

**Richard Schein:** Good afternoon and thank you for allowing me this time to present the following research on the remote wheelchair prescription project as then I'll transition to some of the work we are doing with the VA Polytrauma system of care. This project is very near and dear to my heart. It was my dissertation work for about four years. The project was funded under the first cycle of RERC and the first project with clinical application to use what is called VISYTER today. As you have seen from previous presentations, VISYTER wasn't as fluid and/or integrated as it was when we were testing it in our specific project. First, just a little bit of background. We refer to Dr. Iezzoni's paper which indicated that around six million people have a mobility limitation. In a recent survey, close to 3.3 million people use a wheelchair or similar device. Since this particular project focuses on rural service delivery, about 25 percent of the population lives in rural areas and of which 22 percent of the U.S. population are senior citizens whom possibly use a mobility device such as a manual wheelchair, power wheelchair, scooter or various other mobility devices. As technology has evolved we have seen the growth of how many companies are producing power wheelchairs and scooters. You can see the progression from manual chairs using materials such as aluminum and steel in the past to what is currently being used such as titanium. From three to four wheeled scooters to the progression of power wheelchair products out in the market from consumer to complex mobility devices indicated in the following pictures. There are additional accessories that can be applied to power wheelchairs such as tilt-in-space, recline, seat elevation, and elevating legrests. Wheelchair prescriptions are a

very intrinsically complex intervention. The wheelchair prescription starts with a referral from a licensed medical registered practitioner such as a physician and ends with a script detailing the specific device being recommended. At the University of Pittsburgh we look at the wheelchair user themselves, their needs, abilities, and preferences of their mobility device; what kinds of equipment are they currently using and discuss the environments in which they will be using the device such as the home, work, community, etc. Obviously the clinical settings are optimal for what you want to see but we want to make sure we go to the outside environments to verify and see what is happening there as well. The reason for unsuccessful wheelchair prescription is lack of active involvement by user and family. There are certain companies that do consumer advertising on the web as we are trying to avoid that and add additional layers of accountability. Second, is the lack of training in professionals who are performing such assessments. At the University of Pittsburgh our PTs and OTs have a dedicated amount of time within their curriculum to be taught by experts in various fields of assistive technology as for instance the students really get a good understanding of what is happening in wheeled mobility but that's not very true across other professionals in other schools as well. And last reason for unsuccessful outcomes is poor device performance and not meeting what the needs are. At our center with investigators such as, Drs Mark Schmeler, Bambang Parmanto, Mike McCue, Dave Brienza and Andi Saptono we looked systematically at what are the steps and how can we integrate telerehabilitation in wheelchair prescription. The steps taken was in a step-wise prescription as first is

identifying and analyzing the requirements of what the wheelchair prescription service entails, second; design the system based on those requirements, third; develop the components into a cohesive infrastructure, and last, deploy the infrastructure and develop the clinical outcomes. For example, you can't just skip and go to step three without going to step two first. So where do we start? For our practice, there really is no standard assessment as individuals have their own way of performing such an evaluation. There are a lot of clinicians out there who are performing wheelchair prescriptions but have not documented what their standards or steps taken, so we have taken the telerehabilitation system and modeled it after our Center for Assistive Technology within the University of Pittsburgh Medical Center Pittsburgh, which itself has become a national and international service delivery center for people with mobility impairments. We outline each specific step as it's a very comprehensive assessment. The following details the service delivery process starting with the intake and interview, physical mobility assessment. I however want to highlight a specific task within the process and that is the home assessment. At the clinic, each of our clients has a home assessment performed by a rehabilitation technology supplier to make sure that the device we are recommending fits within their natural environment. The clients can spend up to anywhere from two to three hours going through the process with our team at the clinic demoing equipment, discussing options, being evaluated not only by a clinician (i.e. PT or OT) but also having the documentation from a board certified physiatrist too. We don't want to recommend anything until it is tried within the person's natural home.

So what we have here is actually the telerehabilitation service delivery model for remote wheelchair prescription. On the right side is what we are able to do in person at the clinic and then had to take those specific components and translate them into a telerehab model. Both Bambang and specifically Andi spent a great deal of time with us in the clinic looking at how technology specifically, multimedia systems and data outcome systems can be incorporated to assist with the workflow. This slide brings us to take a look at the core of the service itself. At the remote wheelchair prescription, we observed four phases within its workflow: data collection, documentation, finalizing documents, and system fitting. Within the data collection phase the clinician is gathering demographic information, assessing physical ability, what is working and not working. It is here where we also administer an outcome tool to collect a predetermined function score of how they are actually performing functional tasks with their current mobility device. The tool is called the Functioning Everyday with a Wheelchair. It's a self reporting tool that's been validated at the University of Pittsburgh. It looks at 10 specific tasks while seated in the wheelchair whether it's reaching for an object or transferring to another surface. The tool gives us a rough estimate of where they are at with their current means of mobility. The second phase is this initial documentation as clinicians always have to document what is transpiring during their evaluation.

Through that portal system, seen in the following slide, developed by Bambang and Andi, we are helping the rural therapists with their documentation by providing the mechanisms and basically the algorithms to assist in writing a

document justifying the medical necessity to the client's funding sources. We assist with providing the therapists with the most up-to-date guidelines of who qualifies for a specific device as well as the current research to support the recommended device. The third phase is the final documentation which incorporates the findings from the first two into a cohesive letter. And the last phase is of course the system fitting and delivery. We are there with the rural therapists from the start of the process all the way up to the fitting and delivery. We were also available for follow-ups as needed too.

This next slide displays the interaction flow of phases. In the previous presentations there has been a lot of discussion about multi interdisciplinary teams and this is a huge part of telerehabilitation. Within each assessment or evaluation there was a physician, rural therapist, a supplier, and most importantly the client involved. The client has always been involved in each of our four phases and what we've been able to do using the VISYTER software is to have an expert therapist in Pittsburgh consult on the assessments in rural Pennsylvania.

The next slide shows the deployment of the VISYTER infrastructure. In the past, the University has conducted telerehabilitation research within the lab but we transformed from a lab setting into real world clinical applications. The developers of the system have now been able to deploy multiple camera angles so during assessment both therapists can be able to control different cameras to be able to see different views and seating biomechanics of the clients. The expert therapist did not want to burden the rural therapists by interrupting their

assessment and ask the questions, can you stop what you are doing and move the camera to the left or right. We wanted there to be fluidity throughout the entire assessment so having multiple camera angles was of great assistance. Again, each of our collaborating sites used the same technology to bring a sense of uniformity amongst everyone involved.

Additionally we talked about the portal system and here is another snapshot of the portal demonstrating the workflow. Again, each member of the team had access to the portal but with specific user roles. For instance, the supplier can only review certain parts of the documentation system but has privileges to upload, edit and add information about his home assessment and to assist with justifying accessories on the final specifications. With this type of portal system accessed through the Internet clinicians and suppliers were able to collaborate on client's documentation and cut off about a week to two weeks of delayed time waiting for additional information. You can also look at the work flow to see what has been completed or what still need to be done.

So as we talk about moving out from the laboratory into the clinical setting, this project looked at setting up four remote hospitals in western Pennsylvania and each of these remote clinics were 125 miles away from us. Our first clinic was DuBois Regional Medical Center with a snapshot of an assessment on the left. As the project progressed we moved from one clinic to the next. What we saw happening at these sites with the generalist practitioners was that they did not need our services after so many consultations. The learning curve or effectiveness was so great that they were becoming their own experts and the

greatest result of using telerehabilitation was that each clinic within their own respective hospital has been sustained. The amount of clients being assessed at each clinic might not be as extensive as our clinic in Pittsburgh but they are up and running at least once a month seeing a vast array of diagnosis and disability. The picture of us down in the bottom left hand corner along with DuBois was our first ever telerehab consult assessment that we ever did back in 2007. This was of an individual who came into the clinic who couldn't ambulate without assistance and the wheelchair she has been using was uncomfortable and painful for her to sit in. The rural therapist conducted the assessment without consultation as you can see them on the right-hand side, along with the suppliers taking measurements. The picture on the left, the VISYTER system was connected using a broadband connection provided by the hospital where some of our collaborating sites had different internet connections. For instance we had to use a wireless setting in the next picture showing the versatility and extensibility of using a laptop this time around. Instead of having the control camera on the table we decided to mount the camera at a higher angle to allow for a more aerial view of what is happening.

For this project we looked at various clinical outcomes of which we can spend a great deal of time discussing. We looked at four specific outcomes; reliability of a functional capacity tool, the effectiveness of the new device, patient satisfaction and a term that has been discussed this morning of equivalence or non-inferiority. The first outcome of discussion is reliability of which has been accepted and is in publication right now within the Journal of Rehabilitation

Research and Development. We have two videos of participants performing specific functional tasks while seated in their wheelchair. The top video is of an individual transferring from the device they are currently trying in the clinic. While watching the client, we are measuring the independence satisfactory and the quality of how they are performing specific tasks. So in conclusion the rural therapist is scoring what they are seeing as Mark and I are scoring what we are seeing via telerehabilitation. All of the sessions were archived so that individuals can go back and watch the session again in case they missed something. The bottom video is of an individual who is using their manual wheelchair and performing specific tasks of what they typically would do for indoor mobility.

As far as effectiveness we used the Functioning Everyday with a Wheelchair outcome tool. The FEW was designed as a self-report questionnaire to be administered over time to consumers of wheeled mobility and seating technology as a dynamic indicator or profile of perceived user function related to wheelchair use. The FEW consists of 10 consumer-generated, self-report items which were scored using a 6 point scale of 6 = completely agree to 1 = completely disagree. Some of the 10 items include: comfort, health needs; operate, reach and carry out tasks at different surface heights, transfers, personal care tasks, indoor mobility, and outdoor mobility. Following the collection of demographic data, the FEW was administered with the clients current mobility device and a follow-up FEW interview was conducted in no less than 2 weeks after delivery via the telephone. The 2 week interval following delivery of the new mobility device allowed participants to familiarize themselves

with their new intervention. Overall, the results indicated a high level of change in function measured by the FEW via TR. And concurrently, the clinicians have been following up with their clients performing the FEW so that if they see a drop in score for a particular category they are able to take the necessary steps in meeting their seating needs.

For the clinical outcome of patient satisfaction we looked at not only the device itself but also looking at the evaluation. There was a significant difference in satisfaction particularly with the evaluation using the telerehabilitation system specifically for the areas of meeting all areas of a client's lifestyle, and looking at the quality of video and audio. Within the survey, space was provided for qualitative feedback where participant comments were generally positive for instance; I would love to see this technology expanded to different areas. They treated me. I would do this for all my health care needs instead of making arrangements to travel all over to see my physicians and doctors.

The last clinical outcome was the idea of equivalence or non-inferiority comparing two conditions, our telerehabilitation assessment outcomes with our in-person assessments at the Center for Assistive Technology. The pretest FEW average and item results revealed no significant differences between conditions, and that there were no ceiling or floor effects, indicating a potential for change. We looked at a total sample of close to 100 assessments. This is one of the largest studies that has ever been conducted in telerehabilitation and published in archives of physical medicine and rehabilitation. When comparing the post-test FEW scores for telerehab and in-person conditions, the majority of the 95%

CI contained zero which led to interpretation that the conditions are the same for all of the FEW items. All of these items had a small standard error resulting in a tight CI containing zero.

As a summary the impact we were able to make was on three specific levels; Access, quality and capacity of service delivery. Not only were we able to improve the quality of life but we were able to allow individuals not only to participate but to re-integrate within their own communities. We were able to meet the needs of individuals with mobility impairments in rural areas. We were able to break down geographical barriers by providing alternative modes of service. Travel costs were decreased for participants and provided great clinician and client education. Again I want to say thank you for allowing me the time to discuss the remote wheelchair prescription to all of you today.