



**Category:** Clinical Application of Technology

**Workshop Title:** Applications of Wearable Technology in Rehabilitation: Measuring and Restoring Function in Our Patients

**Workshop Organizer(s):** Megan K. O'Brien

**In person Speaker(s):**

- O'Brien, Megan K., Shirley Ryan AbilityLab / Northwestern University
- Jayaraman, Arun, Shirley Ryan AbilityLab / Northwestern University
- Wen, Yue, Shirley Ryan AbilityLab
- Pons, Jose L., Shirley Ryan AbilityLab / Northwestern University

**Virtual Speaker(s):** Yue Wen

**Workshop Time:** 13:45 - 15:15

**Attendee Engagement:**

The primary goal of this workshop is to generate discussion about meaningful use cases of wearable technology in rehabilitation practice and research. The workshop will be designed for a multidisciplinary audience, particularly intending to open a dialogue between clinicians and scientists/engineers about the utility and design of wearable systems in a real-world rehabilitation setting.

Each speaker will create live audience polls to gauge the opinions of attendees regarding the clinical relevance and feasibility of these technologies for different patient populations. We will also create handouts for a brainstorming session about wearable sensor measures, during which small groups will make a "wishlist" of data that could be collected in the clinic and community, and how this data could be leveraged to inform their clinical care or research. This will inform a larger group discussion about current unmet needs in rehabilitation measurement and whether/how wearable sensors could meet these needs.

**Abstract:**

Wearable sensor technology shows tremendous promise to monitor patients unobtrusively, objectively, and continuously in the clinic and community. Wearable technology also supports the transition from rigid robotics to neuroprosthetics. Recently, there has been an explosion of interest in recording and analyzing biophysical data from wearable sensors – for example, to quantify impairment or to identify biomarkers of disease and recovery, and then close the loop with neuromodulatory strategies. However, there is still hesitancy and nescience on how exactly to implement these data in clinical practice, trials, or studies, and on how to propose robust and safe closed-loop interventions.

In this workshop, we will first explore the rapidly evolving landscape of wearable sensors that can record motion, cardiovascular, muscle, vital signals, and more. These signals can be analyzed to obtain insight into disease and recovery (e.g., to track precise changes in body function and ability,



or to integrate in downstream healthcare practices such as disease diagnosis, discharge planning, and preventative care). However, extracting relevant information from sensors is not as simple as placing them on patients and acquiring the data. This process requires the efficient translation of raw sensor data to clinically meaningful output, with a systematic approach to data validation and interpretation.

We will also show a breadth of wearable technology applications in inpatient and outpatient rehabilitation, including different analytical methods to obtain the desired measurements (e.g., signal processing and machine learning algorithms) and different neuromodulatory methods to improve motor outcomes. We will also present specific challenges with developing these methods and pitfalls to be avoided. At the end of the workshop, attendees will have a roadmap for the thoughtful design and practical implementation of wearable technology in rehabilitation.