Research In Focus: A Weekly Digest of
New Research from the NIDILRR Community

Robotic Exoskeletons May Provide Health Benefits for People with Spinal Cord Injuries

A study funded by the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR).

A spinal cord injury (SCI) is damage anywhere along the spinal cord from an accident or other trauma. People with SCI may have partial or total paralysis, especially in their leg muscles. Robotic exoskeletons are wearable devices that provide hip and knee motion with an external power source, allowing the user to stand upright and walk limited distances. An exoskeleton often consists of a frame surrounding the torso or waist and hinged braces strapped to the legs. It is usually powered by a battery pack, providing several hours of power-assisted movement. This emerging technology is currently in limited use in rehabilitation clinics and research centers across the US. In a recent NIDILRR-funded study, researchers wanted to find out the types of settings in which therapists and patients worked with exoskeletons, the perceived benefits and risks of exoskeleton use, and what recommendations the therapists had for improving exoskeleton design.

Researchers at the Spinal Cord Injury Model System (SCIMS) Centers in Colorado, Georgia, Illinois, and Texas held focus groups with 30 therapists working at 4 affiliated rehabilitation centers. Most of the participants were physical, exercise, or recreational therapists, and all had training in the use of robotic exoskeletons with patients with SCI. During the focus groups, the therapists were asked to describe the settings in which they used exoskeletons with their patients and the procedures they followed. The therapists were also asked to describe their observations of what their patients expected from exoskeletons, the benefits they and their patients perceived from exoskeleton use, and the observed or potential risks of exoskeleton use. Finally, the therapists were asked about design enhancements that they would recommend to exoskeleton manufacturers.

The researchers found that the therapists at all 4 SCIMS centers used robotic exoskeletons mainly in outpatient and community wellness settings. The therapists reported that patients could learn to use the robotic exoskeleton proficiently in about 20-30 sessions, where they practiced standing, stepping, and gait training with the aid of one or more therapists or trainers.

Regarding benefits and risks of exoskeletons, the therapists reported that many patients found the exoskeletons motivating and exciting. They observed that patients who gained the ability to stand and walk with an exoskeleton often developed better endurance, improved their bowel and bladder control, and were less likely to develop urinary tract infections. The therapist also reported that some patients described psychological benefits from standing eye-to-eye with conversation partners and participating in more activities by regaining the ability to walk. However, the therapists

also identified some risks to exoskeleton use including a risk of falling, skin sores from repeated contact with the exoskeleton, or patient disappointment with the limits of the technology.

Finally, the therapists suggested some design enhancements to make the exoskeletons safer and more user-friendly. These suggestions included reducing the weight and bulk of the exoskeletons, adding greater adjustability, improving durability, adding one-handed controls, optimizing the exoskeletons for use on stairs or uneven terrain, and allowing the user to balance without arm support.

The authors noted that robotic exoskeletons may be highly motivating for people with SCI, and they may offer several physical and psychosocial health benefits. However, these exoskeletons may not always meet patients' expectations, and their use may incur risks of falls or other complications. As robotic exoskeleton technology develops, design enhancements may increase their safety and versatility. The authors noted that therapists may benefit from more standardized training and guidance on the optimal use of exoskeletons in SCI rehabilitation. Future research may be useful to examine the strengths and limitations of robotic exoskeletons as the technology evolves over time.

To Learn More

The Model Systems Knowledge Translation Center (MSKTC) offers a large collection of factsheets, videos, and research summaries on SCI, including this factsheet on SCI and Gait Training: https://msktc.org/sci/factsheets/Gait-Training-and-SCI

Learn more about research in robotics and rehabilitation by visiting the Rehabilitation Engineering Research Center for Wearable Robotics: http://centers.njit.edu/rehabilitation/projects-0/

To Learn More About this Study

Heinemann, A.W. et al. (2018) Experience of robotic exoskeleton use at four spinal cord injury model systems centers. Journal of Neurologic Physical Therapy, 42(4), 256-267. This article is available from the NARIC collection under Accession Number J79746.

Research In Focus is a publication of the National Rehabilitation Information Center (NARIC), a library and information center focusing on disability and rehabilitation research, with a special focus on the research funded by NIDILRR. NARIC provides information, referral, and document delivery on a wide range of disability and rehabilitation topics. To learn more about this study and the work of the greater NIDILRR grantee community, visit NARIC at www.naric.com or call 800/346-2742 to speak to an information specialist.

NARIC operates under a contract from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR), Administration for Community Living, Department of Health and Human Services, contract #GS-06F-0726Z.