

## Traumatic brain injury (TBI)

### Introduction:

Traumatic brain injury (TBI) occurs when a sudden trauma causes damage to the brain. TBI can result when the head suddenly and violently hits an object, or when an object pierces the skull and enters brain tissue. A person with a mild TBI may remain conscious or may experience a loss of consciousness for a few seconds or minutes. Other symptoms of mild TBI include headache, confusion, lightheadedness, dizziness, blurred vision or tired eyes, ringing in the ears, bad taste in the mouth, fatigue or lethargy, a change in sleep patterns, behavioral or mood changes, and trouble with memory, concentration, attention, or thinking. A person with a moderate or severe TBI may show these same symptoms, but may also have a headache that gets worse or does not go away, repeated vomiting or nausea, convulsions or seizures, an inability to awaken from sleep, dilation of one or both pupils of the eyes, slurred speech, weakness or numbness in the extremities, loss of coordination, and increased confusion, restlessness, or agitation.

### TBI and the Military:

Traumatic brain injury (TBI) is a significant health issue which affects service members and veterans during times of both peace and war. The high rate of TBI and blast-related concussion events resulting from combat operations directly impacts the health and safety of individual service members and subsequently the level of unit readiness and troop retention. The impacts of TBI are felt within each branch of the military services and throughout both the Department of Defense (DoD) and the Department of Veterans Affairs (VA) health care systems.

In the VA, TBI has become a major focus, second only to recognition of the need for increased resources to provide health care and vocational retraining for individuals with a diagnosis of TBI. Veterans may sustain TBIs throughout their lifespan, with the largest increase as the veterans enter into their 70s and 80s; these injuries are often caused by falls and result in high levels of disability. Diagnosis of TBI, especially mild TBI [since this is the level at which the largest percent of the military population are diagnosed] is becoming of increasing importance in the treatment of veterans as a larger percentage of this population approach their senior years.

The research we are proposing will provide a more quantitative means to diagnosis TBIs, especially mild TBIs where more than 80% of traumatic brain injuries are diagnosed. This population includes large numbers of soldiers returning to America from deployment. The technique will act as an initial screening for diagnosis. For more serious TBIs, our procedure will provide a more accurate means to quantify the extent of injury to the brain, which should help physicians better prescribe the type and extent of treatment. **The combined use of artificial intelligence coupled with the mathematical modifications we developed in our lab, should provide a valuable tool for physicians in this diagnoses and treatment of traumatic brain injuries.** With the ever increasing VA population being diagnosed with TBI and the ever growing population accessing the VA with potential TBI, this research should be a very important and timely predictive tool in any future endeavors of the Veterans Administration.