



Nexus

Aging • Technology • Disability

Rehabilitation Engineering Research Center on Technologies for Successful Aging with Disability

A Message from the Directors:

Carolee Winstein, PhD, PT, FAPTA and Philip Requejo, PhD

Wheeled mobility for persons with impaired lower extremities is essential for independence and good quality of life. Over the past 30 years, there have been many improvements in the design and function of wheelchairs and seating systems that have improved the lives of those with disabilities. Yet upper extremity pain and dysfunction resulting from wheelchair use are still highly prevalent among individuals who depend on a wheelchair for mobility. The negative consequences associated with wheelchair propulsion as well as activities requisite to wheeled mobility (sitting, transfers, and pressure relief raises) and other activities initiated from the seated position (reaching, lifting) continue to challenge functional capacity and restrict participation in daily activities, particularly for those who are aging and use a manual wheelchair.

Fulfilling the OPTT-RERC outcome goals will require maintaining the focus on the nexus of aging, technology and disability as it pertains to optimizing participation for the aging manual wheelchair user. Central to our research and development strategy is to seek guidance from the ASAP (accelerated skill acquisition program) Model that includes 3 key elements: Skill Acquisition, Capacity Building/Preserving, and Motivational Enhancements. We know from Bryan Kemp and others that for those aging with a disability, preserving capacity is the important for enabling participation in meaningful activities. We see the development of skill as a means to preserve capacity, prevent injury (i.e., avoid high risk transfer maneuvers) and enable activities that allow the individual to engage in activities that support a high quality of life, such independent driving. Finally, feelings of confidence in specific tasks or activities (i.e., self-efficacy) are likely an important motivator for continued participation in these activities.

In this issue of Nexus, we report on the activities of our center and highlight how we are optimizing participation in those who are aging and use a manual wheelchair but are young at heart. We are particularly delighted to have one of our advisory board members, Dr. Kim Anderson-Erisman's personal perspectives on how technology can add grace to aging with disability.



How can technology add grace to aging with a disability? Perspective from a user and scientist

When the OPTT-RERC team asked me to write an article for this issue of the NEXUS, I was more than happy. After all, I am aging with a disability and I'm really trying to do it gracefully!

First, though, who am I? My name is Kim Anderson-Erisman. I am currently the Director of Education at the Miami Project to Cure Paralysis research center at the University of Miami. Prior to joining the Miami Project in 2009, I was an Assistant Professor in the Department of Neurological Surgery at the University of California, Irvine and a core faculty member of the Reeve-Irvine Research Center. My previous research has focused on translational investigations and bridging the gap between basic science, clinical science, and the public community living with spinal cord injury (SCI). My training spans the spectrum of SCI research, from cellular and molecular studies as a graduate student, to whole animal and behavioral studies as a post-doctoral fellow, to human clinical research as a faculty member. I obtained that breadth of knowledge on purpose because I wanted to do something different and it has been a great attribute in my role as the scientific interface to the public for the diverse array of cutting-edge research being conducted at the Miami Project.



A special perspective I bring to the SCI research field is that I also have a spinal cord injury. When I was seventeen years old I was involved in a motor vehicle accident that left me with quadriplegic paralysis from a cervical spinal cord injury. After graduating from high school without delay, I went on to college at Texas A&M University and graduate school at the University of New Mexico. I received numerous awards along the way, including the Khatali Award for Outstanding Senior Graduate Student, a NIH National Research Service Award as a post-doctoral fellow, the Paul H. Silverman Award for Outstanding Work on Science and Ethics in 2005, and induction into the SCI Hall of Fame in 2007. I am a member of many professional organizations; I served on the NIH National Advisory Board for Medical Rehabilitation Research and I am currently a member of the OPTT RERC advisory board. Achieving all of those things has not prevented me from aging with a disability though. If you apply the theory of another OPTT RERC board member of disability

contributing to accelerated aging, in which you add the number of years you've been living with a disability to your current age, then my body thinks I'm 63 years old already!

The key for me to age gracefully with my disability is to take advantage of technology. Having a C5/6 injury, my primary mode of mobility is my wheelchair. Therefore, preserving my upper body strength is of primary importance. This is one of the areas the OPTT RERC researchers are focusing on. They have already demonstrated that Strengthening and Optimal Movements for Painful Shoulders (STOMPS) is an effective exercise program for reducing shoulder pain in wheelchair users. Now they are trying to develop an interactive game that incorporates the exercise program so people can do it in the comfort of their own home. In fact, a whole group of their researchers are working on adapting interactive games such as the Wii or Kinect so that they are more user-friendly for those of us with reduced mobility and dexterity. Of course, it's important that exercise is fun as well as effective. Being able to take advantage of the "exergaming" technology in an effective way allows us to stay active while having fun with our family, friends, and loved ones. I also use a power-assist "smart" wheelchair, which is a hybrid between a manual wheelchair and power wheelchair, to maintain my mobility. It's easier to roll than a standard manual wheelchair so there is less stress on my shoulders, but allows me to keep my upper body active as opposed to a standard power wheelchair. OPTT RERC researchers are also studying how people transfer from their wheelchair to their car. These transfers can become more difficult as we age with a disability and can restrict our independence. Researchers are using technology not only to analyze these transfers, but will then evaluate different simple modifications that can be made to make these transfers easier.

These are just a couple examples of how technology can help us maintain our independence as we age with or into a disability. Technology is now integral to our society. If you think of how far computer technology has advanced in the last 20 years, in a similar vein, technology to help maintain and preserve mobility and participation is advancing by leaps and bounds right now. Where will that technology be 20 years from now? Hopefully surrounding me as a natural part of life and enabling me to age gracefully and independently! My advice for all of you in similar situations, or for those of you who will age into reduced mobility, embrace technology – don't fear it. Technology can make your life easier, less painful, and enable you to enjoy your golden years.

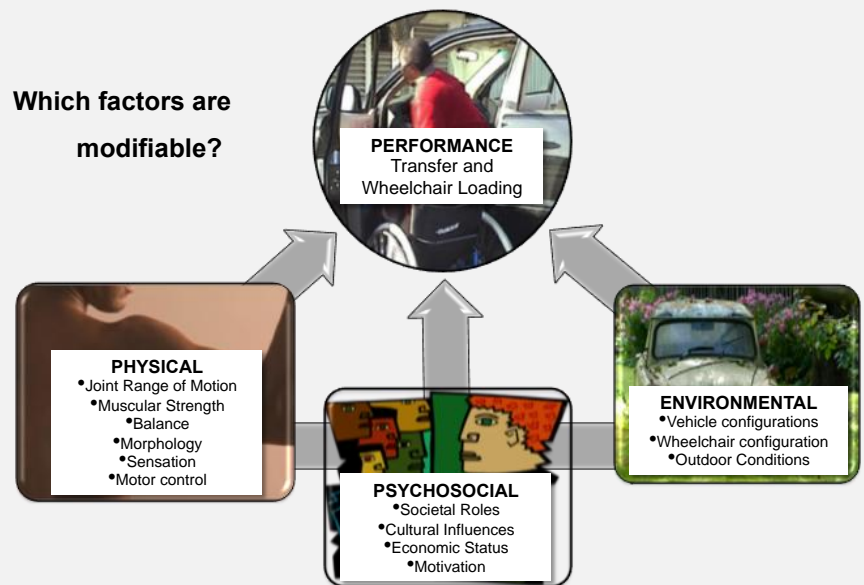
OPTT-RERC Focus on Car Transfers to Optimize Independence and Participation for Individuals Who are Aging and Use a Manual Wheelchair

Approximately 1.5 million people in the U.S. use a manual wheelchair and the proportion of the population using wheelchairs increases sharply with age. For individuals who are aging and use a manual wheelchair, community participation is enhanced with independent use of a vehicle for transportation, necessitating repetitive self-transferring and loading/unloading the wheelchair. Lower limb weakness in wheelchair users, however, shifts transferring demands to the arms, in addition to the high demands associated with lifting the wheelchair. Thus, a comprehensive assessment of this task and intervention to reduce the physical impact is crucial to preserve independent driving and community participation for those who are aging and use a manual wheelchair.

On June 8, 2011, the OPTT-RERC team members Philip S. Requejo, Ph.D., Sara J. Mulroy, Ph.D., and Lisa Lighthall Haubert, MPT, and Giselle Ragusa, Ph.D., presented a 90 minute workshop at RESNA / FICCDAT (Festival International of Conferences on Caregiving, Aging and Technology) in Toronto, Ontario, Canada, entitled, "Introduction of the Car Transfer Evaluation Toolkit to Guide Intervention to Reduce Shoulder Demands and Maximize Participation for Manual Wheelchair Users Aging with a Disability."

In this workshop, the team identified the numerous and complex factors that impact car transfers and wheelchair loading performance. These factors or constraints may be categorized as psychosocial, physical, or environmental and may be potentially modifiable to reduce the shoulder demands and preserve participation. The team presented the background and process in the development

FACTORS INFLUENCING CAR TRANSFERS & WC LOADING



of the Car Transfer Evaluation Toolkit (CTET); to assist in identifying the influence of the complex and interrelated factors in an organized and concise manner. They also identified the interventions to reduce the impact of car transfers and wheelchair loading; including an overview of the shoulder flexibility and strengthening exercise program for those who use a manual wheelchair and technological solutions (including assistive technology and environmental designs) to facilitate independent car transfers and wheelchair loading.

2011 Annual Advisory Board Meeting: Nexus of Aging, Disability, and Technology



Advisory Board Panel (left to right): Dr. Kimberly Erisman-Anderson, Dr. Patrice “Tamar” Weiss, Dr. Kenneth Ottenbacher, Dr. Alma Merians, Dr. David Reinkensmeyer, Dr. Robert Gregor, Dr. Karen Lincoln, Dr. William “Zev” Rymer, Dr. Kenneth Cole, Dr. Elizabeth Rasch, Mr. Greg Thompson, Dr. Walter Greenleaf.

In August 14–15, 2011 the OPTT-RERC held its 3rd Annual Advisory Board Meeting at the University of Southern California’s Institute for Creative Technologies’ newly built state of the art building in the Marina Del Rey Campus. The first day of the meeting provided an opportunity for the advisors and guests to see firsthand the progress of the center, including evaluation of the VR and gaming technologies under development. It also provided the advisors and guests the opportunity to discuss specific details about each research and development project as well as to network with other attendees. The second full day of the meeting highlighted the center’s current progress and articulated a vision for fulfilling our outcome goals within in the next two years. Crucial to the achievement of the centers goals is the guidance from our advisors.

Research and development advances included advances in measurement and analysis techniques for quantifying the changes in dexterity skill with age; the development of interactive/gesture technologies including the FFAST middleware and findings from the usability studies of off-the-shelf VR games; and observational and elegant biomechanical evaluation tools for assessments of car transfer performance of wheelchair users. The advisory board provided important points of guidance including: advice to move past the expected ‘motivation’ effect with VR games towards applications that incorporate better diagnostic assessments and skill acquisition to effect functional changes in those aging with or into disability. The advisors also recommended that the center maintain a continued focus on achieving outcomes that can be shared across the projects including the focus on developing a common database for populations or age groups and a set of common outcome measures that includes measures of social participation. As the center begins its fourth year, we plan to incorporate our set of common data elements and at the same time include the ASAP model elements to optimize the design and selection of outcome measures toward achieving our goals.

2011 American Society of Biomechanics Meeting

The University of Southern California hosted the 35th Annual Meeting of the American Society of Biomechanics (ASB) in Long Beach August 10-13, 2011. Submitted abstracts covered a broad spectrum of topics including aging, computational biomechanics, injury prevention, locomotion, motor



control, rehabilitation, and vehicle occupant safety. There were between 450 and 500 podium and poster presentations and lectures from both national and international researchers.

The program also included Virtual Tours from numerous laboratories at USC on August 10th. Fifteen labs and programs were represented including the OPTT-RERC. They were able to demonstrate hardware and software developed in their respective labs and discussed ongoing and future research studies with interested attendees. T-shirts with information from each were created and distributed throughout the conference to further showcase their research. In addition to the virtual tour, each lab was given the opportunity to set up at a booth in the lobby outside of the meeting rooms throughout the conference. This allowed each laboratory to highlight their accomplishments to a large number of attendees. This was a unique opportunity to both discuss their research as well as foster collaborations between other labs.

As part of the Scientific Program, the OPTT-RERC organized a special session entitled “**Upper Extremity Symposium on Wheelchair Biomechanics**”. This symposium brought together experts in the field to discuss their recent accomplishments and outline how major challenges can be overcome in the near future. The purpose of the Symposium were: to gain insights into how individual muscles of the upper extremities function to satisfy the mechanical demands of wheelchair propulsion, to increase the understanding of upper extremity loading, the consequences of specific wheelchair propulsion techniques and the strategies that can optimize those techniques; to gain insights in to the demands of tasks associated with wheelchair use including independent transfer tasks, and to gain insights regarding the specific biomechanical parameters in wheelchair propulsion and associated tasks that can predict the onset of shoulder pain injury in those who use a manual wheelchair.

This symposium complemented the ongoing research at Rancho Los Amigos National Rehabilitation Center and the OPTT-RERC’s focus on optimizing wheeled mobility function for individuals who are aging and use a manual wheelchair.

Disability Training in Rehabilitation Engineering

The Rehabilitation Engineering Program at Rancho Los Amigos National Rehabilitation Center is an integral part of OPTT-RERC. Our mission is to create and evaluate new assistive device technology for persons with disabilities and to recruit and train persons to become Rehabilitation Engineering professionals – including individuals with disability. Consistent with the training component of the OPTT-RERC mission, the Rehabilitation Engineering Program works in conjunction with local colleges and universities, social services, employment agencies and partner companies to assist in practical job training and employment opportunities for individuals with disability. One goal of the program is to provide a path to employment and improve quality of life for individuals with physical disabilities and from economically disadvantaged backgrounds through hands-on training in computer technologies. As several of the employees in the program are themselves individuals with disability, our training program provides a safe and supportive environment to gain practical experience in state-of-the-art assistive technologies, computer graphics and animation, and multimedia production by leveraging the technical expertise, training capacity, and activities of OPTT-RERC and the Rehabilitation Engineering Program. In the upcoming issues of Nexus, we will highlight those individuals (particularly those with a disability) who have made and are making significant contributions towards the training and capacity building goals of OPTT-RERC.



Next Issue

The next issue of “Nexus” we will feature several exciting activities from the OPTT-RERC projects and provide up-to-date news on current research and developments in the area of successful aging with disability; highlighting several topics most relevant to the nexus area of Aging, Technology, and Disability.

Contact Information

The USC/Rancho RERC on Technologies for Successful Aging with Disability titled "Optimizing Participation through Technology (OPTT-RERC)" is funded by the NIDRR grant # H133E080024. For your comments and questions, contact us at agingrerc@usc.edu



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