



HERL Newsletter

News from the Human Engineering Research Laboratories VOL 15, No 1 · JUNE 2016

A Crowdfunding Success Story

ELeVATE students funded through Pitt site

EngagePitt™

"My experience in the ELeVATE program was a life altering experience that afforded me the chance to get back on my feet after my medical separation from the United States Marine Corps after 15 years of honorable service." - Matt H., ELeVATE student

The EngagePitt™ website (<http://engage.pitt.edu/>) is the University of Pittsburgh's crowdfunding platform, where donors can make online donations to special campaigns such as those of University faculty researchers or Pitt students pursuing service projects and other experiential learning opportunities. This spring, the Human Engineering Research Laboratories successfully used the EngagePitt platform to raise \$10,000 to support two Veterans for the summer 2016 session of Experiential Learning for Veterans in Assistive Technology and Engineering (ELeVATE), a holistic transition program that supports Veterans interested in science, technology, engineering, and mathematics, or STEM, and educates faculty and staff on how to prepare Veterans for success.

The Veterans that we were able to accept into the program thanks to the donations are currently engaging in experiential learning, rehabilitation counseling, mentoring, academic preparation and career exposure activities. These components are designed to increase self-efficacy and outcome expectations which help participants achieve their performance goals as they enroll in and complete engineering and technology degree programs, and pursue a graduate degree or employment in engineering and technology.

We received 67 donations through EngagePitt, 12 of which were anonymous, and we thank each of our generous donors who are listed at <https://engage.pitt.edu/project/1718/wall>. The contributions raised through EngagePitt are helping to cover the Veterans' living stipends.

HERL continues to accept donations for the ELeVATE program at <http://giveto.pitt.edu/elevate>.

Innovation at HERL



Launched by the Office of the Provost in 2013, the Innovation Institute is the University of Pittsburgh's hub for activities that promote and foster innovation and entrepreneurship on campus and throughout the Pittsburgh region. The Institute is built on a foundation supported by education, collaboration, communication, and economic development.

HERL has benefitted greatly from the Institute's work. In April, HERL participated in the Innovation Institute's Pitt Ventures First Gear program. The First Gear program helps shape Pitt inventions originating from University research from early-stage discovery to products and services that can be taken to market. Nine teams from HERL developed go-to-market plans for their innovation throughout the six sessions of the First Gear program, and the program culminated with a judged pitch competition on April 8 that provided additional funding for a 1st place recipient, the Manual Virtual

Seating Coach team, and a 2nd place recipient, the VIP Wheelchair team.

The Manual Wheelchair Virtual Seating Coach is designed to remind people who use manual wheelchairs to shift their weight frequently in order to avoid developing pressure sores. HERL researchers previously developed a reminding system for power wheelchair users.

The VIP Wheelchair assists people with dual mobility and vision impairments. It incorporates feedback systems and control mechanisms to help visually-impaired wheelchair users avoid obstacles and drop-offs.

Visit the Innovation Institute website at <http://innovation.pitt.edu/>.

Portions of this article were taken from a blog post by Rebecca Wardle at <http://blog.innovation.pitt.edu/blog/herl-first-gear-0>.

Current Research Abstracts

Goldberg M, Karimi H, Pearlman JL, Interactive, mobile, AGile and novel education (IMAGINE): a conceptual framework to support students with mobility challenges in higher education, *Disability and Rehabilitation: Assistive Technology*, pp. 50-60, Vol. 11, No. 1, 2016.

SUMMARY: A new conceptual framework for educating students with disabilities improves learning outcomes.

Interactive, mobile, AGile and novel education (IMAGINE) is a conceptual framework to help students with disabilities (SwD) participate more in the physical space and become more engaged in school. IMAGINE recommends and reminds students, and allows them to make requests of key learning resources (LRs). The goal of IMAGINE is to provide SwD with the location and time for attending a LR that is most optimal with respect to their learning style and preference, learning performance and other activities. IMAGINE will be a means through which SwD will be provided with tailored recommendations with respect to their daily activities to improve learning outcomes. A pilot was conducted with SwD who used IMAGINE's navigation and wayfinding functionality, and the subjects reported that it aligns well with their needs. Preliminary results suggest that after completing a training and using the tool, SwD reported that they are more likely to use the tool and their participation may increase as a result. In contrast to before the trial, the SwD were also able to better describe the tool's benefits and how to improve its functionality after using the tool for four weeks.

Rice I, Dysterheft J, Bleakney AW, Cooper RA, The Influence of Glove Type on Simulated Wheelchair Racing Propulsion: A Pilot Study, *International Journal of Sports Medicine*, pp. 30-35, Vol. 37, No. 1, 2016.

SUMMARY: Solid gloves appear to provide some performance benefits over soft gloves.

Our purpose was to examine the influence of glove type on kinetic and spatiotemporal parameters at the handrim in elite wheelchair racers. Elite wheelchair racers (n=9) propelled on a dynamometer in their own racing chairs with a force and moment sensing wheel attached. Racers propelled at 3 steady state speeds (5.36, 6.26 & 7.60 m/s) and performed one maximal effort sprint with 2 different glove types (soft & solid). Peak resultant force, peak torque, impulse, contact angle, braking torque, push time, velocity, and stroke frequency were recorded for steady state and sprint conditions. Multiple nonparametric Wilcoxon matched pair's tests were used to detect differences between glove types, while effect sizes were calculated based on Cohen's d. During steady state trials, racers propelled faster, using more strokes and larger contact angle, while applying less impulse with solid gloves compared to soft gloves. During the sprint condition, racers achieved greater top end velocities, applying larger peak force, with less braking torque with solid gloves compared to soft gloves. Use of solid gloves may provide some performance benefits to wheelchair racers during steady state and top end velocity conditions.

Toro ML, Eke C, Pearlman J, The impact of the World Health Organization 8-steps in wheelchair service provision in wheelchair users in a less resourced setting: a cohort study in Indonesia, *BioMed Central*, 12 pages, Vol. 16, No. 26, 2016.

SUMMARY: WHO's wheelchair service provisions outperform wait-listed controls in less resourced settings.

Background

For people who have a mobility impairment, access to an appropriate wheelchair is an important step towards social inclusion and participation. The World Health Organization Guidelines for the Provision of Manual Wheelchairs in Less Resourced Settings emphasize the eight critical steps for appropriate wheelchair services, which include: referral, assessment, prescription, funding and ordering, product preparation, fitting and adjusting, user training, and follow-up and maintenance/repairs. The purpose of this study was to investigate how the provision of wheelchairs according to the World Health Organization's service provision process by United Cerebral Palsy Wheels for Humanity in Indonesia affects wheelchair recipients compared to wait-listed controls.

Methods

This study used a convenience sample (N=344) of Children, Children with proxies, Adults, and Adults with proxies who were on a waiting list to receive a wheelchair as well as those who received one. Interviews were conducted at baseline and a 6 month follow-up to collect the following data: Demographics and wheelchair use questions, the World Health Organization Quality of Life-BREF, Functional Mobility Assessment, Craig Handicap Assessment Recording Technique Short Form. The Wheelchair Assessment Checklist and Wheelchair Skills Test Questionnaire were administered at follow up only.

Results

167 participants were on the waiting list and 142 received a wheelchair. Physical health domain in the World Health Organization Quality of Life-BREF improved significantly for women who received a wheelchair ($p=0.044$) and environmental health improved significantly for women and men who received a wheelchair as compared to those on the waiting list ($p<0.017$). Satisfaction with the mobility device improved significantly for Adults with proxies and Children with proxies as compared to the waiting list ($p<0.022$). Only 11 % of Adults who received a wheelchair reported being able to perform a "wheelie". The condition of Roughrider wheelchairs was significantly better than the condition of kids wheelchairs for Children with proxies as measured by the Wheelchair Assessment Checklist ($p=0.019$).

Conclusions

Wheelchair provision according to World Health Organization's 8-Steps in a less-resourced setting has a range of positive outcomes including increased satisfaction with the mobility device and better quality of life. Wheelchair provision service could be improved by providing more hours of wheelchair skills training. There is a need for outcome measures that are validated across cultures and languages.

Current Research Abstracts

Candiotti J, Wang H, Shino M, Chung C, Kamaraj D, Cooper RA, Design and Evaluation of a Seat Orientation Controller during Uneven Terrain Driving, *Medical Engineering and Physics*, pp. 241-247, Vol. 38, No. 3, March 2016.

SUMMARY: The robotic MEBot wheelchair's self-leveling seat application was designed and tested.

Electric powered wheelchairs (EPWs) are essential devices for people with disabilities as aids for mobility and quality of life improvement. However, the design of currently available common EPWs is still limited and makes it challenging for the users to drive in both indoor and outdoor environments such as uneven surfaces, steep hills, or cross slopes, making EPWs susceptible to loss of stability and at risk for falls. An alternative wheel-legged robotic wheelchair, "MEBot", was designed to improve the safety and mobility of EPW users in both indoor and outdoor environments. MEBot is able to elevate its six wheels using pneumatic actuators, as well to detect changes in the seat angle using a gyroscope and accelerometer. This capability enables MEBot to provide sensing for a dynamic self-leveling seat application that can maintain the center of mass within the boundaries of the wheelchair, thereby, improving EPW safety. To verify the effectiveness of the application, MEBot was tested on a motion platform with six degrees of freedom to simulate different slopes that could be experienced by the EPW in outdoor environments. The results demonstrate the robustness of the application to maintain the wheelchair seat in a horizontal reference against changes in the ground angle.

Koontz AM, Tsai C, Hogaboom NS, Boninger ML, Transfer Component Skill Deficit Rates Among Veterans who use Wheelchairs, *Journal of Rehabilitation Research and Development*, pp. 279-293, Vol. 53, No. 2, 2016.

SUMMARY: Transfer skills were quantified in Veterans and mapped to subject characteristics.

The purpose of this study was to quantify the deficit rates for transfer component skills in a Veteran cohort and explore the relationship between deficit rates and subject characteristics. Seventy-four men and 18 women performed up to four transfers independently from their wheelchair to a mat table while a therapist evaluated their transfer techniques using the Transfer Assessment Instrument. The highest deficit rates concerned the improper use of handgrips (63%). Other common problems included not setting the wheelchair up at the proper angle (50%) and not removing the armrest (58%). Veterans over 60 yr old and Veterans with moderate shoulder pain were more likely to set up their wheelchairs inappropriately than younger Veterans ($p = 0.003$) and Veterans with mild shoulder pain ($p = 0.004$). Women were less likely to remove their armrests than men ($p = 0.03$). Subjects with disabilities other than spinal cord injury were less inclined to set themselves up for a safe and easy transfer than the subjects with spinal cord injury ($p \leq 0.001$). The results provide insight into the disparities present in transfer skills among Veterans and will inform the development of future transfer training programs both within and outside of the Department of Veterans Affairs.

Han N, Badylak S, Stearns K, Helkowski W, Yabroudi M, Sicari B, Rubin JP, Boninger ML, Ambrosio F, Electrodiagnostic evaluation of individuals implanted with extracellular matrix for the treatment of volumetric muscle injury: A case series, *Physical Therapy*, pp. 540-549, Vol. 96, No. 4, April 2016.

SUMMARY: Placing electrocellular matrices at volumetric muscle loss sites appears to improve muscle function.

Background Electrodiagnosis can reveal the nerve and muscle changes following surgical placement of an extracellular matrix (ECM) bioscaffold for treatment of volumetric muscle loss (VML).

Objective The purpose of this study was to characterize nerve conduction study (NCS) and electromyography (EMG) changes following ECM bioscaffold placement in individuals with VML. The ability of presurgical NCS and EMG to be used as a tool to help identify candidates who are likely to display improvements postsurgically also was explored.

Design A longitudinal case series design was used.

Methods The study was conducted at the McGowan Institute for Regenerative Medicine at the University of Pittsburgh. Eight individuals with a history of chronic VML participated. The intervention was surgical placement of an ECM bioscaffold at the site of VML. The strength of the affected region was measured using a handheld dynamometer, and electrophysiologic evaluation

was conducted on the affected limb with standard method of NCS and EMG. All measurements were obtained the day before surgery and repeated 6 months after surgery.

Results Seven of the 8 participants had a preoperative electrodiagnosis of incomplete mononeuropathy within the site of VML. After ECM treatment, 5 of the 8 participants showed improvements in NCS amplitude or needle EMG parameters. The presence of electrical activity within the scaffold remodeling site was concomitant with clinical improvement in muscle strength.

Limitations This study had a small sample size, and participants served as their own controls. The electromyographers and physical therapists performing the evaluation were not blinded.

Conclusions Electrodiagnostic data provide objective evidence of physiological improvements in muscle function following ECM placement at sites of VML. Future studies are warranted to further investigate the potential of needle EMG as a predictor of successful outcomes following ECM treatment for VML.

State of the Science Symposia: *Fitness and Health Outcomes: Exercise, Health and Nutrition and Global Health and Rehabilitation*

The State of the Science Symposium on Fitness and Health Outcomes: Exercise, Health, and Nutrition for Wounded, Injured, and Ill Veterans was held in Sanford Auditorium at the Uniformed Services University of the Health Sciences in Bethesda, Maryland on March 30, 2016. Presentations and speakers:

Optimizing Brain Performance - Dianna Purvis Jaffin, PhD, Brain Performance Institute

Cognitive Rehabilitation after Traumatic Brain Injury - Daniel Krawczyk, PhD, University of Texas at Dallas



Progressive Return to Activity Following Acute Concussion/Mild TBI - Katharine Stout, PT DPT NCA MBA, Defense and Veterans Brain Injury Center

What do Diffusion Tensor Imaging Abnormalities after Traumatic Brain Injury Really Mean? Radiological-Pathological Correlations and Microdialysis Studies in Mice and Humans - David L. Brody, MD PhD, Washington University School of Medicine

State of the Science of Military Human Performance Optimization - Bradley C. Nindl, PhD FACSM, University of Pittsburgh

Are We Doing As Much As We Can To Support Our Veterans? Thinking Through Mindfulness, Exercise and Nutrition - James H. Rimmer, PhD, Lakeshore Foundation/University of Alabama-Birmingham Research Collaborative

Using Nutrition to Optimize Human Performance - Kim Beals, PhD RD CSSD, University of Pittsburgh

Moving to Health: Powered by the Performance Triad - COL Deydre S. Teyhen, DPT PhD OCS, System for Health & Performance Triad, Office of the Army Surgeon General



The State of the Science Symposium on Global Health and Rehabilitation was held in Sanford Auditorium at the Uniformed Services University of the Health Sciences in Bethesda, Maryland on June 3, 2016. Presentations and speakers:

USU's Center for Global Health Engagement: Championing Innovation in GHE Research - CAPT Glen B. Diehl, Center of Global Health Engagement, Uniformed Services University

USAID's Global Rehabilitation Response - Robert Horvath, Center of Excellence on Democracy, Human Rights and Governance

Extremity Trauma and Amputation Center of Excellence Global Outreach Overview - Robert S. Gailey, PhD, Miller School of Medicine

An Immediate Fit: Transtibial Prostheses for Global Rehabilitation - Timothy R. Dillingham, MD MS, Good Shepherd Penn Partners

Coordination of the Global Wheelchair Sector: Our Goals and Progress - Jonathan L. Pearlman, PhD, University of Pittsburgh



Advantages, Challenges, and Lessons Learned on the Way to Making Appropriate Wheelchairs Available Globally - Keoke King, MBA, UCP Wheels for Humanity

The Evolution of Training and Testing for Wheelchair Service Providers - Susan Eitel, Eitel Global

Sustainable Kidney and Eye Bank Program in Guyana, South America - Rahul M. Jindal, PhD MBA, Uniformed Services University

Videos, presentations, and photos from these symposia, along with biographies of all speakers, are available on the HERL website at <http://herl.pitt.edu/education-outreach/symposia>.

HERL in the News

Awards

On April 18, the *Chronicle of Higher Education* named **Dr. Mary Goldberg** as one of 2016's Tech Innovators for her work with Veterans with disabilities in HERL's Experiential Learning for Veterans in Assistive Technology and Engineering (EL-eVATE) program. Read more at <http://chronicle.com/article/Mary-Goldberg-Helps-Disabled/235995?cid=cp35> (subscription required).

On April 26 **Dr. Rory Cooper** became the inaugural recipient of the University of Pittsburgh Innovation Institute's Marlin Mickle Outstanding Innovator Award. View the video at https://www.youtube.com/watch?v=jIY0Jbc_jcQ.

Dr. Rory Cooper was presented with the National Guard Minuteman Award on May 10 for his outstanding work with the Pennsylvania National Guard. View more at <https://is.gd/sHjX-HE>.

Dr. Michael Boninger was keynote speaker and received the Excellence in Research Award at VA Pittsburgh's Research Week kickoff on May 18. Learn more: <https://is.gd/Pycxil>.

On June 15, **Dr. Rory Cooper** received the Central Rehabilitation Clinic Humanitarian Service Award at the European Seating Symposium in Dublin, Ireland. View more at <https://is.gd/x6PrVh>.

Meet a Researcher: Jonathan Duvall



Jonathan Duvall is a PhD student in Rehabilitation Sciences at the University of Pittsburgh. He has been with HERL since he was an undergraduate intern during the summer of 2010. He received a BS in Mechanical Engineering in 2010 and a Master's in Rehabilitation Science and Technology in 2013 from the University of Pittsburgh. His research has focused on developing and evaluating assistive technologies for people with disabilities. His Master's thesis focused on developing a roughness standard for pedestrian pathways to limit harmful vibrations to wheelchair users. Based on that research, he and other members of the HERL research team founded Pathvu, a company that evaluates and tracks accessibility issues of pedestrian pathways. Jonathan's current research project is to develop and evaluate a bed scale designed for wheelchair users to be able to weigh themselves every day just by getting into and out of bed. The scale which will be able to be placed under any bed will not only obtain the weight of the occupant(s), but also monitor their movements to record sleep quality and evaluate their risk for pressure sores. He has recently been awarded a pat-

Media Mentions

HERL's **E-Scale** project was featured in the Pittsburgh Post-Gazette on May 11. Read at <http://www.post-gazette.com/business/tech-news/2016/05/11/Pittsburgh-researchers-develop-scale-to-help-people-with-mobility-issues/stories/201605100044>.

On May 13, *VA Research Currents* magazine reported on a study, co-authored by **Dr. Michael Boninger**, identifying proteins in the blood and urine that could signal a risk for pressure ulcers in patients with spinal cord injury. Read at <http://www.research.va.gov/currents/0516-1.cfm>.

Homefront Pittsburgh, an initiative of Pittsburgh's Mayor William Peduto to advance opportunities for Veterans and military families across the City of Pittsburgh, featured **Dr. Cooper** on their Facebook page on May 23. View at <https://is.gd/SDBjQ1>.

Josh Marino's review of *Grunt* by Mary Roach was published in the June issue of *Science* magazine. Read at <http://science.sciencemag.org/content/352/6290/1166.full> (subscription required).

A billboard promoting the University of Pittsburgh's research, featuring **Dr. Cooper**, was put up in June at Ross Street and 4th Avenue in Uptown Pittsburgh. View at <https://is.gd/K8kz45>.

ent for his work as an intern and has two other patent applications pending.

Jonathan was a founding member of the Students for Disability Advocacy at the University of Pittsburgh and served as President from 2012-2015. This student group is a resource for students with disabilities to share their experiences and advice with other students and to assist the Disability Resource office with diversity training and advocacy. He is also the current chair of the United States Business Leadership Network's Student Advisory Council. He has previously received the Selfless Spirit award from Pitt and the Rory A. Cooper/Dion Johnson award from the department of Rehabilitation Science and Technology. He is also a recipient of the Craig H. Neilsen Foundation scholarship for students with spinal cord injury.

Jonathan's goal is to obtain a PhD and to become a rehabilitation researcher and faculty. He hopes this career will one day lead to an appointment to the US Access Board or National Council on Disability.

Articles in press

Krishnan S, Boninger ML, Karg PE, Brienza DE, Vodovotz Y, Constantine GM, Sowa GA, Early detection of pressure ulcer development following traumatic spinal cord injury using inflammatory mediators, *Archives of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Mhatre A, Duvall J, Brown J, Grindle GG, Cooper RA, Ding D, Pearlman J, Design and Focus Group Evaluation of a Bed-Integrated Weight Measurement System for Wheelchair Users, *Assistive Technology*, Epub ahead of print, 2016.

Hiremath SV, Intille SS, Kelleher AR, Cooper RA, Ding D, Estimation of energy expenditure for wheelchair users using a physical activity monitoring system, *Archives of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Kamaraj DC, Dicianno BE, Mahajan HP, Buhari AM, Cooper RA, Stability and Workload of the Virtual Reality Based Simulator 2, *Archives of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Hogaboom NS, Huang BL, Worobey LA, Koontz AM, Boninger ML, Cross-sectional investigation of acute changes in ultrasonographic markers for biceps and supraspinatus tendon degeneration after repeated wheelchair transfers in people with spinal cord injury, *American Journal of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Dicianno BE, Glick RM, Sowa GA, Boninger ML, Processes and Outcomes from a Medical Student Research Training Program in Integrative, Complementary and Alternative Medicine, *American Journal of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Tsai C, Boninger ML, Hastings J, Cooper RA, Rice LA, Koontz AM, The Immediate Biomechanical Implications of Transfer Component Skills Training on Independent Wheelchair Transfers, *Archives of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Gartz R, Goldberg M, Miles A, Cooper RA, Pearlman J, Schmelzer M, Bittman S, Hale J, Development of a contextually appropriate, reliable, and valid basic wheelchair service provision test, *Disability and Rehabilitation: Assistive Technology*, Epub ahead of print, 2016.

Toro ML, Worobey LA, Boninger ML, Cooper RA, Pearlman J, Type and frequency of reported wheelchair repairs and related adverse consequences among people with spinal cord injury, *Archives of Physical Medicine and Rehabilitation*, Epub ahead of print, 2016.

Krishnan S, Karg PE, Boninger ML, Brienza DM, Association between Presence of Pneumonia and Pressure Ulcer Formation Following Traumatic Spinal Cord Injury, *Journal of Spinal Cord Medicine*, Epub ahead of print, 2016.



HERL Director Dr. Rory Cooper being presented the Central Rehabilitation Clinic of Dublin, Ireland "Humanitarian Service Award" at the European Seating Symposium banquet by Dr. Owen Hensey, Medical Director, CRC.

Duvall J, Sinagra E, Cooper RA, Pearlman J, Proposed Pedestrian Pathway Roughness Thresholds to Ensure Safety and Comfort for Wheelchair Users, *Assistive Technology*, In press, 2016.

Rubin P, Dziki J, Badylak S, Yabroudi M, Sicari B, Ambrosio F, Stearns K, Turner N, Wyse A, Boninger ML, Brown E, An Acellular Biologic Scaffold Treatment for Volumetric Muscle Loss: Results of a Thirteen Patient Cohort Study, *npj Regenerative Medicine*, In press, 2016.

Tsang K, Hiremath SV, Crytzer TM, Dicianno BE, Ding D, Validity of Activity Monitors in Wheelchair Users: A Systematic Review, *Journal of Rehabilitation Research and Development*, In press, 2016.

Wu Y, Liu H, Cooper RA, The Effect of Powered Seat Function Usage on Wheelchair Discomfort for Powered Wheelchair Users, *Journal of Spinal Cord Medicine*, In press, 2016.

Dicianno BE, Lovelace J, Peele P, Fassinger C, Houch P, Bursic A, Boninger ML, Effectiveness of a Wellness Program for Individuals with Spina Bifida and Spinal Cord Injuries within an Integrated Delivery System, *Archives of Physical Medicine and Rehabilitation*, In press, 2016.

Kirby RL, Worobey L, Cowan R, Pedersen JP, Heinemann A, Dyson-Hudson T, Shea M, Smith C, Rushton P, Boninger ML, Wheelchair Skills Capacity and Performance of Manual Wheelchair Users with Spinal Cord Injury, *Archives of Physical Medicine and Rehabilitation*, In press, 2016.

Crytzer TM, Hong E, Dicianno BE, Pearlman J, Schmelzer M, Cooper RA, Identifying Characteristic Back Shapes from Anatomical Scans of Wheelchair Users to Improve Seating Design, *Medical Engineering and Physics*, In press, 2016.

Pasquina PF, Isaacson BM, Johnson E, Rhoades DS, Lindholm MP, Grindle GG, Cooper RA, A Patient-Controlled Analgesia Adaptor to Mitigate Postsurgical Pain for Combat Casualties with Multiple Limb Amputation: A Care Series, *Military Medicine*, In press, 2016.

Help build the War on Terror Memorial

The Global War on Terror Memorial Foundation, founded by University of Pittsburgh students and alumni, seeks to create a memorial on the National Mall in Washington, DC for Veterans of the Global War on Terrorism. Visit them on Facebook, Twitter, and LinkedIn, or go to the website at <http://gwotmemorialfoundation.org/>. They are a 501(c)(3) nonprofit organization.

GLOBAL WAR ★ ON TERROR ★ MEMORIAL FOUNDATION



HERL Open House YOU ARE INVITED!

Human Engineering
Research Laboratories

Friday, July 29, 2016

1:00 pm - 5:00 pm

Bakery Square Office Building

6425 Penn Avenue, 4th Floor, Suite 400

Pittsburgh, PA 15206

All are welcome to attend!

No RSVP necessary.

Snacks and drinks will be provided.

Poster displays by Research Experience for
Undergraduates and Veterans (REU)
participants will be featured.

1:00 Doors open to public

1:30-2:00 Opening Remarks

• Dr. Rory Cooper, HERL Director

• Dr. Brad Dicianno, HERL Medical Director

• VA Pittsburgh Healthcare System Senior Leadership

• Michael Adelman, VISN-4 Director

2:00-5:00 Tours and Demos

4:00-4:30 REU Award Presentations

Accessibility Barriers to Performing Independent Wheelchair Transfers in the Community

The ability to transfer independently gives wheelchair users the freedom and independence to maintain an active lifestyle. Transferring can allow for more participation in community environments, including locations like swimming pools, amusement parks, and restaurants. However, not all locations in the community are built to allow for easy transfer, and certain barriers can prevent full participation.

The Americans with Disabilities Act Accessibility- Architectural Barriers Act (ADA-ABA) was developed in the 1990's to address accessibility issues for wheelchair users, including problems found when transferring. Even though several amendments have been made to these guidelines to make the community accessible, people with limited mobility still encounter many barriers when transferring. Approximately 90% of wheelchair users in the United States report some kind of activity limitations. Additionally, only 14.7% of wheelchair users report that they can effectively complete all activities of daily living. Previous research has focused mainly on identifying transfer barriers for wheelchair users in medical and health care facilities. There are other areas in the community, however, that wheelchair users express difficulties with completing transfers. These difficulties can impair their ability to participate in the activities that they need or desire to perform.

Researchers at the University of Pittsburgh have been working to identify places in the community where wheelchair users are unable to transfer or are having difficulties with performing transfers. Additionally, they are looking to identify specific features contained within an environment that may improve or hinder a person's ability to transfer. A survey was created to investigate how wheelchair users felt about transfer accessibility in various locations throughout the community. The first part of the survey asked questions about features in the community that helped or hindered transferring when in a community setting. The second part of the survey asked wheelchair users to report on how the transfer accessibility of various locations in the community influenced their participation. A final part of the survey asked about how the accessibility of seats, including toilets, medical equipment, and seats at tables, affected their community participation. The results from this survey give researchers a better idea of what areas of the community still pose accessibility problems for wheelchair users and an idea of where to focus future research efforts.

Forty one wheelchair users (28 men and 13 women) have completed the survey to date. All individuals who completed the study reported being able to transfer independently in their home and community with or without equipment such as a transfer board. The survey respondents used a manual wheelchair, power wheelchair, manual-power-assist wheelchair, or a scooter as their primary mode of mobility. They also had a wide variety of disabilities, including spinal cord injury, multiple sclerosis, traumatic brain injury, and lower limb amputation.

A majority of participants (> 58%) reported that the amount of space next to transfer surfaces that was available to maneuver and setup their wheelchair, presence of grab bars, the size and firmness of the transfer surface, amount of clearance around the transfer surface for their legs and feet and having a place to stow and easily retrieve their wheelchair after making the transfer in certain situations had an impact on their willingness to participate in community activities. The participants also reported that transfer surfaces that were higher than the seat of their wheelchair limited them and made them less likely to participate in community locations.

A large portion of the wheelchair users in this study reported transfer accessibility issues at public pools and hot tubs, dressing rooms, hotels, airplanes, salons and barber shops, amusement parks, boating areas, restaurants, and medical imaging rooms. Specific surfaces that were noted as problematic included airplane seats and toilets and restaurant seats at tables and toilets. Even though most wheelchair users reported still using airplanes despite accessibility issues, they expressed frustration about the lack of room available on planes to transfer. Exam and imaging tables, especially in magnetic resonance imaging and radiology (i.e. x-ray) rooms, were noted to have significant accessibility problems.

These pilot survey results suggest that transfer accessibility in medical facilities, restaurants, airplanes, shopping and recreational areas could be improved. Making a few design changes such as increasing the amount of space around transfer surfaces, providing supports such as grab bars around transfer surfaces, and matching up the height of transfer surfaces to the height of wheelchair user's seat may expand the types of community activities and opportunities that wheelchair users can participate in.

- Hailee Kulich, Sarah Bass, Alicia Koontz, PhD, RET



Human Engineering Research Laboratories



VA Center of Excellence for
Wheelchairs and Associated
Rehabilitation Engineering



University of Pittsburgh
School of Health & Rehabilitation Sciences
School of Medicine



University of Pittsburgh
NIDILRR Model Center on
Spinal Cord Injury



National Science Foundation
Advanced Technology
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We need Pittsburgh-area volunteers for research studies!

We're currently recruiting for the following studies
- and more!

- An Ergonomic Comparison of Wheelchairs
- Effects of Wheelchair Seat Position and Footprint Length on Ramp Propulsion Biomechanics
- Voice-controlled Intelligent Assistive Robotic Manipulation Assistance
- Participatory Evaluation of Assistive Technologies

Check <http://herl.pitt.edu/volunteer> for current studies.

ARE YOU INTERESTED IN ASSISTIVE TECHNOLOGY RESEARCH?

The Human Engineering Research Laboratories (HERL) is recruiting individuals interested in participating in research studies for the ASSISTIVE TECHNOLOGY REGISTRY.

If you would like to be notified of research studies related to assistive technology for which you may be eligible to participate, contact The Human Engineering Research Laboratories and join the Assistive Technology Registry.

This is an informational resource and notification of a study does not obligate you to participate. You do not need to be located in, nor are you required to travel to, Pittsburgh in order to participate in research studies.

If you are at least 18 years of age, and use assistive technology (e.g. wheelchair, scooter, prosthesis, etc) please contact a Clinical Coordinator at (412) 822-3700 or herlregistry@shrs.pitt.edu.

Human Engineering Research Laboratories
VA Center of Excellence
Bakery Square, Suite 400
6425 Penn Avenue, Pittsburgh, PA 15206

Contact us!

Email mil72@pitt.edu or call 412-822-3663

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Editor: Michael Lain

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