

## TBI Tracker: Providing Mobile Strategies for Traumatic Brain Injury Rehabilitation

### Problem

The long-term effects of a traumatic brain injury (TBI) and blast-related brain injuries have become better understood in the past 10 years because of the large number of people injured on the battlefields of Iraq and Afghanistan. Since 2000, the number of TBI diagnoses has tripled each year among members of the armed services. In addition to the high emotional cost, these injuries cost the nation an estimated \$68 billion per year in direct and indirect costs. [1]

Rehabilitative care for patients with these injuries consists predominately of working with different kinds of therapists on issues such as addressing communication deficiencies, regaining skills possessed before the injury, improving memory skills, and learning strategies for handling anger and post-traumatic stress issues. An individual's recovery is influenced by many factors, including severity of initial injury, the areas of function not affected by the injury and, importantly, the resources available to aid in the patient's recovery. Organizations such as the Defense and Veterans Brain Injury Center often use telehealth technologies or home buddy systems to deliver services. This is necessary when in-person screening, assessment, or care are not feasible due to the remote location of the patient or where specialized care is not available.

Veterans who rely on remote access to rehabilitative care—as well as veterans who are between appointments with a therapist—must practice and carry over the skills learned during therapy. This is critical to recovery. Currently, carry-over is fostered through homework assignments and strategies that the therapist assigns to patients to do on their own. Many of them rely on various tools to help them accomplish activities of daily living as well.

### Solution

Mobile health applications are part of the telehealth approach, and the Department of Veterans Affairs (VA) is increasingly making these tools available to improve the health of patients. According to the VA, “By focusing on data mobility, there will be increased opportunities for VA's health care teams to engage with and empower veterans and caregivers in the management of behaviors that affect their health and well-being.” [2]

MITRE researchers began looking for ways to apply their expertise in mobile apps to patients with TBI injuries. We worked with subject matter experts (SMEs) from the VA offices in Boston and other clinicians to better understand the needs of TBI patients and identify any gaps in available services.

The team chose to focus on “prospective memory,” which, according to the SMEs, is a common issue associated with TBI and, from our research, one that has almost no mobile resources available to assist patients who have difficulties with it. We looked at how we could help patients better perform at-home, prospective memory-based tasks and activities of daily living more effectively during rehabilitation and recovery.

The team developed the TBI Tracker prototype—an iPad application designed to help patients accomplish the activities of daily living. Using TBI Tracker, patients plan tasks and assign times to the steps, allowing them to practice methods used in therapy and create a customized aid for themselves. Patients can use the app to walk them through the steps of a task—the app reminds them what comes next and monitors their progress. The app also allows patients to schedule these tasks on their mobile calendar and receive notifications when it’s time to do them. In addition, TBI Tracker provides data that helps clinicians assess how often and in what way patients engage with the app to measure progress.

Using the prototype, the team is exploring the following research questions:

- Can mobile technology empower TBI patients—for example, in planning exercises or tracking pain?
- Can patients with prospective memory impairment more effectively accomplish at-home tasks using TBI Tracker?

We have also implemented the industry-standard baseline measurement tool for prospective memory (called PRMQ for Prospective and Retrospective Memory Questionnaire) into the TBI Tracker as an objective baselining measure. As an offshoot of the project, we built the first iPad version of the PRMQ, which is available through open source.

The team’s next step is to conduct patient testing for the TBI Tracker prototype.

## **Results/Impact**

Patient testing will help us evaluate whether this mobile app can empower patients and help them better accomplish activities of daily living. Success in this area would increase:

1. Accessibility to TBI care, especially for veterans in rural areas
2. The number of mobile/telehealth tools available to TBI patients
3. The independence of TBI patients when performing acts of daily life.

Our goal, if TBI Tracker proves successful, is to work with the VA Mobile Apps group to include this tool in their suite of apps. We would also make it available to other groups treating patients with TBI injuries.

*For more information, please send inquiries to [CEMinnovation@mitre.org](mailto:CEMinnovation@mitre.org).*

[1] “DoD Numbers for Traumatic Brain Injury,” Defense and Veterans Brain Injury Center, [www.dvbic.org](http://www.dvbic.org).

[2] <https://mobilehealth.va.gov>