A Consideration of Voting Accessibility for Injured OIF/OEF Service Members: Needs Assessment

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PREPARED FOR:
Election Assistance Commission
1201 New York Avenue, N.W.
Suite 300
Washington, D.C. 20005

PREPARED BY:
Human Systems Integration Division
Electronic Systems Laboratory
Georgia Tech Research Institute
Georgia Institute of Technology
Atlanta, Georgia 30332

Annotated Literature Review Results

Traumatic Brain Injuries

Brahm, K. D., Wilgenburg, H. M., Kirby, J., Ingalla, S., Chang, C., & Goodrich, G. L. (2009). Visual impairment and dysfunction in combat-injured service members with traumatic brain injury. *Optometry and Vision Science, 86,*(7), 817-825.

> This study determined the frequencies of visual impairments among military personnel who had been treated at the the Polytrauma Network Site (PNS, outpatient facility) and the Polytrauma Rehabilitation Center (PRC, inpatient facility). A vision screening assessment of showed that 90% of PNS-outpatients and 84% of PRC-inpatients had TBIs associated with a blast event. Visual dysfunctions, including lens accommodation and oculomotor problems, were common in both populations. Poor visual acuity (20/100 or worse) was much less common. The findings suggest that military personnel who suffer from blast-induced TBI are at risk for visual dysfunction; in particular, they may often face difficulties with changing focal distance (i.e., accommodation) and with eye movements (i.e., convergence, smooth pursuit, and saccades).

Cifu, D. X., Cohen, S. I. Lew, H. L., Jaffee, M., & Sigford, B. (2010). The history and evolution of traumatic brain injury rehabilitation in military service members and veterans. *American Journal of Physical Medicine & Rehabilitation, 89,*(8), 688-694.

> The incidence of TBI has recently increased, perhaps due to changes in weaponry and increase survival rates. This paper gives a historical account of the medical community's adaptation to combat-related injuries over the years. The Department of Veterans Affairs and the Defense and Veterans Brain Injury Center have made a great impact how soldiers with traumatic brain injury are evaluated and treated. Several facilities and many clinical teams have recently been created to specifically focus on treating soldiers with polytrauma and traumatic brain injury.

Cockerham, G. C., Goodrich, G. L., Weichel, E. D., Orcutt, J. C., Rizzo, J. F., Bower, K. S., & Schuchard, R. A. (2009). Eye and visual function in traumatic brain injury. *Journal of Rehabilitation Research & Development, 46*(6), 811-818.

> Traumatic brain injury in the civilian sector is often associated with visual dysfunctions, which include difficulty changing focal distance and moving the eyes. Often, no reduction in visual acuity occurs. Civilian TBI is often caused by blunt force trauma (e.g., automobile accidents) whereas combat-related TBI is often caused by blasts. Relative to the civilian sector, little is known about the visual effects of military (blast-induced) TBI. Blasts sometimes directly cause eye injury, which can be quickly detected and treated. When the eyes are not directly damaged, the treatment of visual dysfunctions caused by TBI might often be delayed. To rectify this, the authors suggest many lines of the research that should be pursued, such as the development of assessment tools, comparison of treatment methods (e.g., surgical interventions and pharmacological therapies), and a systematized method of documenting the success of rehabilitation.

Colantonio, A., Ratcliff, G., Chase, S., Kelsey, S., Escobar, M., & Vernich, L. (2004). Long term outcomes after moderate to severe traumatic brain injury. *Disability and Rehabilitation, 26*(5), 253-261.

> This study addressed long-term quality of life issues (e.g., self-rated health, employment, and activity limitations) for veterans who had suffered TBI at least 15 years prior to the study. The greatest challenges faced by respondents (N = 306) were related to driving, shopping, and managing finances. Many veterans with TBI may need long term assistance with these activities of daily living despite rehabilitation efforts.

Davis, C., Nelson, J., Hirsch, M. A., Hammond, F. M., Karlawish, J., Schur, L, Kruse, D., & Ball, A. (2010). An exploratory examination of political empowerment and voting among individuals with TBI. *Brain Injury, 24*(3), 208.

> This study used a community-based participatory research approach to assess the voting experience of individuals with TBI (along with their caregivers and family members) during the November 2007 and May 2007 General Election and the November 2008 Presidential Election in North Carolina. Interviews were conducted with 55 individuals with TBI, and with 27 spouses, caregivers, and healthcare and community providers of people with TBI. Participants were shadowed and observed as they voted at the polls. The study found that people with TBI can require extra resources (time, effort, transportation) to vote, and that people with TBI have challenges with remembering to vote, preparing to vote, researching candidates, and arranging transportation to the polls. Some people with TBI also note challenges navigating the polls and the ballot, and difficulty remembering who to vote for.

Doarn, C. R., McVeigh, F., & Poropatich, R. (2010). Innovative new technologies to identify and treat traumatic brain injuries: Crossover technologies and approaches between military and civilian applications. *Telemedicine and e-Health, 16*(3), 373-381.

> The ubiquitous use of improvised explosive devices in Iraq and Afghanistan has contributed to the recent increase of TBI seen in the military. Higher rates of survival are also responsible. Although there has been a reduction in severe TBI, perhaps due to improved armor, mild and moderate TBI have increased. Because the physical and mental effects of TBI are often misdiagnosed, the U.S. Army is pursuing methods for early TBI detection and treatment. To pursue this subjective, the U.S. Army's Telemedicine and Advanced Technology Research Center collaborated with a civilian organization –the American Telemedicine Association – to hold a research symposium on the diagnosis and treatment of TBI. This paper documents the session topics at the symposium and gives general summaries of some of the presentations. This may be a good resource for finding current researchers in the field.

Doarn, C. R. (2009). Symposium report: Innovative new technologies to identify and treat traumatic brain injuries: Crossover technologies and approaches between military and civilian applications, Indian Wells, CA.

> These symposium presentations are focused on current activities in diagnosis and treatment of TBI using various technologies from subject matter experts. One focus of discussion is the use of telemedicine in the diagnosis and treatment of TBI. The use of tele-rehabilitation for TBI patients is also discussed.

Dobscha, S. K., Clark, M. E., Morasco, B. J., Freeman, M., Campbell, R., & Helfand, M. (2009). Systematic review of the literature on pain in patients with poly-trauma including traumatic brain injury. *Pain Medicine, 10*(7), 1200-1217.

> This literature review addressed pain assessment and management in patients with polytraumatic injuries, including blast-related headache and TBI. It covered studies published from 1950 to 2008. Most studies found in the literature search did not include a control group, but instead included observational and qualitative studies. The search criteria yielded one review paper, 93 observational studies, and one qualitative study. Surprisingly, the search did not yield any studies that evaluated the quality of pain-intensity measures or pain-related functional limitations among patients with TBI. There were also no studies that compared blast-related headache with other types of headache, or that evaluated treatment options for blast-related chronic headaches. Symptoms associated with TBI varied widely across studies; variables included pain severity and location, insomnia, fatigue, post-traumatic stress disorder, and depression. The authors advocated further research to guide pain assessment and management for individuals suffering from polytrauma.

DuBose, J. J., Barmparas, G., Inaba, K., Stein, D. M., Scalea, T., Cancio, L. C., Cole, J., Eastridge, B., Blackbourne, L. (2011). Isolated severe traumatic brain injuries sustained during combat operations: Demographics, mortality outcomes, and lessons to be learned from contrasts to civilian counterparts. *Journal of Trauma, 70,*(1), 11-18.

> The epidemiology of severe TBI from the civilian and military (Joint Trauma Theatre Registry) sectors was compared. Patient demographics, treatments, and outcomes were reviewed. Military personnel were significantly more likely than their civilian counterparts to receive intracranial pressure monitoring and neurosurgery. Mortality was lower among military personnel overall, especially in cases of penetrating brain injury. It is suggested that the pressure monitoring and surgical interventions received by military personnel are partially responsible for their higher rates of survival. However, many other factors might play a role.

French, L. M., & Parkinson, G. W. (2008). Assessing and treating veterans with traumatic brain injury. *Journal of Clinical Psychology: In Session, 64*(8), 1004-1013.

This article discusses comorbid injuries and the environmental context in which TBI is sustained by military personnel in recent conflicts. Comorbid injuries in the environmental stressors greatly complicate clinical approaches. The influences of these factors are illustrated with case vignettes.

Hoge, C. W., McGurk, D., Thomas, J. L., Cox, A. L., Engel, C. C., & Castro, C. A. (2008). Mild traumatic brain injury in U.S. soldiers returning from Iraq. *New England Journal of Medicine, 358*(5), 453-463.

The authors surveyed 2525 U.S. Army infantry soldiers 3 to 4 months after their return from deployment. The purpose of the survey was to determine rates of TBI comorbidity with PTSD and major depression, and their combined effects on physical health. The survey consisted of validated measures of TBI, depression, and PTSD. Questions also addressed physical health. Fifteen percent of respondents reported symptoms that were indicative of mild TBI.

Of those who reported loss of consciousness, 43.9% reported symptoms indicative of PTSD. Among other groups who did not report a loss of consciousness, PTSD symptoms were reported much less frequently. Those with mild TBI, particularly those who had lost consciousness, were significantly more likely to report poor health outcomes. However, after a statistical adjustment for PTSD and depression, mild TBI was not significantly associated with physical health outcomes. The results suggest that the relationship between mild TBI and physical health problems is mediated by depression and PTSD; that is, those individuals who suffer from TBI but not depression or PTSD are less likely to suffer from physical health problems.

Iverson, G. I. (2010). Clinical and methodological challenges with assessing mild traumatic brain injury in the military. *Journal of head Trauma Rehabilitation, 25*(5), 313-319.

This article reviews a screening program designed to detect residual symptoms of mild TBI. The authors provide a critical review the current screening program, discuss its challenges, and make recommendations for its improvement. One problem with the current screening program is its inability to determine when a TBI may have been sustained for individuals who have served multiple tours of duty. Another limitation is that TBI may be sufficient but not necessary to generate some of the symptoms that are targeted by screening questions. Most critically, this screening program has a limited ability to dissociate TBI from PTSD and depression. Careful documentation and further research are needed to improve the program.

Lew, H. L., Garvert, D. W., Pogoda, T. K., Hsu, P. T., Devine, J. M., White, D. K., . . . Goodrich, G. L. (2009). Auditory and visual impairments in patients with blast-related traumatic brain injury: Effect of dual sensory impairment on Functional Independence Measure. *Journal of Rehabilitation Research & Development, 46*(6), 819-826.

In this study of 175 patients with blast-related traumatic brain injury (TBI), it was found that 19%, 34%, and 32% of the patients showed clinical signs of hearing impairment, vision impairment, and dual sensory impairment (hearing and vision), respectively. A measure of functional independence was also administered; it comprised a motor subscale and a cognitive subscale. Statistical analysis showed a sensory-group difference for the motor functional independence scores at the time at discharge from a clinical care facility. Regarding improvement over time, the dual sensory impairment group showed significantly less improvement in motor functional independence.

Lew, H. L., Weihing, J., Myers, P. J., Pogoda, T. K., & Goodrich, G. L. (2010). Dual sensory impairment (DSI) in traumatic brain injury (TBI): An emerging interdisciplinary challenge. *NeuroRehabilitation, 26*, 213-222.

Dual sensory impairment (DSI), which often accompanies TBI, is marked by auditory and visual deficits that are either peripherally or centrally based. This review covers unimodal deficits as well as DSI in the military population. The heterogeneous nature of TBI injuries creates a challenge for clinicians to dissociate, for diagnostic and rehabilitative efforts, the effects of multiple sensory deficits from cognitive deficits. Current treatments for DSI include training exercises and sensory aids.

McCarthy, M. L., Dikmen, S. S., Langlois, J. A., Selassie, A. W., Gu, J. K., & Horner, M. D. (2006). Self-reported psychosocial health among adults with traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 87,* 953-961.

Symptoms associated with TBI are not limited to cognitive deficits, but also include physical and psychosocial problems, such as depression, anxiety, and social withdrawal. This study reports subjective measures of psychosocial health of 7612 civilians one year after their discharge from clinics. Twenty-nine percent reported poor psychosocial health. The following factors were positively associated with poor psychosocial health: female sex, younger age, Medicaid coverage, lack of health insurance, poor social support, cognitive deficits, and substance abuse. Of those who reported poor psychosocial health, only 36% reported receiving mental health care. To improve TBI rehabilitation, clinicians should attend to patients' psychosocial health needs in the period following acute treatment.

Mount Sinai Medical Center (2008). What Impact Will Moderate or Severe TBI Have on a Person's Life? Retrieved from http://www.brainline.org/content/2008/07/what-impact-will-moderate-or-severe-tbi-have-persons-life.html.

This article discusses the long-term functional deficits of TBI. A wide variety of bodily functions controlled by the brain may be affected. Given the fact that TBI produces heterogeneous symptoms, individuals may experience only one, several, or most of the possible effects. Furthermore, rehabilitative improvements (or lack thereof) vary greatly across individuals. Moderate-to-severe TBI often causes deficits in basic cognitive skills, such as the ability to sustain attention, remember newly learned material, think creatively, adapt to changes in routine, and make decisions based on many constraints. Personality traits, such as neuroticism,

motivation, and social inhibition may also be altered. The social problems are compounded when patients deny (or are unaware of) the effects of their injuries. This denial can also impede rehabilitation. Other problems include sensory deficits, paralysis, chronic pain, and hormonal imbalances. Given the diversity of symptoms, it follows that the success of rehabilitation varies greatly among individuals. Some individuals will completely recover after several years, whereas others will improve but never fully recover.

Pagulayan, K. F., Hoffman, J. M., Temkin, N. R., Machamer, J. E., & Dikmen, S. S. (2008). Functional limitations and depression after traumatic brain injury: Examination of the temporal relationship. *Archives of Physical Medicine and Rehabilitation, 89,* 1887-1892.

A longitudinal study was conducted to determine the temporal relationship between functional limitations and depression caused by TBI. Functional limitations were measured by the Sickness Impact Profile (SIP), which assesses quality of life issues and functional abilities such as sleep and rest, body care, home management, and social relationships. Evaluations were taken at three time points. Results showed that depressive symptoms were more highly correlated with high SIP scores at later time points than earlier time points. Statistical analyses showed that increased SIP scores usually preceded increased depression, which may imply a causal effect. That is, quality of life issues and functional abilities may influence emotional well-being, but depression may not strongly affect the perception of quality of life and functional abilities. The results have implications for the treatment of TBI related depression.

Schneiderman, A. I., Braver, E. R., Kang, H. K. (2008). Understanding sequelae of injury during the conflicts in Iraq and Afghanistan: persistent postconcussive symptoms and Posttraumatic stress disorder. *American Journal of Epidemiology, 167*(12), 1446-1452.

Associations among PTSD and post-concussive symptoms of TBI were investigated by a survey. Immediate neurologic symptoms that were reported after injuries were used to identify mild TBI. About 12% of 2,235 respondents reported symptoms that were indicative of mild TBI, and 11% reported symptoms consistent with PTSD. Other than TBI, PTSD was the strongest factor associated with post-concussive symptoms.

Silver, J. M., McAllister, T. W., & Arciniegas, D. B. (2009). Depression and cognitive complaints following mild traumatic brain injury. *American Journal of Psychiatry, 166*(6), 653-661.

Problems with cognition, emotion, and behavior often accompany TBI. Although many patients improve significantly during the first several months after sustaining mild TBI, many other patients develop long-term functional problems. Some of the most common symptoms are cognitive impairment and depression. The symptoms sometimes are responsive to a combination of pharmacologic and rehabilitative treatments. This paper offers recommendations for clinical diagnosis and treatment of individuals suffering from depression and cognitive deficits following TBI.

Spencer, R. J., Drag, L. L., Walker, S. J., & Bieliauskas, L. A. (2010). Self-reported cognitive symptoms following mild traumatic brain injury are poorly associated with neuropsychological performance in

OIF/OEF veterans. *Journal of Rehabilitation Research & Development, 47*(6), 521-530.

Screening for TBI is often accomplished by self-report measures, yet the accuracy of such measures is questionable. Self-report in general can be unreliable, and they may be particularly unreliable in this population who are often unaware (or in denial) of their symptoms. The study compared objective clinical assessments with self-reports in 105 service members who recently sustained mild TBI. Self-report measures of cognitive functioning were not significantly correlated with objective clinical measures. Clinicians who were surveyed tended to overestimate the association between clinical measures and self-report measures.

Taber, K. H., Warden, D. L., & Hurley, R. A. (2006). Blast-related traumatic brain injury: What is known? *The Journal of Neuropsychiatry and Clinical Neurosciences, 18*(2), 141-145.

Causes of TBI can be placed in the following three categories: blast wave-induced changes in atmospheric pressure, impact of objects that are thrown by the blast, and impact of people as they are thrown by the blast. This paper discusses the medical complications associated with each of these types of TBI.

Temkin, N. R., Corrigan, J. D., Dikmen, S. S., & Machamer, J. (2009). Social functioning after traumatic brain injury. *Journal of Head Trauma Rehabilitation, 24*(6), 460-467.

A review of published literature was conducted to determine the relationship between TBI and various social functions, including employment, relationships, functional independence, and recreation. Results indicated that unemployment was associated with moderate and severe TBI but not mild TBI. Recreation, quality of social relationships, and functional independence were also adversely affected by TBI, regardless of severity. However, injury severity did affect the severity of social problems.

Tun, C., Hogan, A., & Fitzharris, K. (2009). Hearing and vestibular dysfunction caused by blast injuries and traumatic brain injuries. *The Hearing Journal, 62*(11), 24-26.

Blasts that induce TBI often also induce damage to the auditory and vestibular systems. This paper describes the symptoms associated with damage to the auditory and vestibular systems, as well as the frequency of these injuries at the Boston VA medical clinic.

Wounded Warrier injury fact sheet on traumatic brain injury (TBI). Retrieved from http://wtc.army.mil/aw2/index.html.

The Wounded Warrior website has some informative fact sheets on some of the injuries and disabilities that occur in combat. This fact sheet on TBI includes data on prevalence, as well as information about treatment and recovery.