

# Recovery of Function After Acquired Neurological Injury

Sook-Lei Liew, Amit Sethi, Jaclyn Stephens, Michelle Woodbury

The articles in this Special Issue on Recovery of Function After Neurological Injury include an impressive range of clinical diagnoses, scientific approaches, and theoretical frameworks that demonstrate the breadth and depth of occupational therapy in the restoration of function after neurological injury. An emerging theme throughout is the need for the profession of occupational therapy to identify and use more efficient methods for diagnosing and treating people with neurological injuries to improve their quality of life and the impact of care.

Liew, S.-L., Sethi, A., Stephens, J., & Woodbury, M. (2024). Recovery of function after acquired neurological injury. *American Journal of Occupational Therapy*, 78, 7802070010. <https://doi.org/10.5014/ajot.2024.050758>

Recent medical advances have improved mortality rates for many acquired neurological disorders, such as stroke (Lackland et al., 2014) and traumatic brain injury (Khellaf et al., 2019). However, this has resulted in a growing population living with long-lasting impairments that affect their quality of life. The field of occupational therapy is uniquely positioned to address all aspects of recovery, from recovery of body functions and structures, to recovery of functional activities, to recovery of participation, which spans the entire continuum laid out by the *International Classification of Functioning, Disability and Health* (ICF; World Health Organization [WHO], 2001). Occupational therapists are also equipped to consider the many complex interactions between these levels as well as transactional interactions among the person, occupation, and environment. Throughout the years, occupational therapy's scope of practice has focused on each of these three levels when working with people with neurological injuries, with previous practice

guidelines focusing more heavily on addressing the recovery of body structures and functions and treating impairment. However, the most recent 2023 Practice Guidelines for Stroke emphasize the distinct value of occupational therapy to occupational performance and participation, stating:

In keeping with the philosophy of occupational therapy and the *International Classification of Functioning, Disability and Health: Children and Youth Version* (WHO, 2007) and the evolution of the literature since the last practice guidelines, the primary focus of these guidelines has shifted from impairment to occupational performance and participation. Therefore, the focus here is solely on ADLs, IADLs, and participation outcome measures, not impairment outcome measures (e.g., Modified Ashworth Scale [Bohannon & Smith, 1987], Fugl-Meyer Assessment [Fugl-Meyer et al., 1975; Gladstone et al., 2002]) or upper limb function (e.g., Action Research Arm Test [Lyle, 1981], Wolf Motor Function Test [Wolf et al., 2005]). (Hildebrand et al., 2023)

This renewed focus on occupational performance and participation,

versus body structures and functions, reflects a growing awareness that client-centered care should prioritize functional recovery over treating impairment, because this reflects the client's priorities and concerns. This change in emphasis aligns with more recent proposals suggesting alternative ICF models that acknowledge the inherent complexity of "teasing apart" impairment, function, and participation. Newer models intertwine or embed these levels in one another (Heerkens et al., 2018). For instance, Heerkens et al. (2018) proposed an ICF scheme in which participation is the central focus of functioning and all levels are further embedded in the greater context of the environment. After reflecting on this point as well as the articles in this [Special Issue on Recovery of Function After Neurological Injury](#), we hypothesize that focusing on participation, rather than impairment, might be a holistic way to encourage recovery across all levels; that is, engaging a client in participation as the primary objective may illuminate areas of impairment or function

that need improvement. Focusing on the impairment or functions that will support participation, in the context of occupational participation, may thus be more motivating than initially focusing on impairment. This will allow occupational therapists to leverage research that is targeted at improving impairments or specific functions to ultimately improve occupational performance and participation holistically.

We next posit that, although clinical care may benefit from focusing primarily on occupational performance and participation, occupational therapy research should continue to address all three levels of the *ICF*, because recovery at each level is critical for functional improvements. We believe that the articles in this Special Issue reflect this sentiment. Although each article focuses on a specific domain, such as measurement, assessment, impairment, or intervention, the authors all recognize that their work contributes to a larger effort to promote improved occupational performance, participation, and quality of life. The articles presented in this Special Issue reflect an impressive range of clinical diagnoses, scientific approaches, and theoretical frameworks, demonstrating the breadth and depth of occupational therapy's involvement in the restoration of function after neurological injury. These articles demonstrate that occupational therapy research not only spans the wide range of the *ICF* but also varies widely in methodology (e.g., from descriptive studies, to studies of assessment and measurement, to intervention studies) and populations treated (e.g., individuals with stroke, TBI, acquired brain injury, and cerebral palsy). An emerging theme throughout these articles is the need for occupational therapists to identify and use more efficient methods for diagnosing and treating people with neurological injuries to improve the quality and impact of care. To accomplish this, many occupational therapy research groups are turning to

technology, given the increased accessibility of many low-cost wearable technologies, accelerometers, video capture devices, telerehabilitation platforms, and more, which are reflected in the included articles. In the following sections, we summarize the articles in this Special Issue by focus area: descriptive studies of neurological injury, assessment and measurement of injury, and, finally, interventions after neurological injury.

### Descriptive Studies

Despite the need for more efficient and effective methods, occupational therapy has shown—in research and practice—its ability to support meaningful client outcomes through a focus on occupation. In the descriptive studies included in this Special Issue, researchers, such as Brown et al. (2024), Boone, Henderson, and Zenoozi (2024), Boone, Perry, and Henderson (2024), and Nam et al. (2024), either explicitly focus on occupational identity or occupational performance and satisfaction, whereas others, like Schurr et al. (2024), Davidson et al. (2024), and Dexheimer et al. (2024), expertly link issues with body structures and functions (e.g., visual deficits) to functional outcomes or occupational performance and satisfaction. Our profession's focus on occupation arguably sets us apart from our interdisciplinary colleagues, but our ability to conduct research across levels of the *ICF* makes us excellent partners in team science, given that many disciplines study body structures and function, but fewer work to meaningfully link them—in research or practice—to everyday occupations and overall health and well-being.

### Measurement and Assessment Studies

Building on this, the effect and value of a clinical or research program are defined by the tools chosen to measure outcomes. This Special Issue showcases several measurement tools, both new and

old, that address several challenges facing neurorehabilitation occupational therapists. One measurement challenge is the quantification of real-world home and community skills. Srinivasan et al. (2024) demonstrate that wrist-worn accelerometers can provide meaningful information about patterns of bilateral arm use that may enable measurement of skill generalization from clinic to home. Similarly, Proffitt et al. (2024) demonstrate that data collected from an in-home motion sensor can be analyzed with a custom machine learning algorithm to detect in-home activity levels and quality of arm movement.

Another measurement challenge is the quantification of complex behavioral constructs such as self-awareness or flow state. Ricchetti et al. (2024) show that the psychometric properties of a new self-awareness assessment tool are excellent and support the use of this tool for patients with acquired brain injury. Relatedly, Ottiger et al. (2024) showcase a brand-new questionnaire that can detect a client's flow state during stroke rehabilitation sessions, thereby monitoring engagement to optimize outcomes.

Finally, a well-known measurement challenge is therapists' hesitancy to use existing assessments in clinical practice. Reasons for this hesitancy were elucidated in a survey conducted by Gasque et al. (2024). To further encourage the use of novel methods, Lee et al. (2024b) show the advantages of using machine learning to shorten an existing patient-reported assessment that is widely used but lengthy. Grattan et al. (2024) argue that some existing assessments, even if considered gold standard, may not always provide accurate measurements. The authors highlight the incongruity between assessment scores that suggest no presence of spatial neglect versus patient-reported experiences that suggest the opposite. Together, this collection of articles covers an intriguing range of topics that

address measurement challenges faced by occupational therapists who study or care for people with neurological injury.

## Intervention Studies

Growing evidence from multiple systematic reviews by Bell et al. (2024), Lee and Howe (2024), and Kiriakou and Psychouli (2024) included in this Special Issue support the effectiveness of various occupation-based intervention approaches (e.g., the Cognitive Orientation to daily Occupational Performance, activity-based task-oriented training, and virtual reality) to improve occupational performance after stroke and acquired brain injury. In addition, this Special Issue highlights the role of interventions ranging from alternative and complementary techniques (e.g., yoga) to novel and sophisticated technologies (e.g., noninvasive spinal cord stimulation and telehealth biofeedback) to improve occupational performance in people with neurological conditions. This suggests that new cutting-edge interventions are emerging within occupational therapy, thereby offering innovative approaches to enhance clients' functional abilities and quality of life.

## Conclusion

Together, the articles in this Special Issue reflect the enormous breadth and depth of research occurring across all ICF levels, with the end goal of restoring meaningful occupational performance and participation to people with neurological injuries. On the basis of this, we suggest that there are critical, and complementary, roles for occupational therapists to be involved in at all three levels of the ICF framework, in particular in research. For example, research on neural and physiological mechanisms of recovery after brain injury provide an important foundation for understanding how the brain repairs after injury, what factors are critical for this recovery, and what biomarkers might predict

recovery or response to treatments. This information, in turn, can be used to inform clinical decision-making to choose the therapy that is most likely to support functional recovery for each person, even when the focus of therapy is on participation. In addition, although physiological mechanisms may be mostly directly related to impairment, they are important foundations for recovery of function and improving participation. For instance, Davidson et al. (2024) highlighted how stroke negatively affects cardiovascular function, which then influences occupational performance and participation. Thus, an occupation-based intervention that improves cardiovascular function would also likely enhance participation in stroke survivors. Indeed, in practice, therapists may still consider all ICF levels at once even if their focus is on occupational performance and participation. Fortunately, occupational therapy research—like that which is included in this Special Issue—provides a wide base of knowledge upon which we can improve assessments and interventions to enhance the recovery of function for clients after acquired neurological injury. 🧠

## References

- Allen, J. R., Karri, S. W., Yang, C., & Stoykov, M. E. (2024). Spinal cord stimulation for poststroke hemiparesis: A scoping review. *American Journal of Occupational Therapy*, 78, 7802180220. <https://doi.org/10.5014/ajot.2024.050533>
- Bell, J., Decker, B., Eichmann, A., Palkovich, C., & Reji, C. (2024). Effectiveness of virtual reality for upper extremity function and motor performance of children with cerebral palsy: A systematic review. *American Journal of Occupational Therapy*, 78, 7802180180. <https://doi.org/10.5014/ajot.2024.050374>
- Boone, A. E., Henderson, W. L., & Zenoozi, S. (2024). Surveying the landscape of persistent concussive symptoms in adults through an occupational lens. *American Journal of Occupational Therapy*, 78, 7802180190. <https://doi.org/10.5014/ajot.2024.050405>
- Boone, A. E., Perry, C., & Henderson, W. L. (2024). Addressing participation in adults

- with postconcussive symptoms with cognitive strategy training: A feasibility trial. *American Journal of Occupational Therapy*, 78, 7802180080. <https://doi.org/10.5014/ajot.2024.050396>
- Brown, A., Barth, D. C., & Leslie, A. R. (2024). "You're someone different now": An autoethnography on identity and occupational identity disruption after traumatic brain injury. *American Journal of Occupational Therapy*, 78, 7802180110. <https://doi.org/10.5014/ajot.2024.050411>
- Chen, P.-T., & Chiu, E.-C. (2024). Reablement of instrumental activities of daily living for patients with stroke: A randomized crossover trial. *American Journal of Occupational Therapy*, 78, 7802180160. <https://doi.org/10.5014/ajot.2024.050288>
- Davidson, S., Bischof-Bockbrader, A., Zimmerman, E., Rosenfeldt, A. B., Alberts, J. L., & Linder S. M. (2024). Characterizing heart rate response during upper extremity repetitive task practice in chronic stroke. *American Journal of Occupational Therapy*, 78, 7802180240. <https://doi.org/10.5014/ajot.2024.050478>
- Dexheimer, B., Sainburg, R., Sharp, S., & Philip, B. A. (2024). Roles of handedness and hemispheric lateralization: Implications for rehabilitation of the central and peripheral nervous systems: A rapid review. *American Journal of Occupational Therapy*, 78, 7802180120. <https://doi.org/10.5014/ajot.2024.050398>
- Donnelly, M. R., Marin-Pardo, O., Abdullah, A., Phanord, C., Kumar, A., Chakraborty, S., Liew, S.-L. (2024). Preimplementation analysis of the usability and acceptability of a poststroke complex telehealth biofeedback intervention. *American Journal of Occupational Therapy*, 78, 7802180210. <https://doi.org/10.5014/ajot.2024.050501>
- Gasque, H., Morrow, C., Grattan, E., & Woodbury, M. (2024). Understanding occupational therapists' knowledge and confidence when assessing for unilateral neglect. *American Journal of Occupational Therapy*, 78, 7802180140. <https://doi.org/10.5014/ajot.2024.050354>
- Grattan, E. S., Hounshel Smit, B., Mullen, K., & Woodbury, M. L. (2024). Unilateral spatial neglect may not be detected by performance-based functional neglect assessment. *American Journal of Occupational Therapy*, 78, 7802180200. <https://doi.org/10.5014/ajot.2024.050497>
- Grieb, E. J., Schmid, A. A., Riggs, N. R., & Stephens, J. A. (2024). Executive function after yoga: Adults with acquired brain injury—A pilot study. *American Journal of Occupational Therapy*, 78, 7802180130. <https://doi.org/10.5014/ajot.2024.050403>
- Heerkens, Y. F., de Weerd, M., Huber, M., de Brouwer, C. P. M., van der Veen, S., Perenboom, R. J. M., ... van Meeteren,

- N. L. U. (2018). Reconsideration of the scheme of the *International Classification of Functioning, Disability and Health*: Incentives from the Netherlands for a global debate. *Disability and Rehabilitation*, 40, 603–611. <https://doi.org/10.1080/09638288.2016.1277404>
- Hildebrand, M. W., Geller, D., & Proffitt, R. (2023). Occupational Therapy Practice Guidelines for Adults With Stroke. *American Journal of Occupational Therapy*, 77, 7705397010. <https://doi.org/10.5014/ajot.2023.077501>
- Khellaf, A., Khan, D. Z., & Helmy, A. (2019). Recent advances in traumatic brain injury. *Journal of Neurology*, 266, 2878–2889. <https://doi.org/10.1007/s00415-019-09541-4>
- Kiriakou, A., & Psychouli, P. (2024). Effects of the CO-OP approach to addressing the occupational performance of adults with stroke: A systematic review. *American Journal of Occupational Therapy*, 78, 7802180010. <https://doi.org/10.5014/ajot.2024.050131>
- Lackland, D. T., Roccella, E. J., Deutsch, A. F., Fornage, M., George, M. G., Howard, G., ... Council on Quality of Care and Outcomes Research, Council on Functional Genomics and Translational Biology. (2014). Factors influencing the decline in stroke mortality: A statement from the American Heart Association/American Stroke Association. *Stroke*, 45, 315–353. <https://doi.org/10.1161/01.str.0000437068.30550.cf>
- Lee, C.-Y., & Howe, T.-H. (2024a). Extremity recovery for adults with stroke: A systematic review. *American Journal of Occupational Therapy*, 78, 7802180070. <https://doi.org/10.5014/ajot.2024.050391>
- Lee, S.-C., Chou, C.-Y., Chen, P.-T., Wu, T.-Y., Hsueh, I.-P., and Hsieh, C.-L. (2024b). Validation of the Machine Learning–Based Stroke Impact Scale with a cross-cultural sample. *American Journal of Occupational Therapy*, 78, 7802180060. <https://doi.org/10.5014/ajot.2024.050356>
- Lin, Y.-N., Hung, T.-H., Rodakowski, J., Kang, J.-H., Han, D.-S., Liou, T.-H., ... Chang, F.-H. (2024). Development of a dyad-focused intervention for stroke survivors and their family caregivers: A feasibility study. *American Journal of Occupational Therapy*, 78, 7802180230. <https://doi.org/10.5014/ajot.2024.050571>
- Nam, S., Reistetter, T. A., & Hong, I. (2024). Longitudinal association of health satisfaction with functional status and income satisfaction in stroke survivors. *American Journal of Occupational Therapy*, 78, 7802180170. <https://doi.org/10.5014/ajot.2024.050410>
- Ottiger, B., Veerbeek, J. M., Cazzoli, D., Nyffeler, T., & Vanbellingen, T. (2024). The Flow State Scale for Rehabilitation Tasks: A new flow experience questionnaire for stroke patients. *American Journal of Occupational Therapy*, 78, 7802180030. <https://doi.org/10.5014/ajot.2024.050401>
- Proffitt, R., Rasmussen, K.-A. M., Ma, M., & Skubic, M. (2024). An algorithm for activity recognition and assessment of adults poststroke. *American Journal of Occupational Therapy*, 78, 7802180090. <https://doi.org/10.5014/ajot.2024.050407>
- Ricchetti, G., Navarro-Egido, A., Rodríguez-Bailón, M., Salazar-Frías, D., Merchán-Baeza, A., Ariza-Vega, M. P., & Funes, M. J. (2024). The Breakfast and Dressing Conflict Task: Preliminary evidence of its validity to measure online self-awareness after acquired brain injury. *American Journal of Occupational Therapy*, 78, 7802180020. <https://doi.org/10.5014/ajot.2024.050346>
- Schurr, S., Foy, C., Polonenko, T., & Scheiman, M. (2024). Comparison of visual symptom frequency and occupational issues between patients with and without concussion. *American Journal of Occupational Therapy*, 78, 7802180040. <https://doi.org/10.5014/ajot.2024.050353>
- Srinivasan, S., Amonkar, N., Kumavor, P. D., & Bubela, D. (2024). Measuring upper extremity activity of children with unilateral cerebral palsy using wrist-worn accelerometers: A pilot study. *American Journal of Occupational Therapy*, 78, 7802180050. <https://doi.org/10.5014/ajot.2024.050443>
- Weaver, J. A., Richard, A. K., Press, D., Gupta, K., Schmid, A. A., & Stephens, J. A. (2024). Participants with acquired brain injury realized they “could still do things” after a yoga intervention: A qualitative descriptive study. *American Journal of Occupational Therapy*, 78, 7802180150. <https://doi.org/10.5014/ajot.2024.050409>
- World Health Organization. (2001). *International classification of functioning, disability and health*. <https://www.who.int/standards/classifications/international-classification-of-functioning-disability-and-health>
- World Health Organization. (2007). *International classification of functioning, disability and health: Children and youth version*. [https://iris.who.int/bitstream/handle/10665/43737/9789214547321\\_eng.pdf](https://iris.who.int/bitstream/handle/10665/43737/9789214547321_eng.pdf)

---

**Sook-Lei Liew, PhD, OTR/L**, is Associate Professor and Director, PhD Program in Occupational Science, Chan Division of Occupational Science & Occupational Therapy, University of Southern California, Los Angeles.

**Amit Sethi, PhD, OTR/L**, is Associate Professor and Director, Masters of Science Program in Occupational Therapy, Department of Occupational Therapy, School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA; [asethi@pitt.edu](mailto:asethi@pitt.edu)

**Jaclyn Stephens, PhD, OTR**, is Associate Professor, Health and Exercise Science Department, Colorado State University, Fort Collins.

**Michelle Woodbury**, is Professor and Director, Online Post-Professional OTD Program, Department of Health Science and Research Division of Occupational Therapy, Medical University of South Carolina, Charleston.