

PRINT-OSF developing app to diagnose migraine sooner and more accurately

For millions of people living with [migraine](#), getting the proper diagnosis can take years, sometimes even decades. A new digital tool developed by a team at the University of Illinois College of Medicine Peoria (UICOMP) and OSF HealthCare aims to change that by helping primary care and other first-contact healthcare providers to identify patients with migraine quickly and accurately.

Hrachya Nersesyan MD, PhD, a headache neurologist and the director of the headache clinic at the [OSF Illinois Neurological Institute](#) (INI) in Peoria, Illinois and co-developer of the **MIGRO (migraine referral optimization) application** says primary care providers might frequently experience time constraints to accurately diagnose migraine.

“Well, they have to deal with 55 different problems, all at the same time, and the time constraint is a significant barrier in properly obtaining the history of the headache to be able to correctly and accurately diagnose, not just migraine, but also its sub-types, and decide what to do about that.”

Unlike conditions that can be confirmed with blood tests or imaging, migraine is diagnosed based on presenting symptoms and patient history. That makes accuracy of diagnosis highly dependent on the provider’s time and expertise.

Migraine is one of the most frequent and most disabling types of primary headaches, and what is often misunderstood about migraine is that it is a disorder of the central nervous system. So, it is not just a bad headache but frequently presents with many other symptoms, such as sensitivity to light and sound, nausea and vomiting, disturbances of mood and emotions, and so on. And these disturbances – sometimes called most bothersome symptoms (MBS) – also can happen outside of the actual headache attacks, causing significant discomfort and even prolonged periods of disability to migraine sufferers. Therefore, timely diagnosis and subsequent proper treatment of migraine as a disorder rather than a symptom is important.

In an analysis of randomly selected 150 patients referred to the headache program at OSF ,in 2022, researchers found that primary care providers correctly identified migraine types only about half the time and did not correctly define the migraine subtypes in most cases due to incomplete information and lack of documentation on the quality and behavioral patterns of reported headaches.

“Some of them, it took five, eight, even 10 years to even being diagnosed and receiving the treatment. We had a couple of patients that mentioned their headaches over 20 years ago and just 20 years later (they) were able to be finally diagnosed with the proper type (of migraine) and be introduced to treatment.”

To address that care gap, the research team created an app called MIGRO, built around a decision-tree algorithm based on the current *International Classification of Headache Disorders (ICHD-3)*. The app guides patients through a series of self-directed questions about their symptoms, headache quality and the patterns of headache behavior. Within minutes, it generates a summary of suspected headache diagnosis for the provider to review.

It simply walks the patient and provider through the key points needed to determine whether a headache is migraine, what type of migraine it might be, or if it's something else entirely. Most people can complete the assessment in less than five minutes.

Through incorporated safeguards the app also helps to flag potentially dangerous conditions with headache as a symptom that might require immediate attention and reliably diagnoses medication overuse headaches, a significant cause of a headache changing from occasional to chronic.

After early development and more testing at INI with more than 300 patients, the app outperformed referring providers in diagnostic accuracy of the headache type across the board, especially in detecting migraine subtypes and medication overuse headache. In cases of medication overuse headache, the app identified the condition in 65% of patients, compared to 0% recognition by referring clinicians.

Time to validate

Now entering phase two, the team plans to validate the tool in primary care settings across the OSF HealthCare Ministry, including at several rural sites where access to specialists is limited. Dr. Nersesyan explains the app will also help primary care providers in those settings to know if a patient can be managed locally or absolutely needs to be referred to a headache specialist.

"Because a majority of the migraineurs can be managed with very simple medications and interventions as long as they have the right diagnosis and the right treatment and they don't necessarily need to see a headache neurologist or any other headache specialist. they can be very well managed by primary care providers."

This study is supported by a [Community Health Advocacy \(CHA\) grant](#) through OSF and the University of Illinois Chicago. The digital development work is supported by the OSF Digital Innovation Development and Medical Visualization teams, which created the coding and are now refining the app's language and design for broader public use. The goal is to make the patient questionnaire portion of the application easy to comprehend for every user, regardless of their educational background, and seamlessly integrate this tool into routine clinical workflows.

People with migraine also might frequently hesitate to seek early medical care due to variety of reasons, including social stigma associated with this disorder. The app creators believe that MIGRO can help primary care providers make timely and accurate migraine diagnosis., dramatically shortening the time to implementing an effective treatment. They also believe it could help these patients to overcome societal prejudice about headaches.

"It allows and gives the ability to providers, in a fairly short period of time to hit all the key question marks and points that one needs to come to the diagnosis of migraine or to say, 'Well this headache is not a migraine,' or to define between different types of migraine that exists out there."

The research team expects to begin primary care testing by the end of 2025, with plans to expand the app for general public use once validation of diagnostic accuracy in primary care setting is completed.