VETERAN AND PROVIDER SATISFACTION OF A HOME-BASED TELEREHABILITATION ASSESSMENT FOR WHEELCHAIR SEATING AND MOBILITY

by

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Veterans living in remote areas often experience limited access to healthcare services due to a lack of specialized healthcare professionals and facilities. As a result, Veterans may delay necessary treatment or have to travel long distances to receive the appropriate medical services. Telerehabilitation helps to improve access to care by providing an effective and convenient way for Veterans to receive care remotely. The objective of this project was to measure Veteran and provider satisfaction with a home-based telerehabilitation assessment for wheelchair seating and mobility. Veterans who were in need of a wheelchair seating and mobility evaluation were screened, and initial telerehabilitation assessments were conducted for 43 Veterans. Follow-up telerehabilitation assessments were conducted for 9 Veterans. Each telerehabilitation assessment used a VA videoconferencing system to connect Veterans, at their place of residence, with a provider, located at the VA Pittsburgh Healthcare System Wheelchair, Seating, and Power Mobility Clinic. Veteran and provider satisfaction was collected after each telerehabilitation assessment using the Telerehabilitation Questionnaire. The results revealed that all mean scores for Veterans and providers at the initial telerehabilitation assessment were significantly higher than the scale midpoint of 3.5, demonstrating high satisfaction with the telerehabilitation encounter. However, Veterans and providers showed statistically significant differences in satisfaction scores

for five items on the Telerehabilitation Questionnaire. Providers, in general, showed greater variability in scores pertaining to the technology and quality and clarity of the video and audio. Both Veterans and providers agreed upon the monetary benefit of using telerehabilitation and were willing to use those services again. Overall, the results of this project suggest high satisfaction with conducting wheelchair seating and mobility assessments via telerehabilitation.

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1.0 INTRODUCTION

Rural areas often present unique difficulties regarding the provision of healthcare services. Clients living in remote areas often experience lengthy travel time to medical facilities, lack of specialized providers and healthcare technology, and professional and social isolation (Crandall, & Coggan, 1994). The expansion of telehealth technologies helps to address geographic and economic barriers in healthcare and ameliorate some of these concerns (McCue, Fairman, & Pramuka, 2009). Telehealth provides the ability to match existing quality of service, remotely, to address client demand. This can result in increased availability of services, reduced wait times, and improved continuity of care (Gladden, Beck, & Chandler, 2015). Between 2005 and 2013, VA telemedicine saved 834,724 miles of travel for Veterans, resulting in travel savings of 145 miles for every Veteran visit (Russo, McCool, & Davies, 2016). Telerehabilitation technologies not only provide the potential of reaching rural Veterans, but they offer the benefit of providing rehabilitation services in the individual's home environment (McCue, Fairman, & Pramuka, 2009). Previous studies evaluating telerehabilitation for wheelchair seating and mobility assessments were conducted on individuals who do not receive care through the Veterans Health Administration; thus, it is important evaluate the telerehabilitation services within the VA Healthcare System.

1.1 BACKGROUND

There are approximately 56.7 million people with a disability living in the United States as of the 2010 census and roughly 13.0% of those individuals have mobility limitations (Brault, 2012; Courtney-Long et al., 2015). Mobility is important to achieving and maintaining good health and independence. Mobility limitations are the leading cause of functional limitations among adults, directly correlating to a lower quality of life (Davies, De Souza & Frank, 2003). Reliance on others for assistance with mobility related activities of daily living is associated with reduced independence and participation (Best, Kirby, Smith & MacLeod, 2005). Individuals with impaired mobility often have fewer opportunities to socialize, leading to social isolation, anxiety, and depression (World Health Organization [WHO], 2011). A mobility device is an essential tool for creating equal opportunities for people with disabilities, increasing independence in daily life, and facilitating inclusion and participation, by both the United Nations (1994) and the World Health Organization (n.d.). The wheelchair is an instrumental device that can provide a reliable means of mobility, and thus impact psychosocial and functional health. It is estimated that there are approximately 6.5 million wheelchair users globally (WHO, 2011). In the United States alone, there are an estimated 2.8 million wheelchair users (LaPlante & Kaye, 2010).

1.2 SEATING AND MOBILITY

The prescription of an appropriate mobility device is a complex process and requires informed and trained professionals working to balance the needs and wants of the wheelchair user, the wheelchair technology, and the environment and context of the user (Batavia, Batavia & Friedman,

2001). It has been shown that inappropriate or poorly fitted devices can negatively impact the quality of an individual's life through unnecessary expenses, injuries, or abandonment of the mobility device (Batavia, Batavia & Friedman, 2001) The Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) developed a Wheelchair Service Provision Guide to aid clinicians in the provision of wheelchairs according to best practice. The wheelchair service delivery model includes the following components: referral, assessment, equipment recommendation and selection, funding and procurement, product preparation, fitting, training and delivery, follow-up maintenance and repair, and outcome measurement (Arledge et al., 2011). For individuals who are in need of a mobility device for long-term or permanent usage, it is recommended that the individual be referred to and assessed by a therapist with specific training and experience in seating and mobility (Arledge et al., 2011). The entire wheelchair prescription process consists of a thorough assessment following the components of the International Classification Functioning, Disability and Health (ICF): body structures and functions, activities and participation, and environment and current technology. The assessment is followed up with the proper fitting and training of the prescribed mobility device (WHO, 2002). While these steps are necessary to ensure a successful outcome with the mobility device, they can be inconvenient and burdensome for individuals with mobility limitations or for individuals who live in rural areas.

1.3 VETERANS HEALTH ADMINISTRATION

The Veterans Health Administration (VHA) is the largest integrated healthcare system in the United States. In 2015, the VHA serviced approximately 5.9 million Veterans. Veterans are more

likely (22-30%) to reside in rural areas compared with the rest of the US population (15-20%), making the VHA one of the most important healthcare providers in rural areas. Living in rural areas has been shown to be one of the greatest barriers impeding access to healthcare services (Ohl et al., 2018). The VHA Office of Rural Health has a mission to continue to improve access, disseminate knowledge, and promote health for Veterans living in rural areas (U.S. Department of Veterans Affairs, n.d.a). Community Based Outpatient Centers (CBOC) were established separate from VHA Medical Centers to improve access to care through reduced traveling distances, reduced waiting times, and improving Veteran satisfaction (Nayar, Yu, & Apenteng, 2014). While CBOCs prove successful for certain healthcare services, such as primary care and mental health services, there is still a gap in access to care for specialty services due to the lack of specialized healthcare providers at the CBOC locations (Desko, & Nazario, 2014). For medical specialties such as wheelchair seating and mobility, using telehealth services to reach Veterans in their homes helps to follow best practice guidelines, while eliminating Veteran travel to receive the appropriate medical care.

"Telehealth increases access to high quality healthcare services by using information and telecommunication technologies to provide healthcare services when the patient and practitioner are separated by a geographical distance" (U.S. Department of Veterans Affairs, 2016b, p. 1). In 2016, 12% of all VHA enrollees received certain aspects of their healthcare through telehealth, and almost half of the Veterans who received telehealth services lived in rural areas (U.S. Department of Veterans Affairs, 2016b). Without the option of telehealth services, those Veterans would have otherwise had limited access to necessary healthcare services, or they would have to travel long distances to receive the necessary care. There continues to be growth of telehealth services within the VA, with an expected impact of 762,000 Veterans in 2017 (Elliot, 2016). This

increase in access is associated with a 31% reduction in hospital admissions and 59% decrease in VA bed days, as well as high Veteran satisfaction with the healthcare services received (Elliot, 2016; U.S. Department of Veterans Affairs, 2016b).

1.4 TELEHEALTH MODALITIES

The VA Office of Telehealth Services uses health informatics, disease management, and telehealth technologies to increase access to high quality healthcare services for Veterans. The VA has three main modalities to provide telehealth services: (1) Home Telehealth (HT), (2) Store and Forward Telehealth (SFT), and (3) Clinical Video Telehealth (CVT). HT uses electronic monitoring devices to capture health data for Veterans in post-acute care settings, Veterans with chronic conditions, and Veterans at risk for long-term care placement (U.S. Department of Veterans Affairs, n.d.b). In 2016, Veterans reported 88% satisfaction with HT services (U.S. Department of Veterans Affairs). SFT uses technologies that asynchronously acquire, transmit, and store data between providers and healthcare specialists (U.S. Department of Veterans Affairs, n.d.b). Veterans were 94% satisfied with SFT services (U.S. Department of Veterans Affairs, 2016b). While CVT uses synchronous video technology to assess and treat Veterans remotely, CVT can be accomplished using various methods of transmission. Designated CVT tablets can be distributed for appointments, transportable exam stations can be used at a CBOC to connect Veterans with specialists at a different VA facility, or Veterans can use a personal device with VA secure software, JABBER, downloaded to the device (U.S. Department of Veterans Affairs, n.d.b). Veterans were 92% satisfied with their CVT services in 2016, according to the U.S. Department of Veterans Affairs VA Telehealth Services Fact Sheet. In August 2017, the VA released an

application called VA Video Connect (VVC), which allows the Veteran to connect with a VA provider on demand and on any device. VVC allows Veterans receive specialized care in the privacy of their own home on a personal device without VA software. Since its release, over 20,000 Veterans have received care via VVC, but Veteran satisfaction with this service has not been recorded (Office of Public and Intergovernmental Affairs, 2018).

1.5 TELEREHABILITATION

The use of various telehealth modalities is a way to bridge the gap between Veterans in need of specialized medical services living in remote areas and the location of such specialized care (Schmeler, Schein, McCue & Betz, 2009). "Telerehabilitation can be defined as the application of telecommunication, remote sensing and operation technologies, and computing technologies to assist with the provision of the delivery of medical rehabilitation services at a distance" (Cooper et al., 2001). Using telerehabilitation services connects the Veteran with the correct provider in the most effective, timely manner that helps to maximize Veteran health outcomes (Gladden, Beck & Chandler, 2015). Lamaire, Boudrias, and Greene (2001) defined the benefits of telehealth modalities specifically for physical rehabilitation services as: (1) decreased travel between rural communities and specialized urban health centers; (2) better clinical support in local communities; (3) improved access to specialized services; (4) delivery of local health-care in rural communities; (5) indirect educational benefits for remote clinicians who participate in teleconsultations; (6) reduced feelings of isolation for rural clinicians; (7) improved service stability in regions with high staff turnover; and (8) multimedia communication. Furthermore, telerehabilitation services can enhance Veteran outcomes by providing services in a naturalistic environment. Physical medicine

and rehabilitation services are often impacted by the social and physical environment of the client; thus, providing telerehabilitation services in the client's home or community have much greater relevance to them, can identify factors crucial in the process, and can increase the quality of healthcare services provided to each client (McCue, Fairman & Pramuka, 2009).

The World Report on Disability reported that telerehabilitation services produced similar or improved clinical outcomes compared with conventional face-to-face interventions, according to increasing studies on the efficacy and effectiveness of telerehabilitation (WHO, 2011). Barlow, Liu & Sekulic (2009) found that telerehabilitation clients (n = 9) were just as likely to have their mobility goals met as the clients seen face-to-face (n = 10). Additionally, there were no significant differences between telerehabilitation and in-person services for seating and mobility using the Functioning Everyday with a Wheelchair outcome tool, except for transportation (Schein, Schmeler, Holm, Saptono & Brienza, 2010). Two studies have been conducted comparing satisfaction of telerehabilitation and face-to-face services for wheelchair seating assessments. Both studies have shown that clients are equally satisfied with telerehabilitation, using the Telerehabilitation Questionnaire (TRQ) and the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) (Barlow, Liu, Sekulic, 2009; Schein, Schmeler, Saptono & Brienza, 2010).

Two systematic reviews have been conducted on studies that evaluate patient satisfaction with telehealth (Mair & Whitten, 2000; Williams, May & Esmail, 2001). The systematic reviews reveal that individuals are consistently 80% satisfied with telehealth services, but frequently report 100% satisfaction with telehealth (Mair & Whitten, 2000; Williams, May & Esmail, 2001). Kruse et al. (2017) conducted a systematic review exploring the association between telehealth and patient satisfaction, and what factors impact the effectiveness and efficiency of telehealth studies.

The systematic review recommended that both clients and providers should embrace telehealth because of decreased client travel time, increase in access to care and communication, and improved client outcomes (Kruse et al., 2017). However, many of the published research studies in telehealth have low sample sizes and limited context for assessing client satisfaction, contributing to limited generalizability of the findings. Due to the methodological deficiencies, it was noted that further research be conducted on satisfaction from both the perspective of the client and the provider (Mair & Whitten, 2000).

The primary objective of this project was to measure satisfaction with telerehabilitation services of both Veterans with mobility impairments and providers during the initial wheelchair seating and mobility assessments. The hypotheses were as follows:

1. Telerehabilitation Questionnaire individual item responses would be significantly higher than the scale midpoint of 3.5 for both the Veterans and the providers during the initial assessment.
2. There would be no significant difference between the Veteran and provider Telerehabilitation Questionnaire individual item responses for the initial assessment.

The secondary objective of this project was to measure Veteran and provider satisfaction with follow-up telerehabilitation wheelchair seating and mobility assessments and compare the results with the initial telerehabilitation assessment results.

1. Telerehabilitation Questionnaire individual item responses would be significantly higher than the scale midpoint of 3.5 for both the Veterans and the providers during the follow-up assessment.

2. There would be no significant difference between the Veteran and provider Telerehabilitation Questionnaire individual item responses for the follow-up assessment.
3. Veterans and provider Telerehabilitation Questionnaire individual item responses for the follow-up assessment would be equal to or greater than the initial assessment scores.

2.0 METHODS

2.1 IRB APPROVAL

Prior to the start of this project, the VA Pittsburgh Healthcare System (VAPHS) Institutional Review Board (IRB) and the Human Research Protection Office at the University of Pittsburgh were contacted to determine the research status of this project and if IRB approval was necessary. Both agencies determined that the project did not constitute research because the findings were designed and implemented for internal purposes; thus, it was not required to submit for review and approval by the IRB. It was determined that this was a Quality Improvement project, and approval was obtained from the VAPHS Quality Improvement Committee.

2.2 SAMPLE

In order to conduct wheelchair seating and mobility assessments remotely, a screening process was implemented to integrate telerehabilitation as a part of the routine clinical care in the VAPHS Wheelchair, Seating, and Power Mobility Clinic. For in-person clinical care, each Veteran has a consult placed by one of their treating VA physicians for a seating and wheeled mobility evaluation, and a physical therapist, known as the provider, in the clinic triages the consults for appropriateness and scheduling. To determine if a Veteran was eligible for a telerehabilitation assessment, the providers and trained telehealth clinical technician (TCT) further screened the Veteran according to predetermined criteria. According to the consult and chart review, the

provider recommended the Veteran for a telerehabilitation assessment if: the Veteran's place of residence is within the perimeter of locations serviced by the TCTs for telerehabilitation wheelchair seating and mobility assessments, and the Veteran is medically and psychologically stable. Next, the TCT conducted further screening over the phone and conferred with the providers to decide whether to recommend telerehabilitation services for each Veteran. Inclusion criteria were as follows: Veteran is alert and oriented; Veteran and/or caregiver is able to communicate needs and has the ability to comprehend clinical recommendations; Veteran can follow simple verbal, visual, or gestured requests independently or with the assistance of a caregiver; and Veteran and/or a caregiver is able and willing to participate in the telerehabilitation assessment. Veterans were excluded if: there were any concerns related to the safety and/or health of either the TCT or the Veteran; there were any concerns that exceed the ability to meet the Veteran's clinical needs through a telerehabilitation encounter; the telerehabilitation team is unable to conduct a telehealth assessment at the Veteran's residence due to environmental factors, medical concerns, or technical limitations out of their control; and the Veteran's place of residence does not have reliable 4G/LTE service or internet connectivity. All types of residence, such as an apartment, assisted living facility, or skilled nursing facility, were considered for the project. If the Veteran met all of the inclusion and exclusion criteria, they were scheduled for a wheelchair seating and mobility telerehabilitation assessment with a specific telerehabilitation clinic code. All of the project participants had various seating and wheeled mobility needs including but not limited to: first-time mobility evaluations, mobility replacement evaluations, positioning needs, seating and wheeled mobility education, and wheeled mobility trouble-shooting. Figure 1 shows the flow chart process of triaging and screening Veterans.

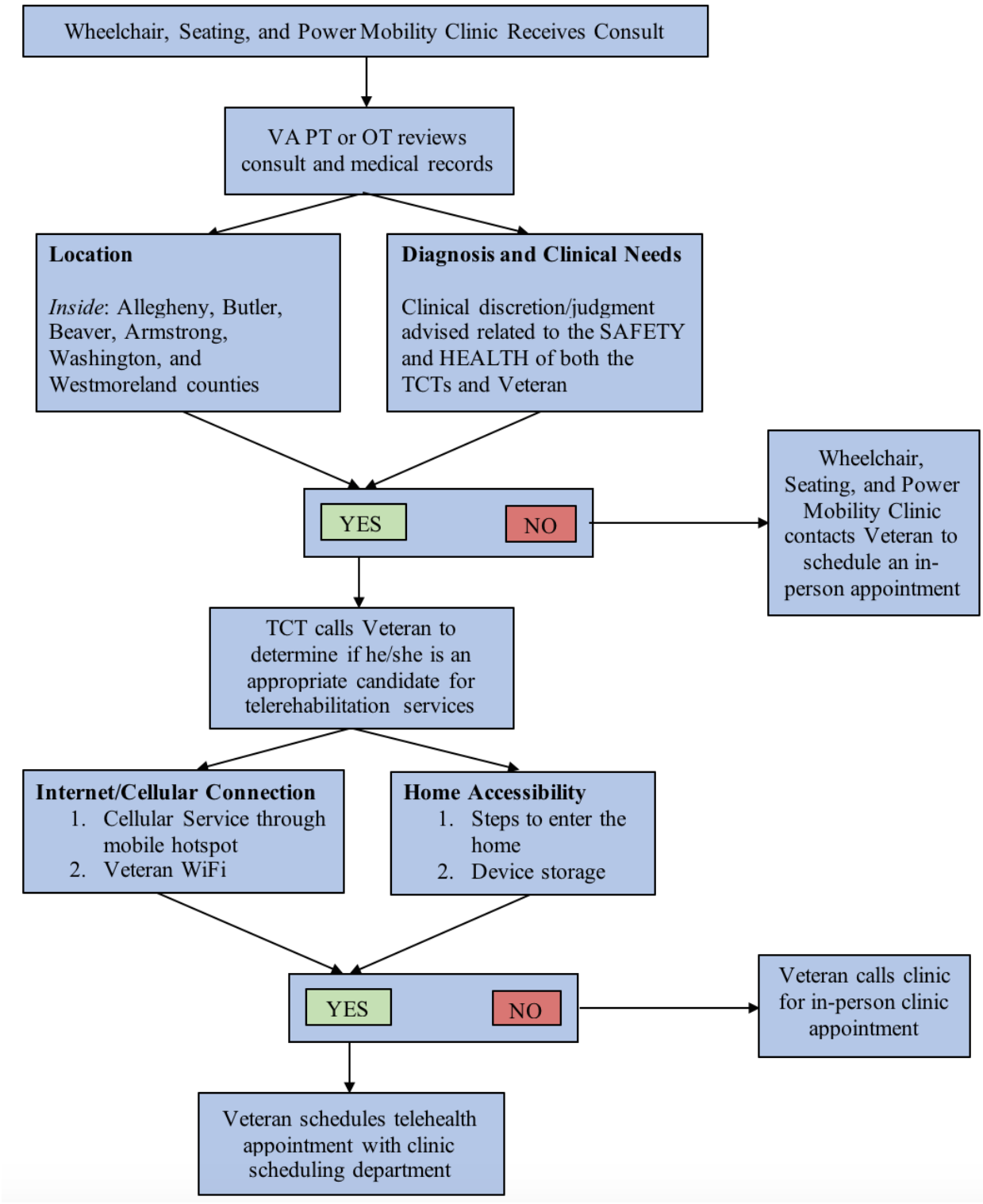

Figure 1. Process Flowchart for Veteran Selection

2.3 QUALITY IMPROVEMENT PROJECT

The project measured Veteran and provider satisfaction with an in-home telerehabilitation assessment for wheelchair seating and mobility provided remotely by physical therapists with expertise in the field of assistive technology. Two physical therapists work in the Wheelchair, Seating, and Power Mobility Clinic at the H.J. Heinz Campus, with over 18 years of combined experience as seating and wheeled mobility specialists. One of the providers, additionally, has an assistive technology professional certification. A trained rehabilitation engineer, working as a TCT, was also part of the telerehabilitation team.

For each telerehabilitation assessment, a VA videoconferencing system, VA Video Connect, was used to provide synchronous communication (i.e., audio and visual) between the provider and the Veteran. The provider was located in the Wheelchair, Seating, and Power Mobility Clinic in Pittsburgh, PA, and the Veteran was located remotely at their place of residence. Veterans who participated in the telerehabilitation project typically resided in communities where travel to and from the H.J. Heinz Campus was challenging. The TCT was present with the Veteran for every telerehabilitation encounter to assist with the use of the telehealth technology and provide the necessary skills to conduct a wheelchair seating and mobility evaluation.

2.4 INSTRUMENTATION

Both the providers and the TCT had their own designated equipment to conduct telerehabilitation encounters. At the VA campus, the providers used a designated private office connected to the Wheelchair, Seating, and Power Mobility clinic. The provider used a system consisting of a VA

issued HP ProDesk 600 G2 desktop computer and Logitech USB Web Camera. A separate computer screen was used simultaneously to access the Veteran's medical records through the Computerized Patient Record System. The telehealth computer was equipped with VA Video Connect software installed on the computer, which utilizes encryption to ensure a private and secure connection between the provider and Veteran. Each provider had a unique VVC profile on the computer which was obtained after specific VVC Talent Management System trainings were completed.

The TCT coordinated and provided the equipment necessary for a telerehabilitation encounter to occur, on the Veteran side. The TCT traveled to the Veteran's place of residence using a rental Dodge Caravan minivan in order to carry the particular devices and accessories necessary for a wheelchair seating and mobility telerehabilitation assessment. The equipment included an Apple iPad Pro (32 GB) with the VA Video Connect application downloaded to the device from the Apple App Store, as well as mobile hotspot devices to wirelessly connect the Apple iPad for each telerehabilitation encounter. A Verizon Jetpack MiFi 7730L and an AT&T Unite Explore mobile hotspots were used, both equipped with 4G LTE speeds and connection speeds up to 450 Mbps. The devices were used due to the prevalence and availability of those services in the Western Pennsylvania region. The Veteran's residence internet connection, if available, also served as a method of connection if consented to by the Veteran or their caregiver. Furthermore, the TCTs traveled with demo equipment provided by the local manufacturing representatives to allow Veterans to try the devices the provider recommended and ensure the appropriate device to meet the Veterans' clinical needs. An accessible folding ramp was available for Veterans to try the mobility devices, when needed. The TCTs always carried sanitation materials including gloves, sanitary wipes, and a first aid kit. Tools were carried to address any

repairs or maintenance issues. Lastly, a cell phone, used specifically for this project, was brought in order to contact the Veterans to confirm the appointment and for any other contact needed.

The Qualtrics Offline Survey Application was additionally used on the iPad. Qualtrics is a secure analytics software used for collecting and analyzing data. The data application allowed the TCT to collect, store, and later analyze data collected from the Veterans and the providers.

2.5 MEASUREMENT TOOLS

2.5.1 Demographics

General demographics including age, sex, height and weight, and diagnosis contributing to the Veteran's need for a mobility device were collected using the internal Uniform Data Set (UDS) form, which is used for other outcome measurement studies at the University of Pittsburgh. Additional information pertaining specifically to seating and wheeled mobility were collected to understand the Veteran's current means of mobility and environmental conditions. Information including Veterans' fall and pressure injury history and use of existing mobility assistive equipment help to guide the clinical decision-making process during a wheelchair seating and mobility assessment.

2.5.2 Travel Distance and Assessment Times

A Veteran's travel distance was defined as the distance between the H.J. Heinz Campus and the Veteran's place of residence zip code. Travel time estimates were calculated and recorded using

the recommended driving distance from Google Maps (Google, n.d.). For each Veteran, data for time spent in each step of the telerehabilitation process was recorded. The TCT documented the time spent during the pre-assessment screening phase, including the CPRS review and phone conversation with the Veteran or caregiver, time for equipment set up at the beginning of each telehealth encounter, and time from the beginning to the end of the telehealth encounter. The total time is defined as the time required to conduct a seating and wheeled mobility assessment using telehealth modalities.

2.5.3 Satisfaction

The purpose of this project was to measure both Veteran and provider satisfaction with telerehabilitation assessments for wheelchair seating and mobility. Satisfaction was measured using the TRQ, a client self-reported measurement tool. The TRQ contains seven items rated on a 6-point scale: 1 = completely disagree and 6 = completely agree. The survey's seven items are as follows:

1. I was comfortable being evaluated through this means.
2. The results of the evaluation through the tele-video conference would be as accurate as an evaluation being completed in person by a certified practitioner.
3. All areas of my lifestyle were considered with this process.
4. The technology did not interfere with the assessment.
5. The quality and clarity of the video and audio were acceptable.

6. Consulting with an expert clinician through tele-video conferencing saved me monetary expenses (i.e., travel time, gas, taking off work, family, etc.).
7. I would be willing to use this tele-video evaluation process again.

This measurement tool was developed at the University of Pittsburgh based on a similar survey by Malagodi et al. (1998) to more specifically measure telerehabilitation satisfaction. Other validated satisfaction surveys, such as the QUEST survey, were not chosen for this project because they do not measure satisfaction regarding the telehealth aspect and require that individuals previously own an assistive device. Schein et al. (2010) measured satisfaction of telerehabilitation services of participants with mobility impairments in the private healthcare sector using the TRQ and established the scale midpoint of 3.5 as an appropriate cutoff to measure satisfaction. Through the previous researching using the TRQ, the tool appears to have face validity. The TRQ was self-administered or administered by the TCT, depending on the needs of the Veteran, at the end of each telerehabilitation encounter.

2.6 PROCEDURE

On the day of each Veteran's telerehabilitation appointment, the TCT gathered and prepared the necessary equipment for the telerehabilitation wheelchair seating and mobility evaluation, confirmed the appointment with both the provider and the Veteran, and drove to the Veteran's place of residence. At the scheduled appointment time, the provider logged onto the designated telehealth computer and requested the VVC session with the TCT and Veteran, as shown in Figure 2. The TCT used a Google email account with the VVC application to initiate the VVC session.

The provider conducted the wheelchair seating and mobility evaluation according to best practice guidelines and determined the appropriate mobility device for each Veteran. At the end of the encounter, the provider filled out a physical paper copy of the TRQ to track their satisfaction with the telerehabilitation encounter. The Veteran filled out the TRQ survey developed in the Qualtrics Survey Application either independently or with the assistance of a caregiver or the TCT. The provider's copy of the TRQ was uploaded electronically to Qualtrics at a later date.

For Veterans whose travel to the H.J. Heinz Campus was completely unreasonable due to the Veteran's means of transportation or nature of the Veteran's diagnosis, the final fitting of the mobility device was conducted remotely via telerehabilitation. Other Veterans traveled to the Wheelchair, Seating, and Power Mobility Clinic for the final fitting of their mobility device. For each of those cases, the TRQ was collected a second time for the Veteran's second telerehabilitation encounter. All de-identified data collected was uploaded and stored in Qualtrics electronic database.

2.7 DATA ANALYSIS

IBM SPSS Statistics Version 24.0 was used to analyze the data. To evaluate Veterans' and providers' satisfaction levels with the TRQ, one-sample *t* tests were conducted to compare individual item means to the scale midpoint of 3.5. A Wilcoxon signed-rank test was performed to compare the TRQ individual item scores between the Veteran and provider for the initial assessment and the follow-up assessment. The TRQ item scores were evaluated between the initial assessment (Time 1) and the follow-up assessment (Time 2) for the Veterans and providers using the Wilcoxon signed-rank test. In order to compare Veteran and provider scores between Time 1

and Time 2, Veteran Time 1 and provider Time 1 descriptives were recalculated to solely evaluate the individuals who were seen for two telerehabilitation encounters. The level of statistical significance was set at $p < 0.05$ for all data analyses.

Although the TRQ data collected is ordinal, past researchers treated this data as continuous to run statistical analyses; thus, to have comparable data with the previous studies, similar analyses were performed. In addition, the data was analyzed using frequencies and percentages for better accuracy and to provide more information.

A Crosstab analysis was conducted to visualize the agreement between both parties for each item at each time point. Crosstabs analyses were performed for each TRQ item, showing the distribution of agreement between the Veterans and providers for each item. Agreement was found if the Veteran and provider scored within one score of each other and was calculated as the number of entries in agreement over the total number of encounters.

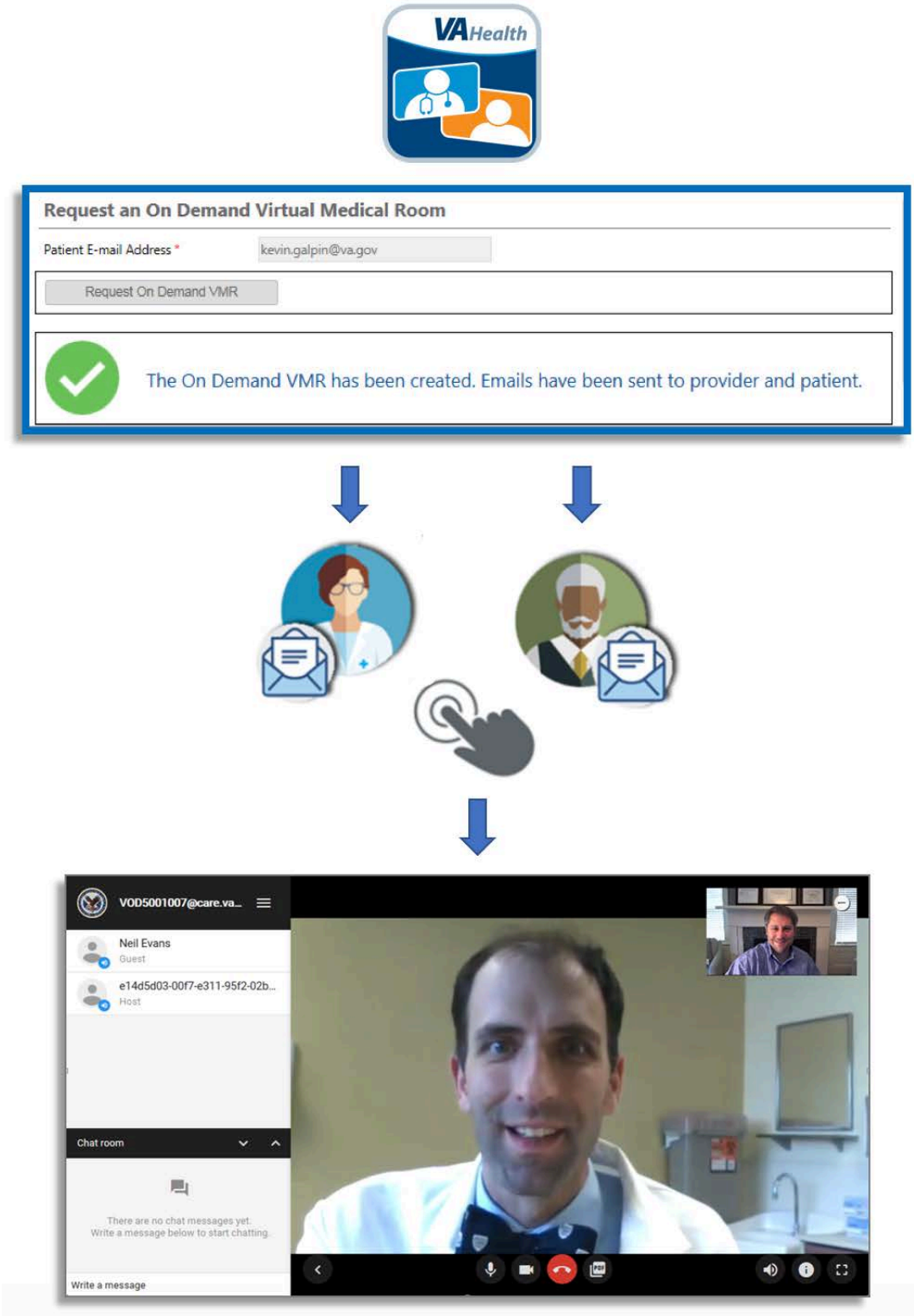

Figure 2. Requesting an On Demand Virtual Medical Room through VA Video Connect (U.S. Department of Veteran Affairs, 2017)

3.0 RESULTS

3.1 DEMOGRAPHICS

A total of 74 Veterans were screened for a telerehabilitation assessment between November, 2017 and July, 2018, and 48 Veterans met the inclusion and exclusion criteria for the project. Table 1 shows the various reasons Veterans were excluded from receiving telerehabilitation services. Telerehabilitation assessments were successfully conducted remotely for 43 Veterans. Five Veterans were successfully screened for a telerehabilitation assessment, but an evaluation did not occur via telerehabilitation. Three Veterans were admitted to the hospital prior to the evaluation date, one Veteran's house was too cluttered to enter, one Veteran did not have sufficient internet connectivity or cellular service for telerehabilitation encounter to occur, and one Veteran passed away before the scheduled appointment. The Veterans not seen via telerehabilitation were subsequently seen in-person for a wheelchair seating and mobility evaluation.

The average age of the participants to receive an initial telerehabilitation assessment was 82 years old (SD = 9.05), 90.7% were Caucasian, and 37.2% used a cane, crutch(es), or walker for mobility and 39.5% used a manual wheelchair at pre-assessment. The participants had a myriad of primary diagnoses leading to mobility limitations, but a majority of the participants had a stroke/CVA (27.9%) or other neuromuscular or congenital disease that was not listed on the UDS form (23.2%). Each telerehabilitation assessment was conducted in the Veteran's place of residence, which was classified into a community, assisted, or skilled setting. A community setting included a home or apartment (79.1%), an assisted setting included a group home or assisted living facility (16.3%), and a skilled setting included a hospital or skilled nursing facility (4.7%).

Table 1. Veteran Exclusion

Reasons for Veteran Exclusions	Initial Assessment N = 26
Provided determined telerehabilitation assessment was unsafe for TCT or Veteran	1
Provider determined wheelchair, seating, and mobility assessment was not appropriate - forwarded consult to different department	2
Veteran was admitted to the hospital before screening process was complete	1
Veteran was scheduled for an in-person assessment before screening process was complete	7
Veteran did not want to move forward with any wheelchair, seating, and mobility assessment	4
There were environmental barriers at the Veteran's place of residence that prevented an in-home telerehabilitation assessment	6
There was an administrative hold on the department	5

Out of the total participants initially evaluated for a new seating and wheeled mobility device via telerehabilitation, nine Veterans had an additional telerehabilitation encounter. Eight of the Veterans were seen for a final fitting of the prescribed mobility device from the initial telerehabilitation assessment, while the other Veteran was seen for follow-up regarding his seating needs. After the second telerehabilitation encounter, 88.9% of Veterans were using an ultralight manual wheelchair (Table 2).

Table 2. Veteran Demographics

Demographics	Initial Assessment N = 43	Follow-up Assessment N = 9
Age, *M±SD (min, max)*	81.7±9.05 (39)	82.3±9.41 (24)
Gender, *n(%)*		
Male	43 (100)	9 (100)
Ethnicity, *n(%)*		
Caucasian	39 (90.7)	8 (88.9)
African American	4 (9.3)	1 (11.1)
Primary Diagnosis, *n(%)*		
Stroke/CVA	12 (27.9)	6 (66.7)
Other Neuromuscular or Congenital Disease	10 (23.2)	1 (11.1)
Cardiopulmonary Disease	7 (16.3)	1 (11.1)
Osteoarthritis	5 (11.6)	-
Other	9 (21.0)	1 (11.1)
Place of Residence, *n(%)*		
Community	34 (79.1)	5 (55.6)
Assisted	7 (16.3)	4 (44.4)
Skilled	2 (4.7)	-
Mobility Assistive Equipment, *n(%)*		
Cane, Crutch, Walker	16 (37.2)	-
MWC*	17 (39.5)	8 (88.9)
PWC**	8 (18.6)	1 (11.1)
POV/Scooter	1 (2.3)	-
No Device	1 (2.3)	-

**includes transport, K0001, K0002, K0003, K0004, K0005, K0006, K0007, K0008, and K0009 manual wheelchairs*

*** includes Group 1, Group 2, Group 3, Group 4, and Group 5 power wheelchairs*

3.2 DESCRIPTIVES

The average travel distance (miles) between the Veteran's place of residence and the VA Healthcare System was 34.14 miles (SD = 22.03). Table 3 shows the average times recorded for each phase of the complete telerehabilitation encounter. The total telerehabilitation encounter times ranged from 45 to 145 minutes.

Table 3. Average Telerehabilitation Encounter Times

Telerehabilitation Encounter	Average Time Recorded (minutes)
Pre-assessment screening, *M±SD (min, max)*	18.26±5.76 (20)
Equipment setup, *M±SD (min, max)*	5.63±2.25 (10)
Wheelchair seating and mobility assessment, *M±SD (min, max)*	63.23±20.60 (90)
Total telerehabilitation encounter, *M±SD (min, max)*	87.12±22.93 (100)

3.3 TELEREHABILITATION QUESTIONNAIRE

3.3.1 Initial Telerehabilitation Assessment

All Veterans who participated in the project for both the initial telerehabilitation assessment (Time 1) and the follow-up telerehabilitation assessment (Time 2) responded to the TRQ. All mean scores, for both the Veterans and providers at Time 1, were significantly higher than the scale midpoint of 3.5, with a majority of Veterans reporting they 'strongly agree', demonstrating high satisfaction with the telerehabilitation encounter (Table 4). Providers typically scored 'mostly

agree' or 'strongly agree', on all TRQ items, except Item 5. Item 5 asked about the quality and clarity of the telerehabilitation encounter, and a majority of provider scores were rated at 'slightly agree' or higher (Table 5). While there is some variation in the providers scores, the positive response from both the Veterans and providers indicates satisfaction with the telerehabilitation wheelchair seating and mobility assessments.

Table 4. Veteran Satisfaction with the Initial Telerehabilitation Assessment (Time 1)

	Veteran Telerehabilitation Questionnaire Score, *n(%)*						One-sample *t* test		
TRQ Item	1	2	3	4	5	6	*M* (SD)	95% CI	*p**
Comfort	0 (0)	0 (0)	0 (0)	0 (0)	3 (7.0)	40 (93.0)	5.93 (0.26)	2.35-2.51	< 0.001
Accuracy	1 (2.3)	0 (0)	0 (0)	2 (4.7)	1 (2.3)	39 (90.7)	5.77 (0.87)	2.00-2.53	< 0.001
Lifestyle	0 (0)	0 (0)	0 (0)	1 (2.3)	3 (7.0)	39 (90.7)	5.88 (0.39)	2.26-2.50	< 0.001
Technology	1 (2.3)	0 (0)	0 (0)	2 (4.7)	1 (2.3)	39 (90.7)	5.77 (0.87)	2.00-2.53	< 0.001
Quality and Clarity	1 (2.3)	0 (0)	0 (0)	1 (2.3)	3 (7.0)	38 (88.4)	5.77 (.0.84)	2.01-2.53	< 0.001
Monetary Expenses	0 (0)	0 (0)	1 (2.3)	3 (7.0)	0 (0)	39 (90.7)	5.79 (0.68)	2.08-2.50	< 0.001
Repeated Use	1 (2.3)	0 (0)	0 (0)	1 (2.3)	1 (2.3)	40 (93.0)	5.81 (0.82)	2.06-2.57	< 0.001

*$p < 0.05$

Table 5. Provider Satisfaction with the Initial Telerehabilitation Assessment (Time 1)

	Provider Telerehabilitation Questionnaire Score, *n(%)*						One-sample *t* test		
TRQ Item	1	2	3	4	5	6	*M* (SD)	95% CI	*p**
Comfort	2 (4.7)	0 (0)	1 (2.3)	2 (4.7)	18 (41.9)	20 (46.5)	5.19 (1.16)	1.33-2.04	< 0.001
Accuracy	2 (4.7)	1 (2.3)	1 (2.3)	0 (0)	25 (58.1)	14 (32.6)	5.02 (1.19)	1.16-1.89	< 0.001
Lifestyle	1 (2.3)	0 (0)	1 (2.3)	0 (0)	14 (32.6)	27 (62.8)	5.49 (0.94)	1.70-2.28	< 0.001
Technology	3 (7.0)	1 (2.3)	0 (0)	6 (14.0)	19 (44.2)	14 (32.6)	4.84 (1.34)	0.92-1.75	< 0.001
Quality and Clarity	3 (7.0)	1 (2.3)	6 (14.0)	12 (27.9)	11 (25.6)	10 (23.3)	4.33 (1.41)	0.39-1.26	< 0.001
Monetary Expenses	0 (0)	0 (0)	1 (2.3)	1 (2.3)	5 (11.6)	36 (83.7)	5.77 (0.61)	2.08-2.46	< 0.001
Repeated Use	1 (2.3)	1 (2.3)	1 (2.3)	0 (0)	8 (18.6)	32 (74.4)	5.53 (1.08)	1.70-2.37	< 0.001

*$p < 0.05$

All items for Time 1 showed 85% agreement between the Veteran and provider except for Item 4 (79.07%) and Item 5 (51.15%) for the Crosstabs analysis. Item 5 had 12 encounters where the provider scored a 4 (slightly agree) and the Veteran scored a 6 (strongly agree). While this does not show agreement, the providers were still generally satisfied, as reported as a positive response on the scale, with this element of the telerehabilitation encounter. The Crosstabs analyses for each item can be seen in Tables 6-12.

The results of the Wilcoxon Signed Rank test comparing Time 1 Veteran and provider scores revealed that there was a statistically significant difference between Veteran and provider scores on Items 1-5 of the TRQ. The providers consistently ranked the different aspects of the telerehabilitation encounter lower than the Veteran. Providers rated Item 4 (M = 4.84, SD = 1.34) and Item 5 (M = 4.33, SD = 1.41) much lower than the Veterans' scores for those items, Item 4 (M = 5.77, SD = 0.87) and Item 5 (M = 5.77, SD = 0.84). Item 6, regarding saved monetary expenses, $Z(43) = -0.16, p = 0.875$, and Item 7, regarding whether the individual would use telerehabilitation again, $Z(43) = -1.93, p = 0.053$, showed no statistical significance, meaning there is no significant differences between Veteran and provider scores (Table 13).

Table 6. Time 1 Crosstabs Analysis for Item 1

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (4.7)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	1 (2.3)
5	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	17 (39.5)
6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	20 (46.5)

N = 43; Agreement between Veterans and Providers for Item 1 = 39/43 = 90.70%

Table 7. Time 1 Crosstabs Analysis for Item 2

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (4.7)
2	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	1 (2.3)	0 (0)	0 (0)	0 (0)	1 (2.3)	23 (53.5)
6	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	13 (30.2)

N = 43; Agreement between Veterans and Providers for Item 2 = 37/43 = 86.05%

Table 8. Time 1 Crosstabs Analysis of Item 3

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	13 (30.2)
6	0 (0)	0 (0)	0 (0)	0 (0)	2 (4.7)	25 (58.1)

N = 43; Agreement between Veterans and Providers for Item 3 = 42/43 = 97.67%

Table 9. Time 1 Crosstabs Analysis for Item 4

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	2 (4.7)
2	1 (2.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (14.0)
5	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	18 (41.9)
6	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	13 (30.2)

N = 43; Agreement between Veterans and Providers for Item 4 = 34/43 = 79.07%

Table 10. Time 1 Crosstabs Analysis of Item 5

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	2 (4.7)
2	1 (2.3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	6 (14.0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	12 (27.9)
5	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	10 (23.3)
6	0 (0)	0 (0)	0 (0)	0 (0)	2 (4.7)	8 (18.6)

N = 43; Agreement between Veterans and Providers for Item 5 = 22/43 = 51.16%

Table 11. Time 1 Crosstabs Analysis of Item 6

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (11.6)
6	0 (0)	0 (0)	1 (2.3)	2 (4.7)	0 (0)	33 (76.7)

N = 43; Agreement between Veterans and Providers for Item 6 = 39/43 = 90.70%

Table 12. Time 1 Crosstabs Analysis of Item 7

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)
3	0 (0)	0 (0)	0 (0)	1 (2.3)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	1 (2.3)	0 (0)	0 (0)	0 (0)	0 (0)	7 (16.3)
6	0 (0)	0 (0)	0 (0)	0 (0)	1 (2.3)	31 (72.1)

N = 43; Agreement between Veterans and Providers for Item 7 = 39/43 = 90.70%

Table 13. Time 1 Veteran and Provider Wilcoxon Signed Rank Test

TRQ Item	Veteran TRQ N = 43	Provider TRQ N = 43	*Z*	*p**
Comfort	5.93 (0.26)	5.19 (1.16)	-4.40	< 0.001
Accuracy	5.77 (0.87)	5.02 (1.19)	-3.82	< 0.001
Lifestyle	5.88 (0.39)	5.49 (0.94)	-3.13	0.002
Technology	5.77 (0.87)	4.84 (1.34)	-4.29	< 0.001
Quality and Clarity	5.77 (.0.84)	4.33 (1.41)	-4.79	< 0.001
Monetary Expenses	5.79 (0.68)	5.77 (0.61)	-0.16	0.875
Repeated Use	5.81 (0.82)	5.53 (1.08)	-1.93	0.053

$p < 0.05$

3.3.2 Follow-Up Telerehabilitation Assessment

Nine Veterans were seen for a follow-up telerehabilitation assessment (Time 2). All Veteran mean scores were significantly higher than the scale midpoint of 3.5, with no Veterans giving a response below ‘mostly agree’, demonstrating very high satisfaction with their telerehabilitation encounter (Table 14). One-sample *t* tests could not be performed on Items 4, 5, or 7 because 100% of Veterans scored strongly agree and there was no variance in TRQ scores for those items. For Time 2, providers had more variability in their scores across most of the TRQ items. All provider mean scores were significantly higher than the scale midpoint of 3.5, except for Item 5 *($p = 0.078$)*. A one-sample *t* test could not be performed on Item 6 because there was no variance in provider scores at a score of 6 (Table 15).

Table 14. Veteran Satisfaction with the Follow-up Telerehabilitation Assessment (Time 2)

	Veteran Telerehabilitation Questionnaire Score, *n(%)*						One-sample *t* test		
TRQ Item	1	2	3	4	5	6	*M* (SD)	95% CI	*p**
Comfort	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)	8 (88.9)	5.89 (0.33)	2.13-2.65	< 0.001
Accuracy	0 (0)	0 (0)	0 (0)	0 (0)	2 (22.2)	7 (77.8)	5.78 (0.44)	1.94-2.62	< 0.001
Lifestyle	0 (0)	0 (0)	0 (0)	0 (0)	2 (22.2)	7 (77.8)	5.78 (0.44)	1.94-2.62	< 0.001
Technology	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (100.0)	6.00 (0.00)	-	-
Quality and Clarity	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (100.0)	6.00 (0.00)	-	-
Monetary Expenses	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)	8 (88.9)	5.89 (0.33)	2.13-2.65	< 0.001
Repeated Use	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (100.0)	6.00 (0.00)	-	-

**p < 0.05*

Table 15. Provider Satisfaction with the Follow-up Telerehabilitation Assessment (Time 2)

	Provider Telerehabilitation Questionnaire Score, *n(%)*						One-sample *t* test		
TRQ Item	1	2	3	4	5	6	*M* (SD)	95% CI	*p**
Comfort	1 (11.1)	0 (0)	0 (0)	0 (0)	2 (22.2)	6 (66.7)	5.22 (1.64)	0.46-2.98	0.014
Accuracy	1 (11.1)	0 (0)	0 (0)	0 (0)	3 (33.3)	5 (55.6)	5.11 (1.62)	0.37-2.85	0.017
Lifestyle	0 (0)	0 (0)	1 (11.1)	0 (0)	0 (0)	8 (88.9)	5.67 (1.00)	1.40-2.94	< 0.001
Technology	1 (11.1)	0 (0)	0 (0)	1 (11.1)	2 (22.2)	5 (55.6)	5.00 (1.66)	0.23-2.77	0.027
Quality and Clarity	1 (11.1)	0 (0)	1 (11.1)	1 (11.1)	2 (22.2)	4 (44.4)	4.67 (1.73)	-0.16-2.50	0.078
Monetary Expenses	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	9 (100.0)	6.00 (0.00)	-	-
Repeated Use	1 (11.1)	0 (0)	0 (0)	0 (0)	0 (0)	8 (88.9)	5.44 (1.67)	0.66-3.23	0.008

*$p < 0.05$

Results of the Crosstabs analyses for Time 2 proved extremely similar to the analysis for Time 1. All items for Time 2 showed 85% agreement between the Veteran and provider except for Item 4 (77.89%) and Item 5 (66.67%). The Crosstabs analyses for each item can be referenced in Appendix A.

A Wilcoxon signed rank test comparing Veteran and provider TRQ item scores at Time 2 revealed no significant results, except for Item 5. There were no significant differences in Veteran and provider scores at Time 2 for most of the items. Item 5, did report significant differences, $Z(9) = -2.032$, $p = 0.042$, as Veterans had higher mean score (M = 6.00, SD = 0.00) compared with the providers (M = 4.67, SD = 1.73). A p-value of 1.000 was calculated for Item 3, suggesting that the difference in signed rank between the Veteran and provider was so small that there were no differences between the scores (Table 16).

3.3.3 Initial Telerehabilitation Assessment Compared to Follow-Up Telerehabilitation Assessment

A graphical display of comparison data between Time 1 and Time 2 for both Veterans and providers can be found in Appendix B. Scores within the upper-right quadrant are prevalent and show high satisfaction and high agreement between the two encounters. Veterans tended to score consistently high at both encounters with little variation. Providers, in general, showed greater variance of scores between items at Time 1 and Time 2. Provider Item 4 and Item 5 showed the greatest discrepancy across the nine different telerehabilitation encounters. One data point stands out, as the provider was highly satisfied during the initial telerehabilitation assessment but was dissatisfied during the follow-up telerehabilitation assessment, giving a score of 1 for five out of the seven items.

Table 16. Time 2 Veteran and Provider Wilcoxon Signed Rank Test

TRQ Item	Veteran TRQ N = 9	Provider TRQ N = 9	*Z*	*p**
Comfort	5.89 (0.33)	5.22 (1.64)	-1.134	0.257
Accuracy	5.78 (0.44)	5.11 (1.62)	-1.134	0.257
Lifestyle	5.78 (0.44)	5.67 (1.00)	0.000	1.000
Technology	6.00 (0.00)	5.00 (1.66)	-1.841	0.66
Quality and Clarity	6.00 (0.00)	4.67 (1.73)	-2.032	0.042
Monetary Expenses	5.89 (0.33)	6.00 (0.00)	-1.000	0.317
Repeated Use	6.00 (0.00)	5.44 (1.67)	-1.000	0.317

*$p < 0.05$

For a majority of the items, Veterans scored equal to or higher during their follow-up telerehabilitation encounter than their initial encounter. For Item 1, Time 1 (M = 6.00, SD = 0.00) and Time 2 (M = 5.89, SD = 0.33), and Item 3, Time 1 (M = 5.89, SD = 0.33) and Time 2 (M = 5.78, SD = 0.44), the decrease in mean scores was minimal. The Wilcoxon Signed Rank Test revealed that there was no statistically significant difference between initial and follow-up telerehabilitation encounters for Veterans. Mean scores for Veterans were already highly satisfied after Time 1. A *p*-value of 1.000 was calculated for Item 2 and Item 4, suggesting that the difference in signed rank between Time 1 and Time 2 was so small that there were no differences between the scores (Table 17).

Table 18 shows that, on average, provider mean scores decreased between Time 1 and Time 2. Item 5, however, regarding the quality and clarity of the telerehabilitation encounter, did increase from Time 1 (*M = 4.22, SD = 1.39)* to Time 2 (*M = 4.67, SD = 1.73).* The Wilcoxon

Signed Rank Test revealed that there was no statistically significant difference between initial and follow-up telerehabilitation encounters for providers.

Table 17. Veteran Time 1 and Time 2 Wilcoxon Signed Rank Test

TRQ Item	Veteran Time 1 N = 9	Veteran Time 2 N = 9	*Z*	*p**
Comfort	6.00 (0.00)	5.89 (0.33)	-1.000	0.317
Accuracy	5.78 (0.67)	5.78 (0.44)	0.000	1.000
Lifestyle	5.89 (0.33)	5.78 (0.44)	-1.000	0.317
Technology	6.00 (0.00)	6.00 (0.00)	0.000	1.000
Quality and Clarity	5.89 (0.33)	6.00 (0.00)	-1.000	0.317
Monetary Expenses	5.44 (1.13)	5.89 (0.33)	-1.342	0.180
Repeated Use	5.89 (0.33)	6.00 (0.00)	-1.000	0.317

*$p < 0.05$

Table 18. Provider Time 1 and Time 2 Wilcoxon Signed Rank Test

TRQ Item	Provider Time 1 N = 9	Provider Time 2 N = 9	*Z*	*p**
Comfort	5.78 (0.44)	5.22 (1.64)	-0.816	0.414
Accuracy	5.33 (0.50)	5.11 (1.62)	-0.378	0.705
Lifestyle	5.89 (0.33)	5.67 (1.00)	-0.447	0.655
Technology	5.22 (0.83)	5.00 (1.66)	-0.137	0.891
Quality and Clarity	4.22 (1.39)	4.67 (1.73)	-0.740	0.459
Monetary Expenses	6.00 (0.00)	6.00 (0.00)	0.000	1.000
Repeated Use	6.00 (0.00)	5.44 (1.67)	-1.000	0.317

*$p < 0.05$

4.0 DISCUSSION

4.1 VETERANS

This home-based telerehabilitation wheelchair seating and mobility project utilized the TRQ to measure whether the Veterans and providers were satisfied with their telerehabilitation encounters, and it additionally measured whether Veterans and providers agreed on their levels of satisfaction amongst themselves and over time. The results indicate that Veterans were satisfied with the telerehabilitation wheelchair seating and mobility assessments at both Time 1 and Time 2. The results are consistent with previous research revealing high participant satisfaction with telehealth services (Gustke, Balch, West, & Rogers, 2000; Mair & Whitten, 2000; Schein, Schmeler, Saptono, & Brienza, 2010; Whitten & Love, 2005; Williams, May & Esmail, 2001).

A majority of Veterans scored ‘strongly agree’ with all TRQ items, showing high satisfaction, but contributing to the ceiling effect. While this possible limitation was addressed by presenting certain Veterans with TRQ scales that read ‘strongly disagree’ first compared with ‘strongly agree’, the results remain unchanged. A previous study revealed that patient satisfaction is rated high for telehealth services because receiving telehealth services directly removes many of the problems found to cause dissatisfaction in standard healthcare, such as appointment scheduling, travel time, and patient involvement with the physical examination (Gustke, Balch, West, & Rogers, 2000). Furthermore, particularly for rural Veterans, high satisfaction rates reported may not be a result of their actual feelings about telehealth, but, rather, it could be due to a perceived increase in quality of care that comes from the convenience of telehealth (Whitten, & Love, 2005). From a clinical standpoint, it is important to understand that while there are questions

regarding “true satisfaction” of Veterans, they were able to receive the appropriate mobility device to meet their needs in a manner more convenient to them using telerehabilitation.

In analyzing Veteran satisfaction, there was one Veteran who reported ‘strongly disagree’ for most of the TRQ items, showing high dissatisfaction with his telerehabilitation wheelchair seating and mobility assessment. While he reported that the telerehabilitation assessment was successful in meeting his mobility needs, he would much rather prefer face-to-face clinical services when possible. He reported that the telerehabilitation services saved him considerable monetary expenses, travel time, and general difficulty in transportation because of his medical condition, as shown by his rate of ‘strongly agree’ for Item 6, but the use of technology and periodic connectivity issues were not his preference. He reported that he would not use telerehabilitation again. This Veteran’s opinion is similar to results found by Greenwood, Chamberlain, & Parker (2004). This study researched telepsychiatry services and found that the sample preferred face-to-face psychiatry services, even though the telepsychiatry was highly rated and preferred over long distance travel.

4.2 PROVIDERS

Schein, Schmeler, Saptono, & Brienza (2010) used the same Telerehabilitation Questionnaire to measure participant satisfaction with telerehabilitation wheelchair seating and mobility assessments in the private medical sector. The results of their study proved extremely similar to this project, as all participant mean scores were significantly higher than the midpoint scale of 3.5, but they did see greater variation in Item 5, regarding the quality and clarity of the video and audio. While this project did not see that variation among Veterans, there was an inconsistency in

responses for Item 5 in the provider scores. Due to the inconsistency of responses, Item 5 provider scores were broken down over time and by provider to determine and understand if there was any pattern associated with their responses. Figure 3 shows that the responses were quite different between the two providers but did not show noticeable changes over time. There may be varying opinions regarding the use of the software between providers, but the lack of relationship over time suggests that the scores recorded were solely due to the telerehabilitation encounter. Providers scored significantly higher than the midpoint scale of all TRQ items at Time 1, but not for Item 5 at Time 2. The discrepancies in provider Item 5 scores at the follow-up encounter compared with the initial telerehabilitation encounter suggests slight changes within the technology between the two encounters. Given the circumstances of this project using a home-based telerehabilitation assessment, there were constraints related to the availability and strength of cellular signal or internet connectivity. While those factors were considered during the pre-screening process,

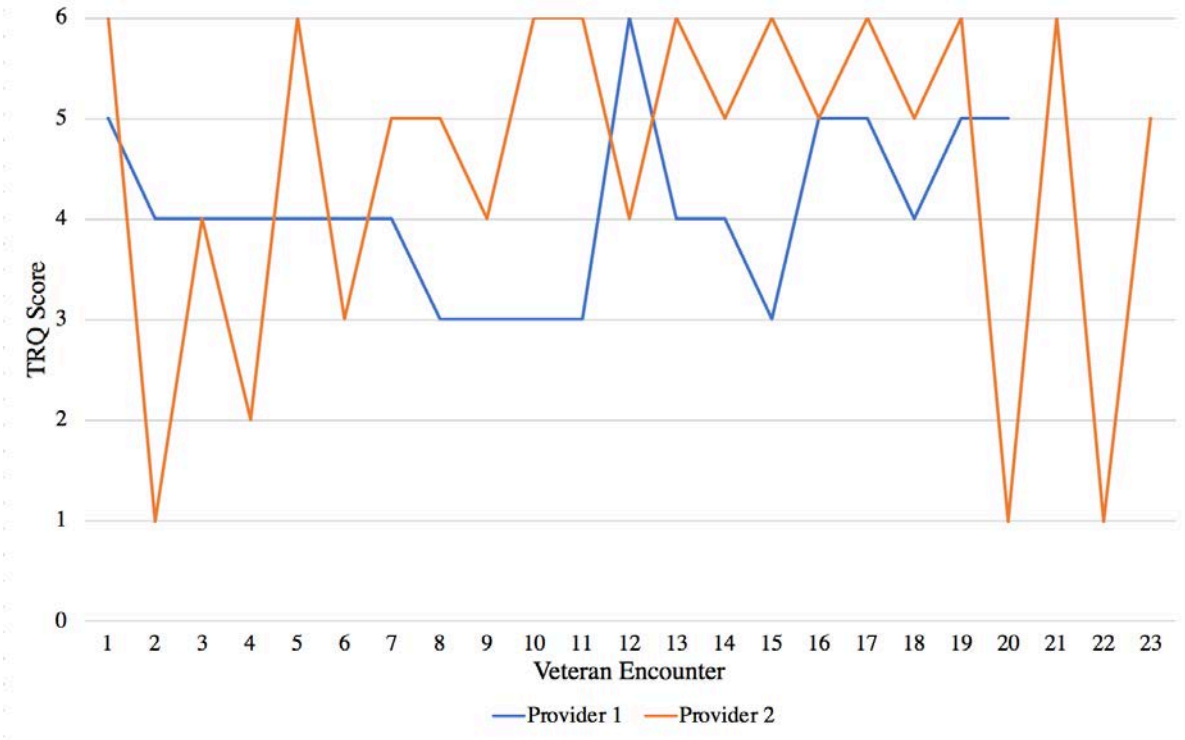

Figure 3. Provider Comparison of TRQ Item 5

fluctuations in quality and clarity of the video and audio throughout the assessment period contributed to lower provider satisfaction scores on Item 5, in particular. During the telerehabilitation assessment, there were several individuals with the Veteran, leading to occasions with multiple people speaking and moving simultaneously. Due to the nature of the encounter, it was necessary to constantly move the iPad around to give the provider the necessary visual to conduct the assessment. It has been shown that poor visual quality during telehealth can impact the usefulness and perceived effectiveness of telehealth technology for providers (Whitten, & Love, 2005). These factors definitely could have contributed to the inconsistencies in provider scores.

During one of the follow-up telerehabilitation assessments, the provider reported being highly dissatisfied with a majority of the TRQ items, despite the fact that he was satisfied with the initial telerehabilitation assessment. While the provider believed the environmental and technical conditions were satisfactory during the initial assessment, he believed that there was too limited space and increased technical difficulties during the follow-up assessment to provide a final fitting of the prescribed mobility device. The conditions made it difficult for him, as a provider, to accurately see the Veteran and the mobility device and make the appropriate clinical recommendations. After that encounter, he did not feel like telerehabilitation would be useful again in that particular Veteran's home environment, as reflected on his TRQ scores. This decrease in provider scores at Time 2 could have contributed to the decrease in provider mean scores between Time 1 and Time 2.

Much of the positive results and feedback from the providers can be attributed to the strong working relationship already established between the providers and the TCTs. The rapport of the TCTs with the providers plays a huge role in the telerehabilitation experience for the provider, due

to the knowledge, training, and experience required for the wheelchair seating and mobility process. The provider's confidence and trust in the TCTs capabilities impacts the ability to successfully conduct the assessment according to the provider's standards; thus, impacting the satisfaction levels recorded.

4.3 VETERAN AND PROVIDER COMPARISON

It was important to not only look at the Veteran and provider scores separately, but also to compare how both parties agreed during each telerehabilitation encounter. The results revealed that there was a statistically significant difference between Veteran and provider scores on Items 1-5 of the TRQ at Time 1, but no significant differences for Item 6 and Item 7. While the results showed no significant differences between the Veteran and provider scores for Item 6 and Item 7, it is difficult to confirm that a difference isn't there. Although the sample size of this project is large in the context of other telerehabilitation wheelchair seating and mobility projects, it is small in the context of research projects as a whole. Given the small sample size, the project may have been underpowered and thus unable to detect those differences. A sensitivity power analysis was run, with 80% power and the minimum effect size to detect differences was calculated ($dz = 0.39$). This relatively small effect size shows that the project has high sensitivity in detecting important differences between the Veteran and provider TRQ scores. While Item 7 did not show significant differences, $Z(43) = -1.93$, $p = 0.053$, based on a significance level of $p < 0.05$, it can be assumed that its effect size would be very close to $dz = 0.39$ due to the current calculated p-value. Furthermore, with a larger sample size, Item 7 would likely follow the pattern of Items 1-5 and show significant differences between the Veteran and provider scores. However, Item 6 results,

$Z(43) = -0.16$, $p = 0.875$, show that the lack of differences found is likely to be true because the project can detect relatively small differences. Veterans and providers likely rated Item 6 similarly because they are considering the same distance between the Veteran's place of residence and the VA facility and the value added by using telerehabilitation services.

During each telerehabilitation encounter, the TCTs at the Veteran's residence acted almost as intermediaries between the Veteran and the provider. Therefore, during times where the Veteran had a difficult time hearing or understanding the provider using VVC, the TCT could intervene and assist the Veteran. Additionally, during any situation with technical difficulties, the TCT could continue the conversation with the Veteran so that the assessment was seamless while the TCT worked to fix the issue. The differences in the environment and conditions between the Veteran and provider during each telerehabilitation encounter could have contributed to the discrepancies in scores. While the statistical results of this project show significant differences between the scores of the Veteran and provider with the Veterans, on average, scoring higher, the providers scores were still positive and showed high satisfaction. Furthermore, a majority of differences between Veteran and provider scores were within a 1 score difference, as shown by the Crosstabs analysis for Time 1 and Time 2. While this may impact the statistical analysis of this data, this is not clinically significant. Veterans and providers within one score of each other for items on the TRQ demonstrates general agreement.

4.4 BENEFITS AND CONSIDERATIONS OF TELEREHABILITATION

Saving monetary expenses like travel time and cost is one of the largest benefits of telehealth services. Veterans living in rural areas will consistently appreciate not having to travel long

distances for medical services; and thus, they are more likely to want to use those services again (Whitten, & Love, 2005). This is consistent with the results found in this project, for both the Veterans and the providers. Previously, if a Veteran was unable to travel to the VA facility for a wheelchair seating and mobility assessment, the provider would have to travel to the Veteran's place of residence themselves. This, often times, meant that the provider would not be able to see any other Veterans during the morning or afternoon block due to travel times. Providing telerehabilitation services allows providers to see a full schedule throughout the day, approximately 6-8 Veterans, because provider travel was eliminated. Additionally, the cost of having a TCT travel is often less than the cost of having a clinician travel to see Veterans. This allows more Veterans to be seen as well as decreasing the cost the care while using telerehabilitation.

This project conducted telerehabilitation wheelchair seating and mobility assessments in the Veteran's place of residence. While conducting the assessment in the Veteran's home environment proved beneficial for many aspects of the wheelchair seating and mobility assessment, it did contribute to some difficulties throughout the process. For Veterans that lived in any sort of assisted living facility or skill nursing facility, it was not only necessary to coordinate with the Veteran and their family, but also the facility in which they resided. It was crucial to make sure all parties were aware of the scheduled telerehabilitation assessment and were prepared when the TCTs arrived to the Veteran's residence. Additionally, due to privacy concerns, if the telerehabilitation encounter was being conducted in any place that was not owned by the Veteran or his family, it was necessary to have a private room to conduct the assessment.

4.5 LIMITATIONS

This project did have certain limitations. First, the Veteran sample size at Time 2 was very small (n = 9) compared with Time 1 (n = 43). Due to the small sample size for Time 2, it is difficult to find significant relationships in the data because the sample is not a good representative distribution of the population. The statistical results of Time 2 data are limited and not as generalizable to the entire population. The similarity in results between Time 1 and Time 2 analyses are promising, but the small sample size for Time 2 makes it difficult to directly compare to Time 1 results and makes the results over time less generalizable. Only Veterans who were in a circumstance where traveling to the H.J. Heinz Campus was unreasonable or impossible due to their diagnosis or availability of transportation were considered and scheduled for a follow up telerehabilitation assessment. The convenience sample of Veterans was clinical determined by the providers and other pertinent members of the Physical Medicine and Rehabilitation Services department. Veterans otherwise, traveled to the clinic to receive the final fitting of their prescribed mobility device. If the sample size of Time 2 Veterans was larger, it can be predicted that data analyses would have yielded similar results found in Time 1.

The second limitation of this project was the lack of women who were evaluated via telerehabilitation for wheeled mobility devices. This project saw 100% male Veterans, which is not representative of the gender distribution within the Veteran population. As of 2015, women made up approximately 9.4% of the total Veteran population (National Center for Veterans Analysis and Statistics, 2017). More specifically, the Veteran Integrated Service Network covering Western Pennsylvania only serves 4,501 female Veterans, representing a mere 6.4% of the total Veteran population in the area (U.S. Department of Veterans Affairs, 2016a). This small percentage of female Veterans in the area as well as specifically those with mobility limitations,

made it difficult to include female Veterans in the telerehabilitation project. Having a few female Veterans be evaluated via telerehabilitation could help generalize the results to better represent the Veteran population.

The third limitation of this project was the ceiling effect for the Veteran scores. A majority of Veterans scored towards the high end of the Telerehabilitation Questionnaire, thus leaving a limited range of scores. While it shows high satisfaction with the telerehabilitation services, it calls into question the accuracy of responses. It could be beneficial to use an outcome tool that measures client satisfaction on a dichotomous scale: 'not satisfied' or 'satisfied'. While this may help to eliminate the ceiling effect for Veteran satisfaction scores, that limitation was not as prominently observed with provider scores. Changing to a dichotomous scale may help address the limitation, but it may cause the loss of valuable information. Furthermore, it would not allow the comparison of Veteran and provider scores if two different scales were used.

The fourth limitation of this project was that the TRQ has not been tested for validity or reliability. This limited the results to an item-wise comparison because there is no interpretation of the total score. Using a validated outcome measurement tool to measure client satisfaction with telerehabilitation services would provide better insight to the extent of satisfaction measured. It would also help researchers understand how the tool works with various populations and in various settings.

4.6 FUTURE WORK

The results of this project produced insightful information on Veteran and provider satisfaction with telerehabilitation wheelchair seating and mobility assessments as well as multiple future

projects to further explore the findings and address some of the limitations noted. Previous wheelchair seating and mobility telerehabilitation studies were conducted in various outpatient centers, which is different than the home-based setting of this project. Further studies should be conducted to compare the equivalence of services provided in the home and services provided in a clinical setting. Conducting wheelchair seating and mobility assessments in the Veteran's place of residence offers naturalistic conditions but also poses different difficulties that would not be experienced in a clinical environment. Those differences should be studied and documented for continued growth of telerehabilitation assessments for wheelchair seating and mobility.

Furthermore, due to the importance of environmental conditions for home-based assessments, future telerehabilitation projects should be conducted in a variety of locations across the country. The hilly, rainy, and cold weather experienced in the Pittsburgh region can be quite different than the environmental conditions experienced at other VA locations. While certain factors may be important for particular climates and geographical settings, they may not be a concern elsewhere. This study should be conducted in various locations to determine how those environmental barriers impact the telerehabilitation services as well as Veteran and provider satisfaction. Processes and clinical standards can then be adjusted depending on the VA location being serviced.

Due to the limited sample size of follow-up wheelchair seating and mobility assessments in this project, another project should work to address that limitation and see more Veterans for follow-up encounters. This will provide insight into how Veteran and provider satisfaction changes over time. Additionally, some of the technical issues found during the initial telerehabilitation encounter may be addressed and mitigated if multiple follow-up telerehabilitation encounters occur.

The TRQ outcome tool is currently not validated in the field. It is important that more research studies be conducted using this tool and the psychometric properties of this outcome measurement tool be tested for continued use. This will help understand how the results apply to different client populations.

Lastly, the positive results of the home-based telerehabilitation assessments for wheelchair seating and mobility could warrant using those services for other areas of assistive technology. Areas such as smart home technology, speech-language pathology, blind and low-vision rehabilitation, driver's rehabilitation, and even home accessibility could greatly benefit by seeing Veterans via telerehabilitation. The field of physical medicine and rehabilitation treats clients with significant medical limitations and incorporates so much of an individual's home residence, mode of transportation, and daily activities in the home and the community, that there is an innate benefit to using telerehabilitation.

4.7 CONCLUSION

Telerehabilitation provides individuals with disabilities and those living in rural areas the ability to receive specialized rehabilitative care without having to travel to a dedicated clinic. This project demonstrated that Veterans and providers are both satisfied with a home-based telerehabilitation assessment for wheelchair seating and mobility. Moreover, this project showed the beneficial aspects telerehabilitation provides for Veterans and providers. Telerehabilitation technology can help to improve access, quality and continuity of care for Veterans with mobility needs.

APPENDIX A

TIME 2 CROSSTABS ANALYSIS OF TRQ ITEMS

Table 19. Time 2 Crosstabs Analysis for Item 1

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (22.2)
6	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)	5 (55.6)

N = 9; Agreement between Veteran and Provider for Item 1 = 8/9 = 88.89%

Table 20. Time 2 Crosstabs Analysis for Item 2

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)	2 (22.2)
6	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)	4 (44.4)

N = 9; Agreement between Veteran and Provider for Item 2 = 8/9 = 88.89%

Table 21. Time 2 Crosstabs Analysis for Item 3

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
6	0 (0)	0 (0)	0 (0)	0 (0)	2 (22.2)	6 (66.7)

N = 9; Agreement between Veteran and Provider for Item 3 = 8/9 = 88.89%

Table 22. Time 2 Crosstabs Analysis for Item 4

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (22.2)
6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (55.6)

N = 9; Agreement between Veteran and Provider for Item 4 = 7/9 = 77.78%

Table 23. Time 2 Crosstabs Analysis for Item 5

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (22.2)
6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4 (44.4)

N = 9; Agreement between Veteran and Provider for Item 5 = 6/9 = 66.67%

Table 24. Time 2 Crosstabs Analysis for Item 6

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
6	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)	8 (88.9)

N = 9; Agreement between Veteran and Provider for Item 6 = 9/9 = 100%

Table 25. Time 2 Crosstabs Analysis for Item 7

Provider Telerehabilitation Questionnaire Score	Veteran Telerehabilitation Questionnaire Score, *n(%)*					
	1	2	3	4	5	6
1	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (11.1)
2	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
3	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
4	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
5	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
6	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (88.9)

N = 9; Agreement between Veteran and Provider for Item 7 = 8/9 = 88.89%

APPENDIX B

VETERAN AND PROVIDER TIME 1 AND TIME 2 COMPARISON DATA

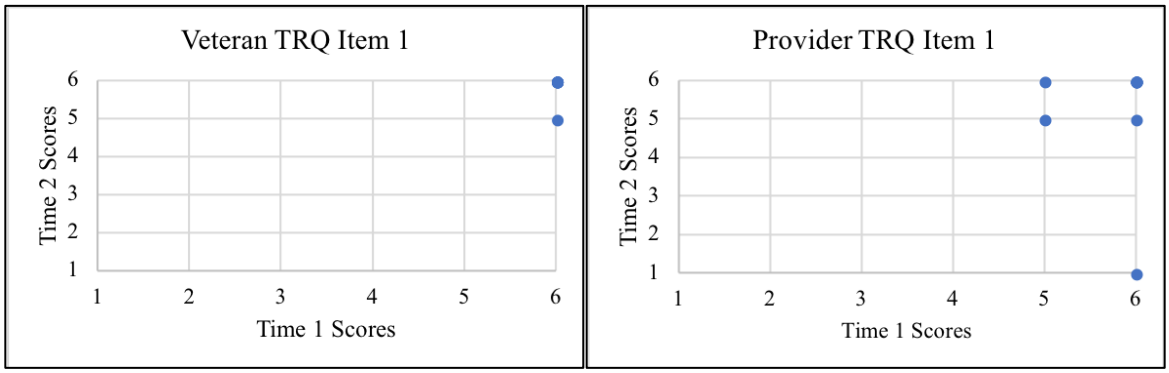

Figure 4. Veteran and Provider TRQ Item 1

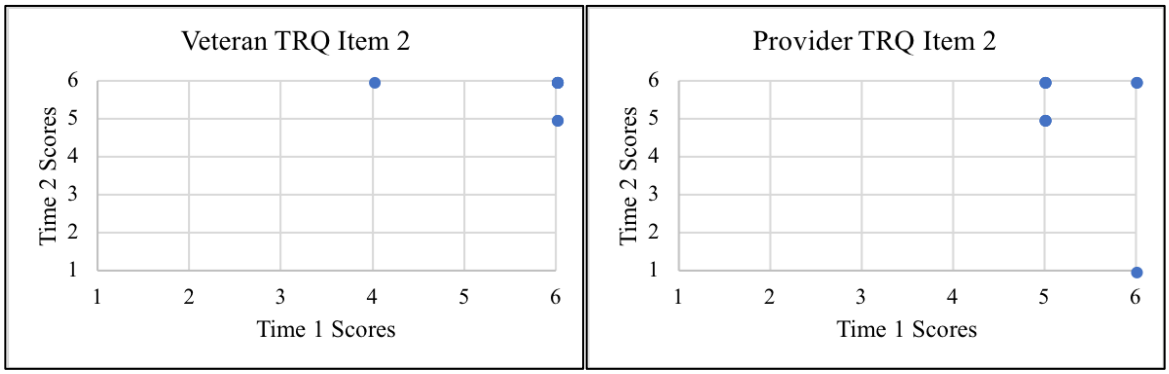

Figure 5. Veteran and Provider TRQ Item 2

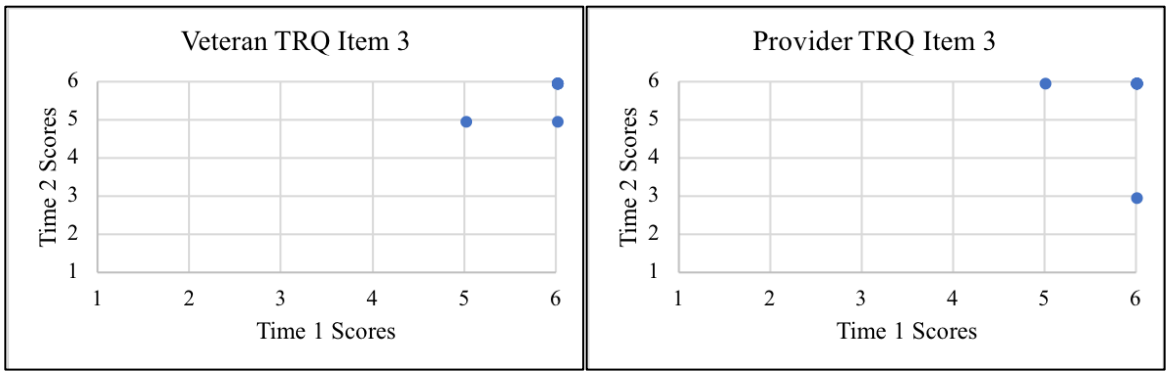

Figure 6. Veteran and Provider TRQ Item 3

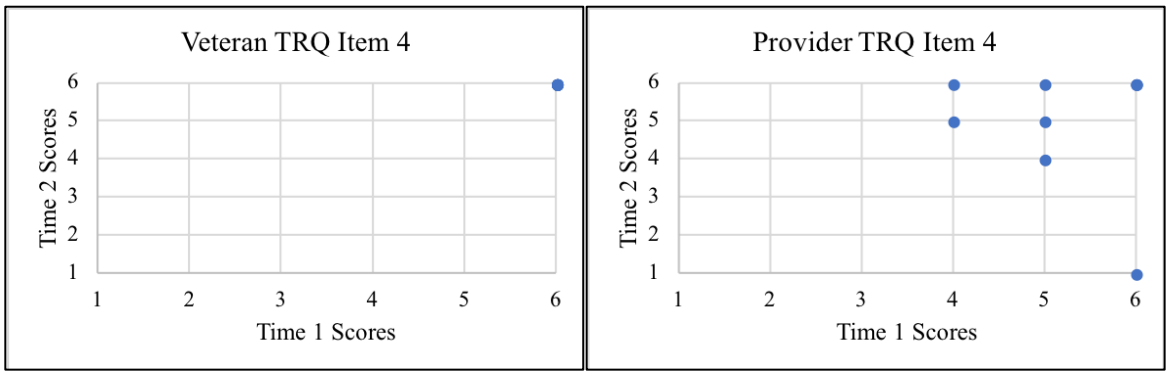

Figure 7. Veteran and Provider TRQ Item 4

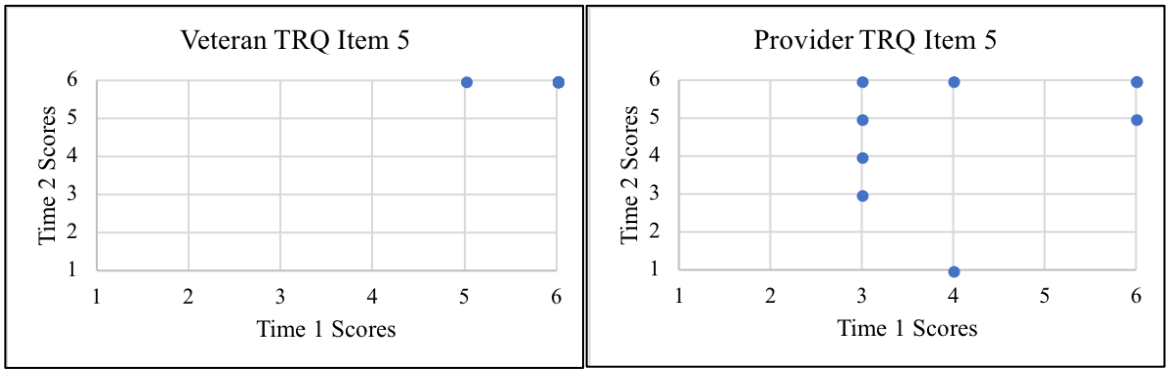

Figure 8. Veteran and Provider TRQ Item 5

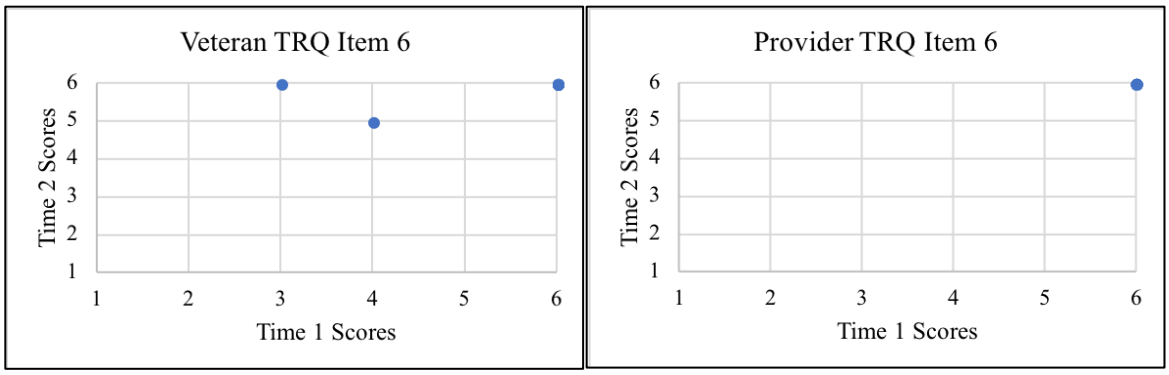

Figure 9. Veteran and Provider TRQ Item 6

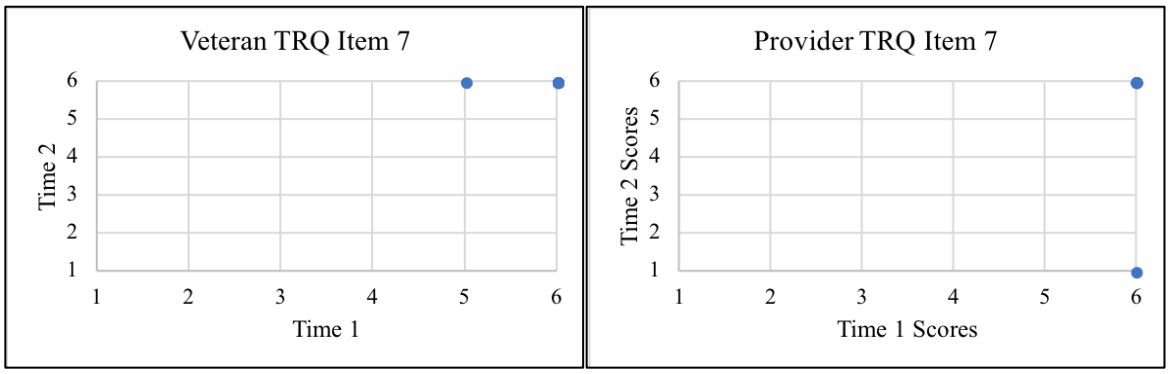

Figure 10. Veteran and Provider TRQ Item 7

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