



# #HERL QUARTERLY

HUMAN ENGINEERING RESEARCH LABORATORIES  
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**PUBLICATIONS**

**ACCOLADES**

**COMMUNITY**

**NATIONAL VETERAN  
WHEELCHAIR GAMES**

**ACTIVE STUDIES**

**THANK YOU**

# PUBLICATIONS

Lafe, C. W., Liu, F., Simpson, T. W., Moon, C. H., Collinger, J. L., Wittenberg, G. F., & Urbin, M. A.

Stability of precision grip depends on the ability to regulate forces applied by the digits. Increased frequency composition and temporal irregularity of oscillations in the force signal are associated with enhanced force stability, which is thought to result from increased voluntary drive along the corticospinal tract (CST). There is limited knowledge of how these oscillations in force output are regulated in the context of dexterous hand movements like precision grip, which are often impaired by CST damage due to stroke. The extent of residual CST volume descending from primary motor cortex may help explain the ability to modulate force oscillations at higher frequencies. Here, stroke survivors with longstanding hand impairment (n = 17) and neurologically-intact controls (n = 14) performed a precision grip task requiring dynamic and isometric muscle contractions to scale and stabilize forces exerted on a sensor by the index finger and thumb. Diffusion spectrum imaging was used to quantify total white matter volume within the residual and intact CSTs of stroke survivors (n = 12) and CSTs of controls (n = 14). White matter volumes within the infarct region and an analogous portion of overlap with the CST, mirrored onto the intact side, were also quantified in stroke survivors.

Lafe, C. W., Liu, F., Simpson, T. W., Moon, C. H., Collinger, J. L., Wittenberg, G. F., & Urbin, M. A. (2023). "Force Oscillations Underlying Precision Grip in Humans with Lesioned Corticospinal Tracts." *NeuroImage: Clinical*, 103398.

Liew, S. L., Schweighofer, N., Cole, J. H., Zavaliangos-Petropulu, A., Lo, B. P., Han, L. K., ... & Thompson, P. M.

Functional outcomes after stroke are strongly related to focal injury measures. However, the role of global brain health is less clear. In this study, we examined the impact of brain age, a measure of neurobiological aging derived from whole-brain structural neuroimaging, on poststroke outcomes, with a focus on sensorimotor performance. We hypothesized that more lesion damage would result in older brain age, which would in turn be associated with poorer outcomes. Related, we expected that brain age would mediate the relationship between lesion damage and outcomes. Finally, we hypothesized that structural brain resilience, which we define in the context of stroke as younger brain age given matched lesion damage, would differentiate people with good vs poor outcomes.

Liew, S. L., Schweighofer, N., Cole, J. H., Zavaliangos-Petropulu, A., Lo, B. P., Han, L. K., ... & Thompson, P. M. (2023). Association of Brain Age, Lesion Volume, and Functional Outcome in Patients With Stroke. *Neurology*.

Stratton C, Fourtassi M, Ramia I, Pandiyan U, Cooper R, Hajjioui A, Krassioukov A, Peterson MD, Balikuddembe JK, Palomba A, Hong BY, Tripathi Dr, Tuakli-Wosornu YA, Muñoz Velasco LP.

On March 24, 2020, the Mexican Government established social distancing measures to address the outbreak of the COVID-19 pandemic. The resulting home confinement affected daily lifestyle habits such as eating, sleeping, and physical activity (PA). The objectives of this study were to determine changes in PA behaviors among Mexican women due to the COVID-19 pandemic and to assess potential factors associated with these changes.

Stratton C, Fourtassi M, Ramia I, Pandiyan U, Cooper R, Hajjioui A, Krassioukov A, Peterson MD, Balikuddembe JK, Palomba A, Hong BY, Tripathi DR, Tuakli-Wosornu YA, Muñoz Velasco LP. Changes to physical activity behavior during the COVID-19 pandemic and their associated factors: a cross sectional survey of Mexican women. *BMC Womens Health*. 2023 May 11;23(1):254. doi: 10.1186/s12905-023-02393-1. PMID: 37170080; PMCID: PMC10173915.

Hu, H., Ambadar, Z., Quinby, E., Choi, Y. K., Setiawan, I. M. A., Saptono, A., Parmanto, B., & Dicianno, B. E.

Family caregivers with continuous caregiving responsibilities are at increased risk for adverse physical and mental health outcomes. In response to the challenges of caregiving, a mobile health system (iMHere 2.0) was developed to support caregivers. The study's objective was to gather feedback from family caregivers of older adults on the current features of iMHere 2.0 and to formulate design criteria for future iterations of the system.

Hu, H., Ambadar, Z., Quinby, E., Choi, Y. K., Setiawan, I. M. A., Saptono, A., Parmanto, B., & Dicianno, B. E. (2023). The iMHere 2.0 System for Family Caregivers of Older Adults: A Focus Group. *International Journal of Telerehabilitation*, 15(1). <https://doi.org/10.5195/ijt.2023.6557>

Lafe, C. W., Liu, F., Simpson, T. W., Moon, C. H., Collinger, J. L., Wittenberg, G. F., & Urbin, M. A.

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Shantanu A. Satpute, Jorge Luis Candiotti, Jonathan A. Duvall, Hailee Kulich, Rosemarie Cooper, Garrett G. Grindle, Benjamin Gebrosky, Josh Brown, Ian Eckstein, Sivashankar Sivakanthan, Nikitha Deepak, Joshua Kanode, and Rory A. Cooper

Caregivers that assist with wheelchair transfers are susceptible to back pain and occupational injuries. The study describes a prototype of the powered personal transfer system (PPTS) consisting of a novel powered hospital bed and a customized Medicare Group 2 electric powered wheelchair (EPW) working together to provide a no-lift solution for transfers. The study follows a participatory action design and engineering (PADE) process and describes the design, kinematics, and control system of the PPTS and end-users' perception to provide qualitative guidance and feedback about the PPTS. Thirty-six participants (wheelchair users (n = 18) and caregivers (n = 18)) included in the focus groups reported an overall positive impression of the system. Caregivers reported that the PPTS would reduce the risk of injuries and make transfers easier. Feedback revealed limitations and unmet needs of mobility device users, including a lack of power seat functions in the Group-2 wheelchair, a need for no-caregiver assistance/capability for independent transfers, and a need for a more ergonomic touchscreen. These limitations may be mitigated with design modifications in future prototypes. The PPTS is a promising robotic transfer system that may aid in the higher independence of powered wheelchair users and provide a safer solution for transfers.

Satpute, Shantanu A., et al. "Participatory Action Design and Engineering of Powered Personal Transfer System for Wheelchair Users: Initial Design and Assessment." *Sensors* 23.12 (2023): 5540.



# HERL ACCOLADES



Dr. George Wittenberg spoke at the Medical University of South Carolina's (MUSC) NC NM4R Speaker series on "TMS and MRI Determine Cortical Area's Role and Connectivity as it Pertains to Motor Behavior"

Dr. Rory Cooper, the Director of the Human Engineering Research Laboratories (HERL), has been bestowed with the prestigious title of "Distinguished Eagle Scout" by the Boy Scouts of America. This illustrious accolade, reserved for individuals who have attained the esteemed rank of Eagle Scout, marks the pinnacle of recognition within the organization. Dr. Cooper's exceptional achievements were rigorously evaluated on a national level, and less than five individuals are selected annually to receive this esteemed honor. It is noteworthy that, over the past fifteen years, he stands as the sole recipient from Western Pennsylvania to be bestowed with this distinguished award. Our heartfelt congratulations are extended to Dr. Rory Cooper for this momentous accomplishment.



Dr. Rory Cooper, was honored by the Department of Veterans Affairs (VA) as one of only six distinguished research investigators. This prestigious accolade was presented during a noteworthy ceremony that signified the commencement of National VA Research Week. The VA's recognition serves as a testament to Dr. Cooper's invaluable contributions to groundbreaking research endeavors dedicated to enhancing the well-being of our esteemed veterans. For additional information on this remarkable achievement, kindly [click here](#).



Dr. Brad Dicianno has been honored with the inaugural Archives of Physical Medicine and Rehabilitation Most Downloaded Review Article Award. This esteemed recognition celebrates his exceptional paper titled "Systematic Review of Mobile Health Applications in Rehabilitation." This accolade distinguishes Dr. Dicianno's original research (review) paper as the most downloaded publication in the history of the Archives of Physical Medicine and Rehabilitation.



Dr. George Wittenberg, distinguished recipient of the prestigious Pitt Innovation Award, was honored at the grand Celebration of Innovation. This distinguished event serves as a platform to acknowledge the exceptional accomplishments of Pitt faculty and student innovators who are dedicated to enhancing the quality of life through the commercialization of their groundbreaking ideas and discoveries. We extend our heartfelt congratulations to Dr. Wittenberg for this remarkable achievement.



The Human Engineering Research Laboratories (HERL) achieved remarkable success during VA Research Week. HERL Team Member Adam Sterczala emerged victorious in the R&D abstract category with his groundbreaking study titled "Circulating Irisin Positively Correlated with Volumetric Bone Mineral Density in Men." His remarkable achievement led to his recognition as a featured presenter at the esteemed VA Pittsburgh Research Day. Additionally, HERL Team Member Dr. Hailee Kulich displayed outstanding prowess by securing first place in the poster competition for her research on the "Reliability and Validity of the Caregiver Assisted Transfer Technique."



# HERL MAKING A DIFFERENCE IN THE COMMUNITY

At the International Seating Symposium (ISS) hosted by Pitt, HERL investigators, including Sivashankar Sivakanthan, Cheng-Shiu Chung, Hailee Kulich, Ahlad Neti, Allison Brunswick, Benjamin Gebrosky, Shantanu Satpute, and Dr. Jorge Candiotti, delivered presentations on groundbreaking advancements in rehabilitation engineering. The symposium, held from April 13th to 15th, served as a platform for sharing innovative research and fostering collaboration in the field.



Dr. Cooper, member of the National Inventor Hall of Fame, had the opportunity to serve as a national judge at the Invention Convention Worldwide. This exceptional K-12 invention education program instills problem-identification, problem-solving, entrepreneurship, and creativity skills in students, fostering a lifelong confidence in invention, innovation, and entrepreneurship. During the event, Dr. Cooper inspired young inventors and presented them with personally signed trading cards from the US Patent and Trademark Office (USPTO), as well as USPTO inventor posters for their schools. Invention Convention programs span across school, local, regional, and national levels in the United States, with an increasing presence in numerous countries worldwide. The Invention Convention U.S. Nationals, held at The Henry Ford Museum (HFM), showcased the exceptional talent of student inventors selected from thousands of participants who competed in state and local invention competitions.



Dr. Cooper presented a lecture to students and faculty at the Fraunhofer Institute, the preeminent organization for applied research in Europe. With 76 institutes and research units across Germany, Fraunhofer-Gesellschaft leads the way in cutting-edge research endeavors.



Dr. Cooper served as a panelist moderated by Symone Sanders, MSNBC for the Policy and Partnership Forum organized by Easter Seals held at the National Press Club in our nation's capital. The inaugural Forum brought together lawmakers from the Administration, the House, and the Senate; representatives from the disability community; thought leaders on diversity, equity, inclusion, and accessibility; and corporate change makers to review disparities in employment, transportation, and other critical Social Determinants of Health – and discuss solutions to eliminate these barriers.



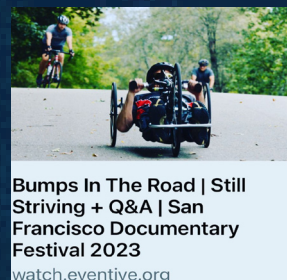
Dr. Koontz, expert in biomechanics, delivered a guest lecture at the University of Washington's Mechanical Engineering Department. The lecture centered around the critical topic of Biomechanical Risk Factors of Pain and Secondary Injury among Manual Wheelchair Users, providing valuable insights and highlighting potential intervention opportunities.

Dr. Cooper, in a remarkable display of solidarity, actively took part in the annual Washington, DC Soldier Ride, alongside wounded, injured, and ill service members. The first day entailed a momentous 20-mile ride through Annapolis, including a visit to the esteemed US Naval Academy, where Dr. Cooper had the honor of joining RADM Buck, the USNA Superintendent. The local fire and police departments worked diligently to ensure the safety of all participants. On the second day, the riders had the privilege of visiting the White House, where they received a warm welcome from Vice President Harris, Douglas Imhoff, Secretary of Interior Haaland, and esteemed leaders from federal government entities and veteran service organizations.

## HERL FEATURED IN THE PRESS



Ever since the inception of the handcycle division in 2009, Dr. Cooper has actively participated in the Pittsburgh Marathon annually. Recently, KDKA featured Dr. Cooper in a special segment, shedding light on the profound significance this event holds for him and fellow veterans. To watch the captivating segment, kindly click here.



"Bumps in the Road" is a captivating short documentary showcasing the remarkable work of HERL. We are thrilled to announce its acceptance into the esteemed San Francisco Documentary Festival 2023! Stay tuned to HERL's social media channels for updates regarding the highly anticipated premiere..

Bumps In The Road | Still Striving + Q&A | San Francisco Documentary Festival 2023  
[watch.eventive.org](https://watch.eventive.org)





Dr. Cooper and Rosemarie Cooper were in attendance at Pittsburgh's Juneteenth celebration, held at Point State Park, where they had the distinct pleasure of experiencing a captivating performance by the Jazz Ambassadors of the US Army Field Band. Additionally, they had the privilege of meeting with MAJ John Rafferty, the Chief of Public Affairs, during the event. This gathering served as a meaningful opportunity to engage with distinguished individuals and embrace the cultural significance of Juneteenth.

Congratulations to Nikitha Deepak and Dr. Garrett Grindle on their remarkable achievements! Nikitha was honored at the 2023 SHRS State of the School event for her five-year tenure, highlighting her exceptional dedication to HERL. Similarly, Dr. Garrett Grindle was recognized for his outstanding commitment spanning an impressive decade. These milestones exemplify the invaluable contributions of both individuals as esteemed members of the HERL community. We look forward to witnessing their continued excellence and growth in the years to come.

## STATE OF THE SCIENCE



HERL, the U.S. Department of Veterans Affairs, and the Uniformed Services University of the Health Sciences presented the State of the Science Symposium on "Wearable Robotics: To Enhance Performance, Reduce Injury and Facilitate Rehabilitation" on Thursday, June 15th 2023, in Bethesda, MD. The overall objective of this symposium was to provide participants with an overview regarding the current state of wearable robotic technology and its clinical utility within the field of rehabilitation medicine. The course identified ongoing novel research on the optimization of varying robotic systems that are in the prototype and clinical stages of development. To an audience of over 150 attendees, experts from Germany, Italy and the US provided lectures on exoskeletons, robotics and wearable sensory technology, among them HERL's Dr. Garrett Grindle and Mr. Shantanu Satpute. Thank you to all who attended and participated in the event.

## THE BUCKEYE WHEELCHAIR GAMES

The team from the HERL assisted with the Buckeye Wheelchair Games held at Spire Institute organized by the Ohio Chapter of the Paralyzed Veterans of America and the Cleveland Veterans Affairs Medical Center. Veterans competed using their wheelchairs in a variety of events from Archery to Wheelchair Slalom. Veterans participated from Ohio, Indiana, and Pennsylvania. HERL conducted the slalom (obstacle course events) and assisted with Table Tennis. It was great to get Veterans together for workshops and friendly competition. These events provide Veterans and families a chance to learn and grow together and highlight the strengths that come from Veteran organizations and VA working together and including the community.



## VISITORS



The University of Pittsburgh played host to the prestigious National Association of Engineering Student Councils (NAESC) Engineering Leadership Summit. HERL had the distinct privilege of welcoming NEASC students into our state-of-the-art laboratory, where we showcased our groundbreaking technologies and elucidated the significance of our research. These bright students displayed open-mindedness and posed insightful questions to our accomplished investigators. It was truly a pleasure to host them at HERL and engage in such enriching interactions.



HERL had the privilege of hosting a visit from students of the Ellis School. The students were exposed to our groundbreaking research, witnessed demonstrations of assistive devices, and gained invaluable insights into the transformative power of technology in society. This enriching experience expanded their understanding of the vital role technology plays in improving lives.



This June HERL investigators and students met with a group of student athletes for Kyrgyzstan and Rwanda, who were invited by the U.S. Department of State to participate in the Sports visitor program. The sports visitor program enhances cross cultural understanding and opens avenues of dialog between individuals and nations. HERL was one of several facilities they toured during their two weeks visit in the U.S.

## HERL OPEN HOUSE

**JULY 27TH | 2-6 PM**  
**6425 PENN AVENUE, SUITE 400**  
**PITTSBURGH, PA 15206**

Join us at HERL's Open House to explore our latest technological advancements. Engage with innovative creations and gain insights into intern projects as our REU students present their posters.

**PLEASE REGISTER BY JULY 20TH!**





# **HERL IS EXCITED TO BE BACK LIVE AT THE NATIONAL VETERAN WHEELCHAIR GAMES IN PORTLAND JULY 4-9TH!**

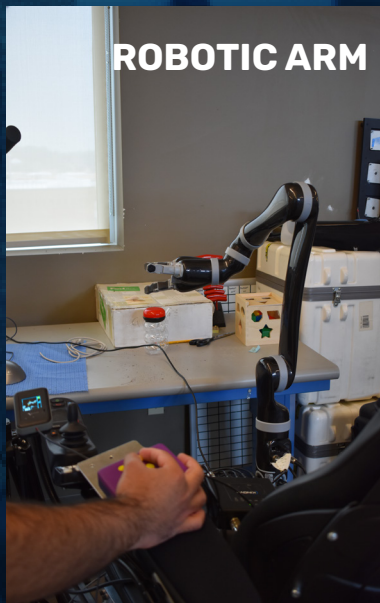
The HERL research team is looking forward to seeing you at the NVWG Adaptive Sports, Recreation and Fitness Exposition **HERL booth 117** and at our research rooms **C120-122** in the Oregon Convention Center (OCC) for your participation in our research studies

Take part in a focus group to identify mobility device users' needs, pain points, and current solutions/alternatives when using commercial airline services.



**MEBOT**

HERL will be recruiting power wheelchair users to use the MeBot and the Robotic Arm!



**ROBOTIC ARM**

Play HERL'S Transportation Board Game and give us your feed back! The game has been created to be a fun and educational board game shedding light on what obstacles a wheelchair user faces on a daily basis.



**TRANSPORTATION BOARD GAME**

**RESEARCH STUDIES WILL BE ONGOING THROUGH ENTIRETY OF THE GAMES!**



# ACTIVE STUDIES

Principal Investigator: Alicia Koontz, PhD



This study will require two visits and 12 weeks of at-home in-wheel suspension use. During your first lab visit, you will be asked to complete a standardized mobility course of various surfaces and obstacles you may encounter during daily activities of living. You could earn up to \$250 for your time!

**FOR MORE INFO ON EFFECTS OF IN-WHEEL SUSPENSION IN REDUCING VIBRATION, NECK, AND BACK PAIN STUDY CALL 412-407-2047 AND MENTION "IN-WHEEL SUSPENSION STUDY"**

The purpose of this research study is to examine how in-wheel suspension in manual wheelchairs changes vibrational exposure and how this impacts pain and fatigue.

**YOU ARE ELIGIBLE TO PARTICIPATE IF:**

- You have an SCI which occurred at least one year ago
- You use a manual wheelchair full time (>30 hours per week)
- You use a manual wheelchair with 24" or 25" quick-release wheels
- Your wheelchair does not have in-frame suspension elements
- You weigh under 265 lbs. (weight limit of suspension wheels)
- You have moderate chronic neck/ or back pain



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- Your wheelchair does not have in-frame suspension elements
- You weigh under 265 lbs. (weight limit of suspension wheels)
- You have moderate chronic neck/ or back pain

**YOU MAY NOT BE ELIGIBLE TO PARTICIPATE IF YOU:**

- Have impaired vision
- Have pressure ulcers that prevent you from sitting continuously for a long period of time

This study will be completed in six hours - either in one session or multiple sessions - and is located at our Human Engineering Research Labs (Bakery Square, 6425 Penn Ave., Suite 400, Pittsburgh, PA, 15206). Participants will receive \$25 per hour and up to \$150 for completing the study.

**INTERESTED IN THE ROBOTIC ARM STUDY? CALL 412-822-3705 FOR MORE INFORMATION**

Principal Investigator: Rory Cooper, PhD



This research study will collect feedback from rehabilitation professionals and caregivers on the PPTS transfer process and the new custom seating system.

**YOU MAY BE ELIGIBLE TO PARTICIPATE IF YOU ARE:**

- Are over the age of 18 years.
- Weigh less than 250 pounds (weight limit of device).
- Fit in an 18-inch-wide and 18-inch-deep seat.
- Are a rehabilitation professional (therapists, caregivers, physicians, nurses, attendants and aides) with experience transferring adults with complex disabilities who use Electric Power Wheelchair (EPW)

**PARTICIPANTS WILL BE ASKED TO:**

- Transfer a rescue dummy from the EPW to the bed using PPTS.
- Compare the test wheelchair with the original manufacturer's seating by maneuvering the wheelchairs through a few obstacles and evaluating them through a series of questionnaires.
- Complete additional testing of the PPTS which will involve evaluating the transfer process, if needed.

The study will take one visit lasting no longer than three hours. Participants may be compensated up to \$80 for completing the study. Location: Human Engineering Research Laboratories (Bakery Square, 6425 Penn Ave., Suite 400, Pittsburgh, PA, 15206). CALL 412-417-7923 for more information!

**THE PPTS STUDY IS ACCEPTING PARTICIPANTS THROUGH APRIL 2023!**

Principal Investigator: Alicia Koontz, PhD



This is a research study conducted by the University of Pittsburgh. The purpose of this study is to examine the Caregiver Assisted Transfer Technique Instrument (CATT), which has been developed as a tool to assess proper technique of caregivers who provide transfer assistance to individuals with physical disabilities.

**YOU MAY BE ELIGIBLE TO PARTICIPATE IF YOU ARE:**

- Over the age of 18 years old
- Routinely provides transfer assistance to an adult with a physical disability for at least two years
- Served as a caregiver for at least three months
- Have no formal training on assisted transfer techniques

This study will require two visits for care recipients and up to four visits for caregivers, and you will have the option to participate remotely in your home. For the first visit, you will be asked to complete surveys and perform routine transfers to be evaluated. For the second visit you will be asked to perform the same transfer procedures as visit one. Visits three and four for caregivers involve completing an online assessment of their transfer skills. Care recipients could earn up to \$50 and caregivers could earn up to \$100 for participation in the study. Caregivers will be given the opportunity to participate in an option sensor portion of the study for an additional \$50.

**THE CAREGIVER ASSISTED TRANSFER TECHNIQUE (CATT) STUDY IS ACCEPTING PARTICIPANTS THROUGH DECEMBER 2023!**



# A THANK YOU TO OUR PARTICIPANTS!

Thank you to all research participants who have volunteered their time to participate in our HERL studies! We value the contributions and loyalty to HERL and we look forward to continued participation in HERL research activities.

Our mission here at HERL is to continuously improve the mobility and function of people with disabilities through advanced engineering in clinical research and medical rehabilitation and our vision is to create a world where all people with disabilities have unencumbered mobility and function so that they can fully participate in and contribute to society. Without all your support and donations, HERL wouldn't be what is without you today and for that we thank you!

**RORY COOPER, PHD**  
Director

**BRAD DICIANNO, MD**  
Medical Director

**ALICIA KOONTZ, PHD, RET**  
Senior Associate Director for Research

**ROSEMARIE COOPER, MPT**  
Associate Director for Stakeholder Engagement

**GARRET GRINDLE, PHD**  
Associate Director for Engineering

**BARB KLIPA, MBA**  
Assistant Director for Finance & Research Administration

**GINA MCKERMAN, PHD**  
Assistant Director for Data Science

**D. JOSHUA MARINO, MS, ATC**  
Assistant Director for Education and Outreach

**NIKITHA DEEPAK, MS**  
Assistant Director for Research Coordination and Regulatory Compliance

## THANK YOU

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VA Office of Research and Development  
VA Pittsburgh Healthcare System



University of Pittsburgh



National Institute on Disability, Independent Living and Rehabilitation Research



National Science Foundation



US Department of Transportation – University Transportation Center



Paralyzed Veterans of America



Scan to follow HERL's social media!

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