PRINT-OSF Innovation-backed research shows promise for digitized neuro exams

All too often, during a holiday visit, an out of town relative realizes an aging family member seems a little slower, has tremors, complains of stiffness or spasms, or has difficulty moving through familiar spaces. How does the family know if those changes are a natural result of the aging process, or something more concerning such as Parkinson's, ALS, dementia, or another serious neurological condition?

OSF HealthCare neuromuscular specialist Chris Zallek, MD, along with a team of researchers, are building a platform that will use digitized neurological exam information and artificial intelligence technology to help medical providers detect and evaluate neurological conditions. The goal is to support the triage and care for patients regardless of their location – in a primary or urgent care office, emergency department, neurology clinic, and even at home.

Dr. Zallek is the [lead investigator of the NeuroHealth Lab](#) at Jump Trading Simulation and Education Center in Peoria, Illinois. Zallek and engineers Minh Do and George Heintz at the University of Illinois Urbana-Champaign, with support from a [Jump ARCHES grant](#), are trying to provide tools to help compensate for the critical growing shortage of providers who specialize in neurological care. The gap in neurologists in the U.S. is projected to increase to 19% by 2025.

The solution is called a Digital Neurological Examination (DNE). Dr. Zallek explains the exam can be done with a smartphone or tablet and currently records four distinct exam movements clinicians might observe to help assess an individual's coordination, strength, balance, and movement organization.

The exam includes the patient rapidly tapping their finger and thumb, rolling their arms around each other, touching the pointer fingers of their hands to each other, and standing up from a chair and walking back and forth.

The DNE extracts from the recorded exams the 2D/3D human-body poses and quantifies clinically relevant features. This can help the provider to identify and follow changes in exam findings over time and aid in the diagnosis and care for people experiencing neurological conditions.

The platform will help physicians triage and care for patients with neurological symptoms regardless of exam location. Zallek says that'll be a game-changer because the average wait time to see a neurologist is a month, and in some places across the country, there are "neurology deserts" where people have to travel great distances to get a diagnosis and treatment.

"This will hopefully help with the triage of the patients. We want to see all patients but there are some patients that need to be seen sooner rather than later. If we have tools helping us to say okay, this person, we need to get them in a little more quickly, or at least meet with them via tele neurology, it is an opportunity to improve care."

Dr. Zallek and the team recently [published their pilot research](#) about the DNE.

DNE was evaluated on a collected dataset of 21 volunteers with normal and simulated-impaired movements. The overall accuracy of DNE was demonstrated by evaluating the recorded movements using various machine learning models. The results show an accuracy for detecting differences between normal and simulated impairment beyond 90% for upper-limb tests and 80% for the stand-up and walk tests.

The next step is to continue the research recording 100 patients experiencing neurological conditions and demonstrating abnormal exam findings. New care paths will also need to be tested to learn how these digitized tools can best help clinical teams care for patients.

Dr. Zallek hopes the research will alert others engaged in similar efforts at other health systems and universities to consider a collaboration.

"It would be great if one of the outcomes from the publication was collaboration with other institutions that are working on similar problems with similar solutions. In the end, we're all trying to help care for patients

better. And what we'd like to do is get tools out into the clinical workflows as soon as we can, when they're ready, to improve patient care and lower the cost of health care."