

Multi-sensor band quickly and simply records subtle changes in patients with multiple sclerosis

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Multiple sclerosis (MS) is a progressive, chronic disorder in which the body's immune system attacks the central nervous system, resulting in multiple adverse effects, from numbness, fatigue and impaired speech to loss of muscle control and vision. There is no cure for MS; treatment focuses upon managing symptoms and slowing progression.

As a result, the ability to precisely assess the extent of MS-related disability and disease advancement is critical to effective treatment. In a new study, published in the February 26, 2020 online issue of *Annals of Clinical and Translational Neurology*, an international team of scientists, led by researchers at University of California San Diego School of Medicine, describe a new, multi-sensor tool that measures subtle changes in MS patients, allowing physicians to more frequently and more quickly respond to changes in symptoms or patient condition.

"We currently lack reliable measures of subtle MS disability progression over short time intervals," said senior study author Jennifer Graves, MD, Ph.D., a neurologist at UC San Diego Health and associate professor of neurosciences at UC San Diego School of Medicine.

"For example, a patient may tell us that that she can no longer play piano, but our 150-year-old bedside neurological exam techniques can't quantify this. In a standard clinical trial, this patient would be rated stable and not progressing. Developing tools that can capture MS progression reliably within six to 12 months instead of three to five years will drive faster drug development for the most disabling forms of MS."

MS affects approximately 1 million persons in the United States and 2.5 million worldwide. The cause is unknown, but the condition, which

typically appears between the ages of 20 and 40, is more common in women. MS is one of the most common causes of non-traumatic disability among young and middle-aged adults.

Traditional assessment of MS has involved periodic clinical exams, which may only produce actionable findings over the course of several years. There are no tools to measure smaller, more subtle changes in the disease that may happen in shorter intervals.

The new device employs a combination of sensors, such as accelerometers, gyroscopes and surface electromyography (which records nerve electrical impulses using electrodes placed on the skin), that have been repurposed from commercial uses.

"The use of multi-sensors allows for use of complementary data-types that can be employed for a more comprehensive view of the movement," said Graves. "The types of sensors we used are widely available in different hardware products. We used a product that could be purchased off Amazon and was originally used for gaming and other gesture control tasks. The critical steps in our work involved the data processing and analyses, including use of artificial intelligence approaches."

The device involves wearing a small, sensor-laden band on the forearm or calf, then completing 20 finger or foot taps. Data is wirelessly downloaded to a computer in real-time. The procedure is repeated on all four limbs of the patient, and takes less than five minutes.

"A great advantage is potential use by non-experts and even non-clinicians, such as medical assistants or research coordinators," Graves said. The researchers are now preparing to publish a longitudinal analysis demonstrating the device's sensitivity to within patient changes over short time periods. Subsequent steps include validation in a multi-site study and development of commercial grade software to allow more

expansive dissemination.

More information: Alireza Akhbardeh et al, Novel MS vital sign: multi-sensor captures upper and lower limb dysfunction, *Annals of Clinical and Translational Neurology* (2020). [DOI: 10.1002/acn3.50988](https://doi.org/10.1002/acn3.50988)

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