total | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | $\sum(O-E)^2/E=$ | 20.58145 |
| SA | 8 | 4 | 12 | SA | 6 | 6 | SA | 2 | -2 | SA | 4 | 4 | SA | 0.666667 | 0.666667 | | |
| A | 3 | 4 | 7 | A | 3.5 | 3.5 | A | -0.5 | 0.5 | A | 0.25 | 0.25 | A | 0.071429 | 0.071429 | | |
| N | 0 | 1 | 19 | N | 9.5 | 9.5 | N | -9.5 | -8.5 | N | 90.25 | 72.25 | N | 9.5 | 7.605263 | | |
| D | 0 | 2 | 2 | D | 1 | 1 | D | -1 | 1 | D | 1 | 1 | D | 1 | 1 | | |
| SD | 0 | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | | |
| Total | 11 | 11 | 22 | Total | 20 | 20 | Total | -9 | -9 | Total | 95.5 | 77.5 | Total | 11.2381 | 9.343358 | | |

**Contingency Table - Clinician's Q#5 - The images and videos contained on the site instill a sense of presence (more real or relevant).**

RSP = Regularly See Patient / NRSP = Do Not Regularly See Patient

| | Observed (O) | | | Expected (E) | | | O-E | | | $(O-E)^2$ | | | $(O-E)^2/E$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RSP | NRSP | Total | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | | RSP | NRSP | $\sum(O-E)^2/E=$ | 26.91614 |
| SA | 13 | 5 | 18 | SA | 10.66667 | 7.333333 | SA | 2.333333 | -2.33333 | SA | 5.444444 | 5.444444 | SA | 0.510417 | 0.742424 | | |
| A | 3 | 5 | 8 | A | 4.740741 | 3.259259 | A | -1.74074 | 1.740741 | A | 3.030178 | 3.030178 | A | 0.639178 | 0.929714 | | |
| N | 0 | 1 | 26 | N | 15.40741 | 10.59259 | N | -15.4074 | -9.59259 | N | 237.3882 | 92.01783 | N | 15.40741 | 8.686998 | | |
| D | 0 | 0 | 0 | D | 0 | 0 | D | 0 | 0 | D | 0 | 0 | D | 0 | 0 | | |
| SD | 0 | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | SD | 0 | 0 | | |
| Total | 16 | 11 | 27 | Total | 30.81481 | 21.18519 | Total | -14.8148 | -10.1852 | Total | 245.8628 | 100.4925 | Total | 16.557 | 10.35914 | | |

# References

Alem, L., Hansen, S., & Li, J. (2006). Evaluating Clinicians' Experience in a Telemedicine Application: A Presence Perspective. *OZCHI 2006 Proceedings*. Sydney, Australia: CHISIG.

Alpay, L., Toussaint, P., & Zwetsloot-Schonk, B. (2004). Supporting Healthcare Communication Enabled by Information and Communication Technology: Can HCI and related cognitive aspects help? *Dutch Directions in HCI*, Amsterdam, Netherlands: Association for Computing Machinery, Inc.

Baldor, R. & O'Brien, J. (2010). Primary Care of the Adult with Intellectual Disability (Mental Retardation). Retrieved on June 3, 2012 from http://www.uptodate.com.

Ballegaard, S. A., Hansen, T. R. & Kyng, M. (2008). Healthcare in Everyday Life - Designing Healthcare Services for Daily Life. *CHI 2008 Proceedings · Personal Health*. Florence, Italy:CHISIG.

Bannon, L. (2011). Reimagining HCI: Toward a More Human-Centered Perspective. *Interactions, 18* (4), 50-57. DOI:10.1145/1978822.1978833.

Beach, S., Schulz, R., Downs, J., Matthews, J., Barron, B., & Seelman, K. (2009). Disability, Age, and Informational Privacy Attitudes in Quality of Life Technology Applications: Results from a National Web Survey. *ACM Transactions on Accessible Computing, 2* (1), 1-21.

Bonvissuto, K. (2010). Telemedicine is Maturing. It Can Increase Patient Access and Maybe Even Your Income. *Medical Economics, 87* (11), 14-18.

Burke, C. (2012, April). Building a Stronger System for People with Developmental Disabilities. Retrieved from http://www.opwdd.ny.gov/news_and_publications/publications/2012-one-year-progress-report.

Butler, K. A., Brennan, P., Payne, T., Shneiderman, B. & Zhang, J. (2011). Re-engineering Health Care with Information Technology: The Role of Computer-Human Interaction. *CHI '11 Extended Abstracts on Human Factors in Computing Systems,* 451-454. DOI:10.1145/1979741.1979490.

CDC MMWR. (2006). *Economic Costs Associated with Mental Retardation, Cerebral Palsy, Hearing Loss, and Vision Impairment (Errata) – United States, 2006*. Retrieved from http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5532a5.htm.

Cheah, L., Amott, D. H., Pollard, J. & Watters, D. A. K. (2005). Electronic Medical Handover: Towards Safer Medical Care. *Medical Journal of Australia,* 183 (7), 369-372.

Cheung, D. S., Kelly, J. J., Beach, C., Berkeley, R. P., Bitterman, R. A., Broida, R. I., . . .White, M. L. (2009). Improving Handoffs in the Emergency Department. *Annals of Emergency Medicine, 20* (1), 1-10.

Chismar, W. & Wiley-Patton, S. (2002). Does the Extended Technology Acceptance Model Apply to Physicians. *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03).* DOI: 10.1109/HICSS.2003.1174354.

Coiera, E. (2000). When Conversation is Better Than Computation. *Journal of the American Medical Informatics Association, 7* (3), 277-286.

Correia de Barros, A., Cevada, J., Bayes, A., Alcaine, S. & Mestre, B. (2013). User-Centered Design of a Mobile Self-Management Solution for Parkinson's Disease. *Proceedings of the 12th International Conference on Mobile and Ubiquitous Multimedia.* DOI:10.1145/2541831.2541839.

Davis, F.D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*, 319-339.

Department of Health and Human Services Centers for Medicare & Medicaid Services. (2010). Evaluation and Management Services Guide. Retrieved on June 3, 2012 from https://www.cms.gov/MLNProducts/downloads/eval_mgmt_serv_guide-ICN006764.pdf.

Drummond, E. & Marsh, L. (2008). Health Needs in People with Learning Disabilities: using the "OK" Health Check. *Learning Disability Practice, 11* (4), 16-21.

El-Gayar, O. F., Sarnikar, S. & Wills, M. J. (2010). A Cyberinfrastructure Framework for Comparative Effectiveness Research in Healthcare. *43rd Hawaii International Conference on System Sciences, 1-9.* doi:ieeecomputersociety.org/10.1109/HICSS.2010.9.

Elstein, A. S. & Schwarz, A. (2002). Evidence Base of Clinical Diagnosis: Clinical Problem Solving and Diagnostic Decision Making. *British Medical Journal*, 729. Doi:324.7339.

Farmer, A.P., Legare, F., Turcot, L., Grimshaw, J., Harvey, E., McGowan, J. & Wolf, F. M. (2008). Printed Educational Materials: Effects on Professional Practice and Health Care Outcomes (Review). *The Cochrane Collaboration*, 3, 1-34. DOI: 10.1002/14651858.CD004398.pub2.

Fontelo, P., Ackerman, M. & Kim, G. (2004). Development of Evidence-Based Medicine Resources: Bridging Clinical Research to Medical Practice. *Proceedings of the 37th Annual Hawaii International Conference on System Sciences (HICSS'04), 6*, 60160b. doi:ieeecomputersociety.org/10.1109/HICSS.2004.1265393.

Glatter, R. (2010). Is the Physical Exam a "Dying Artform"? *Medscape Blog*. Retrieved on March 14, 2011 from http://boards.medscape.com/forums?128@340.V8BXafi7OnB@.2a0363eb!comment=1

Grady, D. (2010). Physician Revives a Dying Art: The Physical. *The New York Times*. Retrieved from http://www.nytimes.com/2010/10/12/health/12profile.html?scp=1&sq=Dr.+Abraham+Verghese&st=nyt

Hallet, C. (2008). Multi-modal Presentation of Medical Histories. *Proceedings of the 13th International Conference on Intelligent User Interfaces.* Doi:10.1145/1378773.1378785.

Hanna, L. M., Taggart, L. and Cousins, W. (2011). Cancer Prevention and Health Promotion for People with Intellectual Disabilities: An Exploratory Study of Staff Knowledge. *Journal of Intellectual Disability Research*, 55, 281–291. doi: 10.1111/j.1365-2788.2010.01357.x

Hayes, G. & Abowd, G. (2006). Tensions in Designing Capture Technologies for an Evidence-based Community. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* 937-946. Doi:10.1145/1124772.1124911

Harrison R, MacFarlane A, Murray E, Wallace P. (2006). Patients' Perceptions of Joint Teleconsultations: a Qualitative Evaluation. *Health Expect, 9*, 81–90. doi: 10.1111/j.1369-7625.2006.00368.x.

Hewett, T. T., Baecker, R., Card, S., Carey, T., Gasen, J., Mantei, M., Perlman, G., Strong, G. & Verplank, W. (2009). Curricula for Human-Computer Interaction. In *ACM SIGCHI* (chapter 2). Retrieved from http://old.sigchi.org/cdg/cdg2.html

Hing, E. & Hsiao, C. (2010). Electronic Medical Record Use by Office-based Physicians and Their Practices: United States, 2007. *National Health Statistics Reports, 23*, 1-11.

Hochheiser, H. & Shneiderman, B. (2011). Electronic Medical Records: Usability Challenges and Opportunities. *Interactions,18* (6), 48-49. DOI=10.1145/2029976.2029989.

Hoffman, L. (2009). Implementing Electronic Medical Records. *Communications of the ACM, 52 (11),* 18-20. Doi: 10.1145/1592761.1592770.

Hogg, J. (2001). Essential Healthcare for People with Learning Disabilities: Barriers and Opportunities. *Journal of the Royal Society of Medicine (JRSM), 94* (7), 333-336.

Hook, K. (2008). Knowing, Communicating, and Experiencing Through Body and Emotion. *IEEE Transactions on Learning Technologies, 1* (4), 248 – 259.

Horn ,S.D. & Gassaway, J. (2007). Practice-based Evidence Study Design for Comparative Effectiveness Research. *Med Care, 45* ( 2), 50 –57.

Huston, J. & Huston, T. (2000). Is Telemedicine a Practical Reality? *Communications of the ACM, 43* (6), 91-95.

Janicki, M. P., Davidson, P. W., Henderson, C. M., McCallion, P.,Taets, J. D., Force, L. T., Sulkes, S. B., Frangenberg, E. & Ladrigan, M. (2002). Health Characteristics and Health Services Utilization in Older Adults with Intellectual Disability Living in Community Residences. *Journal of Intellectual Disability Research, 46* (4), 287-298.

Karunakaran, A., Hee-Nam, Y. & Reddy, M. (2012). Investigating Barriers to Electronic Medical Record Use during Collaborative Information Seeking Activities. *Proceedings of the 2nd ACM SIGHIT International Health Informatics Symposium,* 743-747. doi:10.1145/2110363.2110451.

Kosiedowski, M., Mazurek, C., Stroinski, M. & Weglarz, J. (2009). Medical Digital Library Services as an Improvement of the Teleconsultation System in the Regional Health Network. *In Proceedings of eTELEMED'2009.* 154-159. Doi:10.1109/eTELEMED.2009.36.

Larcher, B., Arisi, E., Berloffa, F., Demichelis, F., Eccher, C., Galligioni, E., Galvagni, M., Martini, G., Sboner, A., Tomio, L., Zumiani, G., Graiff, A. & Forti, S. (2003). Analysis of User-Satisfaction with the Use of a Teleconsultation system in Oncology. *Medical Informatics and Telemedicine, 28* (2), 73-84.

Lewis, C. (2005). HCI for People with Cognitive Disabilities. *ACM SIGACCESS Accessibility and Computing, 83,* 12-17. DOI:10.1145/1102187.1102190.

Ling, Y., Nefs, H. T., Brinkman, W., Heynderickx, I. & Qu, C. (2010). The Role of Display Technology and Individual Differences on Presence. *Proceedings of ECCE 2010 Conference,* 323-326.

Lindsey, M. (2002). Comprehensive Health Care Services for People with Learning Disabilities. *Advances in Psychiatric Treatment,* 8, 138–48. DOI: 10.1192/apt.8.2.138.

Llahi, L., Ghannouchi, S. A. & Martinho, R. (2014). Healthcare Information Systems Promotion: From an Improved Management of Telemedicine Processes to Home Healthcare Processes. *Proceedings of the Second International Conference on Technological Ecosystems for Enhancing Multiculturality*, 333-338. DOI:10.1145/2669711.2669920.

Max, J. (2009). The Lost Art of the Physical Exam. *Yale Medicine*. Retrieved from http://yalemedicine.yale.edu/ym_wi09/feature3_physical.html.

McGowan, J., Grad, R., Pluye, P., Hannes, K., Deane, K., Labrecque, M., Welch, V. & Tugwell, P. (2010). Electronic Retrieval of Health Information by Healthcare Providers to Improve Practice and Patient Care (Review). *The Cochrane Collaboration,* 3, 1-25. DOI:10.1002/14651858.CD004749.pub2.

Mueller, F., Kethers, S., Alem, L. & Wilkinson, R. (2006). From the Certainty of Information Transfer to the Ambiguity of Intuition. *Proceedings OZCHI '06 Proceedings of the 18th Australia conference on Computer-Human Interaction: Design: Activities, Artefacts and Environments,* 63-70. DOI:10.1145/1228175.1228189.

Peate, I. & Maloret, P. (2007). Testicular Self-examination: The Person with Learning Disabilities. *British Journal of Nursing, 16 (15*), 931 – 935.

Picard, R. W. (2003). Affective Computing: Challenges. *International Journal of Human Computing Studies,* 59 (1-2), 55-64. DOI:10.1016/S1071-5819(03)00052-1

Porter, M. E. & Teisberg E.O. (2004). Redefining Competition in Health Care. *Harvard Business Review*. Retrieved from http://hbr.org/2004/06/redefining-competition-in-health-care/ar/1.

Reilly, B. M. (2003). Physical examination in the care of medical inpatients: an observational study. *The Lancet*, 362, 1100-1105.

Reynolds, T., Zupanick, C. E., & Dombeck, M. (2011). The Diagnosis of Intellectual Disabilities. Retrieved from http://www.mentalhelp.net/poc/view_doc.php?type=doc&id=10345&cn=208.

Salkind, N. J. (2010). *Statistics for people who (think they) hate statistics: Excel 2010 edition, 3rd edition.* Thousand Oaks, CA: SAGE Publications.

Schlesselman, L. S. (2004). Incorporation of Evidence-Based Medicine Into Daily Practice. *Highlights From the 39th American Society of Health-System Pharmacists (ASHP) Midyear Clinical Meeting; December 5-9, 2004; Orlando, Florida.* Retrieved from http://www.medscape.com/viewarticle/496652.

Sears, A., Lazar, J., Ozok, A. & Meiselwitz, G. (2008). Defining an Agenda for Human-Centered Computing. *ACM SIGACCESS Accessibility and Computing,* 91, 17-21.

Shelly, G. B. & Rosenblatt, H. J. (2012). *Systems Analysis and Design, 9th edition*. Boston, MA: Course Technology.

Shneiderman, B. (2000). Creating Creativity: User Interfaces for Supporting Innovation. *ACM Transactions on Computer-Human Interaction, 7* (1), 114–138.

Shneiderman, B. & Plaisant, C. (2010). *Designing the User Interface: Strategies for Effective Human-Computer Interaction, 5th edition*. Boston, MA: Course Technology.

Shoolin, J., Ozeran, L., Hamann, C. & Bria, W. (2013). Association of Medical Directors of Information Systems Consensus on Inpatient Electronic Health Record Documentation. Applied Clinical Informatics, 4, 293-303. DOI:10.4338/ACI-2013-02-R-0012.

Shute, N. (2011). *The Parkinson's Doctor Will Video Chat With You Now*. Retrieved from http://www.npr.org/2011/06/27/137089619/the-parkinsons-doctor-will-video-chat-with-you-now.

Tachakra, S. & Rajani, R. (2002). Social Presence in Telemedicine. *Journal of Telemedicine and Telecare, 8* (4), 226-230.

Templeton, J. R. (2010). *Trust and trustworthiness: A framework for successful design of telemedicine.* Nova Southeastern University. *ProQuest Dissertations and Theses*, http://search.proquest.com.ezproxylocal.library.nova.edu/docview/755017524?accountid=6579

United Nations. (2006). *Final report of the Ad Hoc Committee on a Comprehensive and Integral International Convention on the Protection and Promotion of the Rights and Dignity of Persons with Disabilities.* Retrieved on June 3, 2012 from http://daccess-dds-ny.un.org/doc/UNDOC/LTD/N06/645/30/PDF/N0664530.pdf?OpenElement.

United States Medical Licensing Examination. (2012). *2012 Step 2 Clinical Steps Content Description and General Information.* Retrieved on June 23, 2012 from http://www.usmle.org/pdfs/step-2-cs/cs-info-manual.pdf.

US Department of Health and Human Services: Administration on Intellectual and Developmental Disabilities (AIDD). (2013). ADD Fact Sheet. Retrieved on June 3, 2013, from http://www.acl.gov/Programs/AIDD/DD_History/index.aspx.

US Department of Health and Human Services. (2011). Health Information Technology Improves Care and Saves Lives. Retrieved on June 3, 2012 from http://www.ahrq.gov/research/jan11/0111RA1.htm.

Virtual Mentor. (2000). Diagnosing Rembrandt: The Role of Visual Evidence in Medicine. Retrieved on June 3, 2012 from http://virtualmentor.ama-assn.org/2000/06/imhl1-0006.html

Woodhouse, J. M., Adler, P. & Duignan, A. (2004). Vision in Athletes with Intellectual Disabilities: The Need for Improved Eyecare. *Journal of Intellectual Disability Research, 48,* 736-745.

World Health Organization. (2010). *CBR Guidelines*. Retrieved on June 3, 2012 from http://whqlibdoc.who.int/publications/2010/9789241548052_health_eng.pdf.

Zhang, C., Reichgelt, H., Rutherfoord, B., Brown, B. & Wang, A. J. A. (2012). Developing and Improving Interdisciplinary Health Information Technology Certificate Programs. *Proceedings of the 13th Annual Conference on Information Technology Education*, 43-48. DOI:10.1145/2380552.2380565.

Zhanpeng, J. & Chen, Y. (2014). Telemedicine in the Cloud Era: Prospects and Challenges. *Pervasive Computing, IEEE, 14*(1), 54-61. DOI:10.1109/MPRV.2015.19.