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Traumatic Brain Injury Among Veterans

Erin Bagalman
Analyst in Health Policy

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Summary

Traumatic Brain Injury (TBI) has been defined as "an alteration in brain function, or other evidence of brain pathology, caused by an external force." In the general population, TBI results mainly from falls, motor vehicle/traffic accidents, assaults, and other instances in which the head is struck by or strikes against an object. In military servicemembers, TBI may also result from improvised explosive devices, mortars, grenades, bullets, or mines.

Traumatic brain injury has become known as a "signature wound" of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), because the incidence of TBI is higher in these conflicts than it has been in previous conflicts. From FY2002 through FY2011, 1.4 million OEF/OIF veterans (including members of the Reserve and National Guard) left active duty and became eligible for VA health care; by the end of FY2011, 53% of them had obtained VA health care. The total number of OEF/OIF veterans with TBI is not known, in part because some OEF/OIF veterans have not accessed VA health care services.

The VA reaches out to OEF/OIF veterans to inform them of their benefits by participating in DOD activities (in order to make contact with servicemembers before separation and conversion to veteran status), contacting OEF/OIF veterans through the Combat Veterans Call Center, and using social media and other Internet-based outreach, among other activities. Some OEF/OIF veterans may choose not to enroll in VA health care because they have health coverage from other sources or because they do not perceive a need for health care; others may experience barriers to accessing VA care.

Servicemembers who sustain mild TBI (concussion), which accounts for the majority of injuries, may walk away from the event, seemingly unharmed; thus mild TBI may go unnoticed and untreated. Accordingly, VA policy requires that all OEF/OIF veterans receiving medical care in the VA health care system must be screened for possible TBI, and that those who screen positive must be offered further evaluation and specialized treatment. The VA and the DOD have jointly developed evidence-based clinical practice guidelines for treatment of mild TBI.

Servicemembers who sustain moderate to severe TBI (i.e., recognizable injuries) require immediate treatment, which begins at the site of the event and continues at a military treatment facility. Once stabilized, servicemembers may remain at a military treatment facility or be transferred to the VA Polytrauma System of Care. Transfers from DOD to VA facilities require coordination between the two systems, and several programs have been developed to facilitate coordination of care.

The VA's budget for "Traumatic Brain Injury and Other Neurotrauma" research was $21 million in FY2011 (actual), $24 million in FY2012 (current estimate), and $29 million in FY2013 (request). The large number of studies conducted by the VA and the DOD, as well as the Department of Health and Human Services (HHS), raises questions for some about potential duplication of effort, gaps in the research, dissemination of research findings, and translation of research into practice.

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Introduction

Traumatic brain injury (TBI) has become known as a "signature wound"[1] of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF),[2] because the incidence of TBI is higher in these conflicts than it has been in previous conflicts. This report discusses TBI among veterans receiving care in Department of Veterans Affairs (VA) medical facilities, with particular attention to OEF/OIF veterans.

The VA health care system does not function in a vacuum. Individuals may sustain injuries during military service, receive early stages of treatment from the Department of Defense (DOD), and transfer to the VA for later stages of treatment. In this report, agencies other than the VA are addressed only to the extent that they work in coordination with the VA.

The remainder of this report is organized in three parts. The first part provides an overview of TBI, as background for the rest of the report. The second part focuses on TBI among veterans receiving VA health care services,[3] with sections addressing access to care, identification of TBI, treatment of TBI, and TBI research. The third part discusses potential issues for Congress, in the context of past congressional action related to TBI among veterans.

Several numbers are presented in this report, quantifying TBI among different populations (i.e., civilians, servicemembers, or veterans), measured over different periods (i.e., a single year or multiple years), by different organizations (i.e., the Centers for Disease Control and Prevention, DOD, or VA). Each number is independent of the others; they do not sum to a total.

Traumatic Brain Injury (TBI) Overview

To provide some context for the discussion of TBI among veterans, this part of the report discusses TBI in general terms, including the definition, causes, and prevalence of TBI; various ways in which traumatic brain injuries can be classified; the signs and symptoms of TBI; and associated comorbid conditions (including both mental and physical health).

[1] Committee on the Initial Assessment of Readjustment Needs of Military Personnel, Veterans, and Their Families, Board on the Health of Selected Populations, Institute of Medicine, "Summary," in *Returning Home from Iraq and Afghanistan: Preliminary Assessment of Readjustment Needs of Veterans, Service Members, and Their Families* (Washington, DC: The National Academies Press, 2010).

[2] Operation Enduring Freedom (OEF) began on October 7, 2001; Operation Iraqi Freedom (OIF) began on March 20, 2003 and was redesignated Operation New Dawn on September 1, 2010. These operations are not defined in statute; the dates presented here are commonly accepted. The abbreviation OEF/OIF is used throughout this report to refer to Operation Enduring Freedom and Operation Iraqi Freedom (including Operation New Dawn).

[3] This report focuses on TBI as a health care issue, and therefore does not address classification of TBI as a service-connected disability for compensation purposes; for a general discussion of veterans' disability benefits, refer to CRS Report RL34626, *Veterans' Benefits: Benefits Available for Disabled Veterans*, by Christine Scott, Carol D. Davis, and Libby Perl. This report does not address TBI in the military health care system, except where necessary to provide context or explain joint endeavors of the Departments of Defense and Veterans Affairs; for information about the military health care system, refer to CRS Report RL33537, *Military Medical Care: Questions and Answers*, by Don J. Jansen and Katherine Blakeley. For information about TBI among professional football players, refer to CRS Report R41555, *NFL Players and Efforts to Protect Them From Concussions*, by L. Elaine Halchin.

Definition, Causes, and Prevalence

In 2011, the Brain Injury Association of America adopted a definition of TBI as "an alteration in brain function, or other evidence of brain pathology, caused by an external force."[4] In the general population, TBI results mainly from falls, motor vehicle/traffic accidents, assaults, and other instances in which the head is struck by or strikes against an object.[5] In the United States each year, an estimated 1.7 million people sustain TBI:

- 1.365 million are treated and released from an emergency department,
- 275,000 are hospitalized, and
- 52,000 die as a result of their injuries.

In military servicemembers, TBI may result from the events listed above, or from improvised explosive devices, mortars, grenades, bullets, or mines.[6] The DOD reports that in 2011 (the most recent full-year data), a total of 32,591 servicemembers sustained TBI.[7]

Classification

Traumatic brain injury is not a specific diagnosis; the term encompasses a range of conditions. A TBI may be classified as focal or diffuse; open or closed; and mild, moderate, or severe. If the injury is localized to a small area of the brain, it is a focal injury; an injury occurring over a large area is diffuse. If the head hits, or is hit by, an object that penetrates the skull and the brain's protective coverings, the injury is open (also called penetrating); otherwise, the injury is closed and can be further classified as mild, moderate, or severe.[8]

Many methods have been used to classify TBI as mild, moderate, or severe; three commonly used methods are based on loss of consciousness, post-traumatic amnesia (i.e., loss of memory), or the Glasgow Coma Scale.[9] The Glasgow Coma Scale assigns points in three areas: eye opening, verbal response, and motor response. The sum of points in the three areas ranges from 3 to 15, with lower scores indicating greater severity of TBI.[10] **Table 1** summarizes the criteria for mild, moderate, and severe TBI.

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[4] Brain Injury Association of America, "BIAA Adopts New TBI Definition," press release, February 6, 2011, http://www.biausa.org/AnnouncementRetrieve.aspx?ID=66290.

[5] Mark Faul et al., *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations, and Deaths*, Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, Atlanta, GA, March 2010, http://www.cdc.gov/traumaticbraininjury/pdf/blue_book.pdf.

[6] Terri Tanielian and Lisa H. Jaycox, eds. *Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery*, RAND Corporation, 2008, p. 310, http://www.rand.org/pubs/monographs/2008/RAND_MG720.pdf.

[7] Defense and Veterans Brain Injury Center, *DOD Worldwide Numbers for TBI*, http://www.dvbic.org/dod-worldwide-numbers-tbi.

[8] Marcia Vital, *Traumatic Brain Injury: Hope Through Research*, National Institutes of Health, National Institute of Neurological Disorders and Stroke, NIH Publication No. 02-158, Bethesda, MD, September 2002, http://www.ninds.nih.gov/disorders/tbi/tbi_htr.pdf.

[9] Michael S. Jaffee et al., "Acute clinical care and care coordination within Department of Defense," *Journal of Rehabilitation Research & Development*, vol. 46, no. 6 (2009), pp. 655-666.

[10] Vital, *Traumatic Brain Injury: Hope Through Research*.

Table 1. Classification of TBI as Mild, Moderate, or Severe

	Mild	Moderate	Severe
Loss of consciousness	< 30 minutes	30 minutes-24 hours	> 24 hours
Post-traumatic amnesia	< 1 day	1-7 days	> 7 days
Glasgow Coma Scale score	13-15 points	9-12 points	3-8 points (coma)

Source: CRS summary of classification described by Michael S. Jaffee et al., "Acute clinical care and care coordination within Department of Defense," *Journal of Rehabilitation Research & Development*, vol. 46, no. 6 (2009), pp. 655-666.

Signs and Symptoms

Mild TBI (concussion) may manifest as a range of physical, psychological, and cognitive problems. Common physical signs and symptoms of mild TBI include headaches, fatigue, lethargy, dizziness, and lightheadedness. Individuals with mild TBI may experience blurred vision, eye fatigue, ringing in the ears, or a bad taste in the mouth. Psychological symptoms may appear as behavioral or mood changes. Cognitive difficulties may include confusion and problems with memory, attention, concentration, or thinking. Individuals with mild TBI may also sleep more or less than usual.[11]

Individuals with moderate to severe TBI may experience any of the signs and symptoms listed above, as well as repeated nausea or vomiting, a persistent or worsening headache, seizures or convulsions, numbness or weakness in their feet or hands, and loss of coordination. They may experience increased confusion, restlessness, or agitation. Their pupils might be dilated and their speech might be slurred. They may be unable to awaken from sleep.[12]

Comorbid Conditions

Traumatic brain injury is associated with comorbid conditions that include both mental and physical illnesses. Mental disorders associated with TBI include anxiety disorders and depressive disorders; estimates of how often such conditions co-occur with TBI vary.[13] While some studies have found a link between TBI and increased alcohol or drug use, a report by the Institute of Medicine (IOM) found just the opposite: limited/suggestive evidence of an association between TBI and decreased alcohol and drug use within one to three years of the injury.[14]

Individuals with TBI are at increased risk of developing epilepsy and neurodegenerative diseases such as Alzheimer's disease, Lewy body dementia, or Parkinson's disease. Repetitive blows to the head can result in chronic traumatic encephalopathy (CTE); CTE may begin with loss of concentration, attention, or memory, and may eventually progress to problems with coordination,

[11] Vital, *Traumatic Brain Injury: Hope Through Research*.

[12] Vital, *Traumatic Brain Injury: Hope Through Research*.

[13] Brent E. Masel and Douglas S. DeWitt, "Traumatic Brain Injury: A Disease Process, Not an Event," *Journal of Neurotrauma*, no. 27 (August 2010), p. 1529–1540; and Tanielian and Jaycox, eds. *Invisible Wounds of War*.

[14] Masel and DeWitt, "Traumatic Brain Injury: A Disease Process, Not an Event;" and Institute of Medicine (IOM), *Gulf War and Health, Volume 7: Long-term Consequences of Traumatic Brain Injury* (Washington, DC: The National Academies Press, 2009).

gait, slurred speech, and tremors. Post-traumatic hypopituitarism (PTH) is a neuroendocrine disorder associated with TBI; chronic PTH leads to other neuroendocrine conditions, including hypothyroidism and deficiencies in growth hormone and gonadotropin. Individuals with TBI may also develop sleep disturbances, obstructive sleep apnea, incontinence, sexual dysfunction, metabolic dysfunction, or musculoskeletal dysfunction.[15]

The next part of the report addresses TBI in the veteran population, including sections on access to care, identification of TBI, treatment of TBI, and TBI research.

TBI Among Veterans

Traumatic brain injury has become known as a "signature wound" of OEF/OIF because servicemembers in these operations have experienced TBI in larger numbers than those serving in past conflicts.[16] Three factors contribute to the increase in TBI. First, the number of blast injuries caused by improvised explosive devices (IED), rocket-propelled grenades, and land mines has increased; it has been reported that the primary mechanism of injury in OIF is a blast injury.[17] Second, injuries that would have been fatal in the past may not be fatal now, thanks to advances in protective equipment, combat medicine, and air evacuation.[18] Third, health care professionals are more alert to the possibility of TBI and may be more likely to diagnose TBI accurately.[19]

The total number of veterans who have experienced TBI is not known, in part because TBI is difficult to identify,[20] and in part because some veterans have not accessed VA health care services.[21] The VA indicates that 201,435 veterans from all eras (i.e., not limited to OEF/OIF veterans) enrolled with VA for healthcare have a *diagnosis associated with* TBI.[22] The VA identifies 56,695 OEF/OIF veterans enrolled with VA for healthcare as having been evaluated or treated for a *condition possibly related to* TBI.[23]

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[15] Masel and DeWitt, "Traumatic Brain Injury: A Disease Process, Not an Event;" and IOM, *Gulf War and Health, Volume 7: Long-term Consequences of Traumatic Brain Injury*.

[16] Committee on the Initial Assessment of Readjustment Needs of Military Personnel, Veterans, and Their Families, Board on the Health of Selected Populations, Institute of Medicine, "Summary," in *Returning Home from Iraq and Afghanistan: Preliminary Assessment of Readjustment Needs of Veterans, Service Members, and Their Families* (Washington, DC: The National Academies Press, 2010).

[17] Geoffrey Ling et al., "Explosive Blast Neurotrauma," *Journal of Neutrotrauma*, vol. 26 (2009), pp. 815-825.

[18] Atul Gawande, "Casualties of War—Military Care for the Wounded from Iraq and Afghanistan," *New England Journal of Medicine*, vol. 351, no. 24 (2004), pp. 2471-2475.

[19] Office of the Surgeon General, Center for Excellence in Medical Multimedia, *Traumatic Brain Injury: The Journey Home*, http://www.traumaticbraininjuryatoz.org.

[20] Tanielian and Jaycox, eds. *Invisible Wounds of War*.

[21] U.S. Department of Veterans Affairs (VA), Veterans Health Administration (VHA), Office of Public Health, Post Deployment Health Strategic Healthcare Group, Epidemiology Program, *Analysis of VA Health Care Utilization among Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND) Veterans, Cumulative from 1st Quarter FY2002 through 4th Quarter FY2011*, November 2011. The VA reports that, as of FY2011Q4, 1,396,477 OEF/OIF/OND veterans have left active duty and become eligible for VA health care; of these, 741,954 (53%) have used VA health care.

[22] VA response to CRS inquiry in December 2012; these data are from the Veterans Health Administration Support Service Center workload files for FY2008—FY2012.

[23] VA, VHA, Office of Public Health, Post Deployment Health Strategic Healthcare Group, Epidemiology Program, *Identifying Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND)* (continued...)

This part of the report focuses on TBI among veterans receiving care provided by VA medical facilities. The four sections address access to care, identification of TBI, treatment of TBI, and TBI research. Because individuals may sustain injuries during military service, the DOD may have a role in each of these areas; however, the focus of this report is on the VA, and other agencies are addressed only to the extent that they work in coordination with the VA.

Access to Care

Veterans generally must enroll in the VA health care system to receive medical care; for information about enrollment, health benefits, and cost-sharing, see CRS Report R42747, *Health Care for Veterans: Answers to Frequently Asked Questions*, by Sidath Viranga Panangala and Erin Bagalman. This section briefly describes VA outreach efforts to increase enrollment. The VA reaches out to OEF/OIF veterans to inform them of their benefits by

- participating in Reserve component out-processing at DOD demobilization sites;
- attending the DOD's Yellow Ribbon Program (YRP) events;[24]
- partnering with the National Guard in training transition assistance advisors;
- contacting OEF/OIF veterans through the Combat Veterans Call Center;
- supporting the DOD health assessment and linking veterans with appointments;
- hosting Individual Ready Reserve musters; and
- using social media and other internet-based outreach.[25]

From FY2002 through FY2011, 1.4 million OEF/OIF veterans (including members of the Reserve and National Guard) left active duty and became eligible for VA health care; by the end of FY2011, 53% of them had obtained VA health care.[26] Some veterans may choose not to enroll in VA health care because they have health coverage from other sources (e.g., private health insurance) or because they do not perceive a need for health care. Others may experience barriers to accessing VA care; potential barriers to access are discussed under "Potential Issues for Congress" later in this report.

(...continued)

Veterans Diagnosed with a Potential Traumatic Brain Injury (TBI), November 2011.

[24] The DOD Yellow Ribbon Program, established under the National Defense Authorization Act for Fiscal Year 2008, enacted 1/28/2008 (P.L. 110-181), is distinct from the VA Yellow Ribbon Program (which focuses on education).

[25] VA, *OEF/OIF Review: VA Offers "Seven Touches of Outreach" to Connect OEF/OIF/New Dawn Veterans to VA Benefits and Care*, December 2010, p. 3, http://www.publichealth.va.gov/docs/oefoif/oefoif-newsletter-dec2010.pdf.

[26] U.S. Department of Veterans Affairs (VA), Veterans Health Administration (VHA), Office of Public Health, Post-Deployment Health Group, Epidemiology Program, *Analysis of VA Health Care Utilization among Operation Enduring Freedom (OEF), Operation Iraqi Freedom (OIF), and Operation New Dawn (OND) Veterans: Cumulative from 1st Quarter FY2002 through 4th Quarter FY2011*, November 2011, http://www.publichealth.va.gov/docs/epidemiology/healthcare-utilization-report-fy2011-qtr4.pdf. The VA reports that, during the specified time frame, 1,396,477 OEF/OIF veterans left active duty and became eligible for VA health care; of these, 741,954 (53%) used VA health care.

Identification of TBI

This section describes the two-step process the VA uses to identify TBI: screening for TBI and confirming a diagnosis of TBI.

The initial injury may occur during military service; thus the DOD may be responsible for identification of TBI. Moderate to severe TBI, in particular, is likely to be recognized immediately at the time of the initial injury; however, mild TBI may go unnoticed if an individual walks away seemingly unharmed. Despite repeated assessments by the DOD, a veteran may enter the VA health care system with an undiagnosed TBI. In order to identify cases of TBI that might otherwise go untreated, VA policy requires that all OEF/OIF veterans receiving medical care in the VA health care system must be screened for possible TBI, and that those who screen positive must be offered further evaluation and specialized treatment.[27]

The VA developed a screening instrument and a protocol for further evaluation of individuals who screen positive. The screening instrument was adapted from one already used by the DOD and was incorporated into a national clinical reminder in the computerized patient record system. When a provider opens a veteran's computerized record, the clinical reminder alerts the provider that action is required. The clinical reminder then prompts the provider to ask the veteran a series of questions in order to complete the TBI screening instrument.

If a veteran screens negative for possible TBI, the clinical reminder is resolved and no further action is required. If a veteran screens positive for possible TBI, the clinical reminder generates an electronic consult for a follow-up evaluation. The protocol for completing the additional evaluation includes a 22-item neurobehavioral symptom inventory.

The diagnosis of TBI is complicated by symptoms that overlap with posttraumatic stress disorder (PTSD),[28] such as difficulty concentrating, irritability or outbursts of anger, and memory loss.[29] Because of the complexity of diagnosing TBI and differentiating symptoms of other disorders,[30] specialized training is required to administer the evaluation.

If the follow-up evaluation finds that the veteran does not have TBI, the consult is completed and results are reported to the referring clinician. If the follow-up evaluation finds that the veteran has TBI, the veteran is referred for specialized treatment, as described in the next section.

Treatment of TBI

This section describes treatment of veterans with TBI in the VA health care system, focusing on treatment of veterans with moderate to severe TBI. The first subsection describes the VA

[27] VA, Veterans Health Administration, Screening and Evaluation of Possible Traumatic Brain Injury in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) Veterans, VHA Directive 2010-012, March 8, 2010, http://www.va.gov/vhapublications/ViewPublication.asp?pub_ID=2176.

[28] Posttraumatic stress disorder (PTSD) is an anxiety disorder that may occur following a traumatic event.

[29] American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, Fourth Edition, Text Revision (Arlington, VA: American Psychiatric Association, 2000), pp. 463-468.

[30] The VA is studying differential diagnoses in an effort to build objective and consistent diagnostic criteria for TBI and PTSD. Department of Veterans Affairs, Office of Public Health and Environmental Hazards, http://www.publichealth.va.gov/epidemiology/studies/mind-study.asp.

Polytrauma System of Care. The second subsection describes several programs aimed at coordinating VA and DOD treatment.

The early stages of treatment may occur within the military health care system, if the initial injury occurs during military service; however, this report focuses on treatment within the VA health care system. Regardless of where treatment is provided, the type of treatment needed depends on the severity of the injury.

Servicemembers who sustain mild TBI (which accounts for the majority of injuries[31]) may walk away from the event, seemingly unharmed; thus mild TBI may go unnoticed and untreated. Most cases of mild TBI resolve without medical attention. Education about mild TBI can effectively "normalize symptoms and provide expectation of rapid recovery."[32] The VA and the DOD have jointly developed evidence-based clinical practice guidelines for treatment of mild TBI.[33]

Servicemembers who sustain moderate to severe TBI (i.e., recognizable injuries) require immediate treatment, which begins at the site of the event and continues at a military treatment facility. Once stabilized, servicemembers may remain at a military treatment facility or be sent to VA medical facilities for continuing treatment, rehabilitation, and transitional care. When servicemembers transfer from DOD to VA facilities (regardless of whether they change to veteran status), coordination between the two systems is necessary.

VA Polytrauma System of Care

Veterans with moderate to severe TBI (alone or in combination with other conditions) may receive care through the VA Polytrauma System of Care (PSC).[34] The PSC is designed to function within the existing VA health care system, which is organized into geographic regions called Veterans Integrated Service Networks (VISN). Like the larger VISN structure, the PSC is geographically dispersed, thereby making the specialized treatment more accessible to veterans, regardless of where they live. The PSC operates as a "hub and spoke" model with four components, each of which is described below.

Component I of the PSC comprises five regional Polytrauma Rehabilitation Centers, which serve as regional referral centers, the "hubs" of the PSC. Polytrauma Rehabilitation Centers provide direct care and consultation, as well as research and education related to polytrauma and TBI. Each Polytrauma Rehabilitation Center has a minimum of 12 dedicated comprehensive rehabilitation beds and 10 dedicated transitional rehabilitation beds. Required staff include a rehabilitation physician (physiatrist), registered nurses, social workers, speech-language

[31] Mild TBI accounted for 81% of the servicemembers sustaining TBI in 2010. Defense and Veterans Brain Injury Center, *DOD Numbers for Traumatic Brain Injury*, http://www.dvbic.org/dod-worldwide-numbers-tbi.

[32] Charles W. Hoge et al., "Mild Traumatic Brain Injury in US Soldiers Returning from Iraq," *New England Journal of Medicine*, vol. 358, no. 5 (2008), pp. 453-463.

[33] VA and Department of Defense (DOD), *VA/DOD Clinical Practice Guideline for Management of Concussion/mild Traumatic Brain Injury (mTBI)*, April 2009, http://www.healthquality.va.gov/management_of_concussion_mtbi.asp.

[34] Veterans Health Administration, *Polytrauma-Traumatic Brain Injury (TBI) System of Care*, Department of Veterans Affairs, VHA Directive 2009-028, Washington, DC, June 9, 2009; unless otherwise noted, all information in this subsection is drawn from this source. Polytrauma is defined therein as "two or more injuries sustained in the same incident that affect multiple body parts or organ systems and result in physical cognitive, psychological, or psychosocial impairments and functional disabilities." See also the VA's polytrauma website, which updates the numbers for the four components of the Polytrauma System of Care: http://www.polytrauma.va.gov/system-of-care.

pathologists, physical therapists, occupational therapists, recreation therapists, and a neuropsychologist, among others.

Component II of the PSC extends the "spokes" to 23 Polytrauma Network Sites: one in each VISN (including one at each of the Polytrauma Rehabilitation Centers) plus one in Puerto Rico. In consultation with the Polytrauma Rehabilitation Centers, Polytrauma Network Sites provide specialized, post-acute rehabilitation services in a setting appropriate to the needs of veterans, servicemembers, and families. Each Polytrauma Network Site has a dedicated interdisciplinary team with specialized training, to provide case management and identify resources both within and outside the VA. **Figure 1** shows the location of each Polytrauma Network Site, including the Polytrauma Rehabilitation Centers.

Component III of the PSC extends care to 87 VA medical facilities that do not have Polytrauma Rehabilitation Centers or Polytrauma Network Sites, by establishing Polytrauma Support Clinic Teams. These local teams of providers have rehabilitation expertise and deliver follow-up services in consultation with regional and network specialists. They provide direct care, consultation, and telerehabilitation, as needed.

Component IV of the PSC addresses the needs of veterans at 38 VA medical facilities that lack the necessary services to provide specialized care. Such facilities must designate a Polytrauma Point of Contact who is responsible for coordinating the treatment of veterans at their facility. The role of the Polytrauma Point of Contact is to ensure that veterans are referred to a facility capable of providing the services they require.

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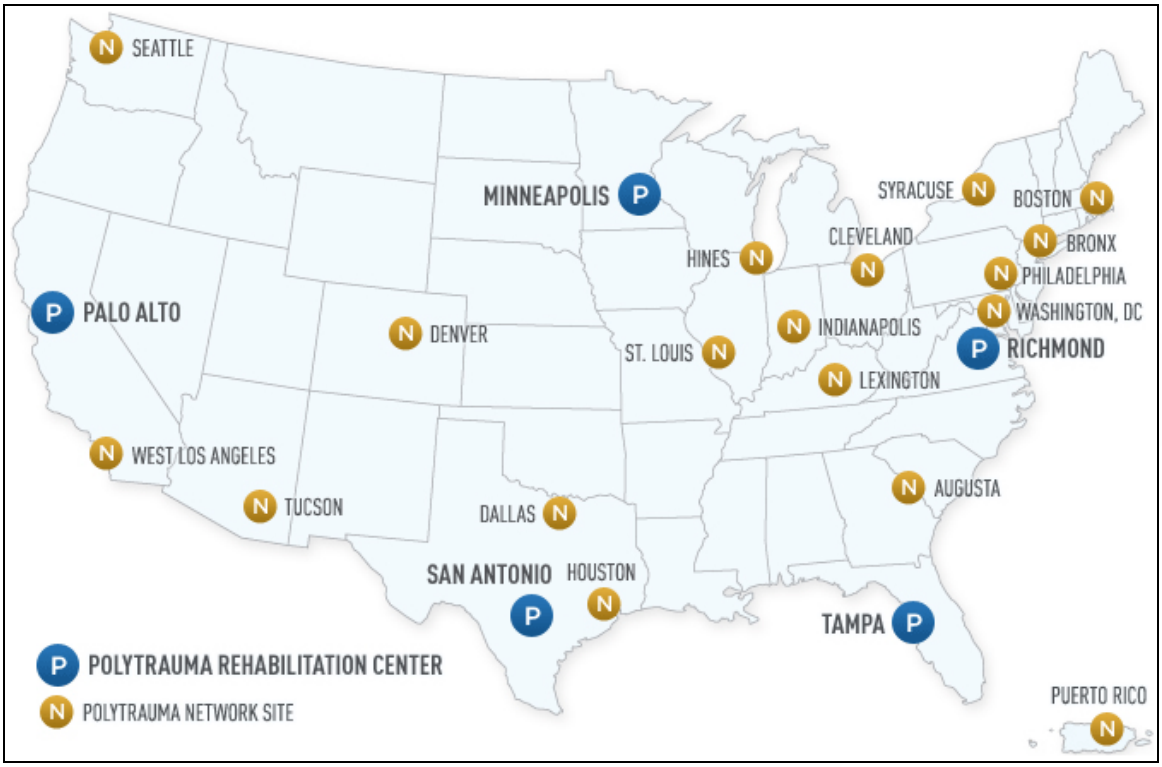
Figure 1.VA Polytrauma System of Care

Location of Polytrauma Rehabilitation Centers and Polytrauma Network Sites



Source: U.S. Department of Veterans Affairs (VA), Polytrauma/TBI System of Care, Care Facilities, http://www.polytrauma.va.gov/system-of-care/care-facilities/http://www.polytrauma.va.gov/system-of-care/care-facilities.

Coordination of VA and DOD Treatment

Injured servicemembers may transfer directly from military treatment facilities to VA medical facilities (and may later convert to veteran status), or veterans may access VA medical facilities after having received treatment in military facilities. Such situations require coordination between the two agencies in caring for servicemembers or veterans with TBI. Three VA and joint VA/DOD programs seek to address the transition from DOD to VA health care facilities: OEF/OIF Care Management, the VA Liaison Program, and the Federal Recovery Coordinator Program.

Every VA Medical Center has an OEF/OIF Care Management Team, consisting of case managers and transition patient advocates, to help coordinate care and navigate the VA system. Case managers are either nurses or social workers. Transition patient advocates serve as personal advocates for patients moving throughout the VA health care system. This service is available to all OEF/OIF veterans without referral.[35]

The VA Liaison Program places VA employees at military treatment facilities, where they provide onsite consultation about VA resources. Liaisons coordinate referrals with the OEF/OIF Care

[35] VA, *Returning Service Members (OEF/OIF/OND): Care Management Teams*, updated September 7, 2012, http://www.oefoif.va.gov/caremanagement.asp.

Management teams at local VA facilities; they maintain involvement until health care is arranged and transfer is complete.[36]

The Federal Recovery Coordination Program (FRCP), established jointly by the VA and the DOD in 2007, is intended to coordinate services provided by the DOD, the VA, and other public and private entities. Veterans or servicemembers with TBI (one of several qualifying conditions) can self-refer to the FRCP or be referred by clinicians, family members, veterans service organizations, or others. Each veteran (or servicemember) enrolled in the FRCP is assigned a Federal Recovery Coordinator (FRC) who coordinates care but does not provide direct services.[37]

TBI Research

The VA's budget for "Traumatic Brain Injury and Other Neurotrauma" research was $21 million in FY2011 (actual), $24 million in FY2012 (current estimate), and $29 million in FY2013 (request).[38]

The VA Office of Research and Development supports research on a range of topics related to TBI, including (but not limited to)

- characterizing changes in the brain to improve diagnosis and treatment of TBI;
- regenerating nerve cells (through gene therapy, for example); and
- treating TBI using medications.[39]

Research on TBI and related conditions may also be conducted under the auspices of the VA's Mental Health Strategic Healthcare Group (MHSHG), which supports the research efforts conducted at the National Center for PTSD, four Centers of Excellence (CoEs), and 10 Mental Illness Research Education and Clinical Centers (MIRECCs).[40]

The VA is collaborating with the National Institute of Disability and Rehabilitation Research (NIDRR, within the Department of Education) to develop the Traumatic Brain Injury Veterans Health Registry, which will facilitate future research by providing longitudinal data on the demographics, military service data, injury information, and treatment of all OEF/OIF veterans with TBI.[41] The VA is also working with NIDRR to establish a database similar to NIDRR's

[36] VA, *Department of Veterans Affairs Liaison for Healthcare Stationed at Military Treatment Facilities*, VA Handbook 1010.02, November 13, 2009, http://www1.va.gov/vhapublications/ViewPublication.asp?pub_ID=2115. For a listing of military treatment facilities with VA liaisons, see the VA's National VA Liaison Program—Contact Listing at http://www.oefoif.va.gov/docs/Web_VA_Liaisons_and_PSA_Contact_Info_website.htm.

[37] U.S. Government Accountability Office, *DOD and VA Health Care: Federal Recovery Coordination Program Continues to Expand but Faces Significant Challenges*, GAO-11-250, March 23, 2011, http://www.gao.gov/products/GAO-11-250.

[38] VA, Congressional Submission: FY2013 Funding and FY2014 Advance Appropriations Request, Volume II Medical Programs & Information Technology Programs, pp. 3A-5, http://www.va.gov/budget/docs/summary/Fy2013_Volume_II-Medical_Programs_Information_Technology.pdf.

[39] VA, VHA, Office of Research and Development, *Traumatic Brain Injury: Spotlight on VA Research*, updated October 4, 2011, http://www.research.va.gov/research_topics/tbi.cfm.

[40] VA, *MIRECCs and Centers of Excellence*, http://www.mirecc.va.gov/national-mirecc-overview.asp.

[41] VA Quality Enhancement Research Initiative (QUERI), *Polytrauma/Blast-Related Injuries QUERI Center Strategic Plan: FY2013 through FY2015*, November 2012, p. 20, http://www.queri.research.va.gov/about/strategic_plans/ptbri.pdf.

existing TBI Model System National Database (established in 1989), which will facilitate research collaboration and program evaluation.[42]

The Defense and Veterans Brain Injury Center (DVBIC), a component of the Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, is a collaboration between the VA and the DOD. Research conducted by the DVBIC includes clinical studies of treatment strategies for TBI, epidemiologic studies of military-related TBI, and studies involving brain imaging technology.[43]

Potential Issues for Congress

This part of the report focuses on ongoing issues that may be of interest to Congress, in the context of past congressional action addressing these issues. **Appendix B** summarizes provisions of public laws that address TBI among veterans, beginning with the 108th Congress and ending with the 112th Congress. In addition to specific issues noted here, TBI treatment and research initiatives are ongoing, providing opportunities for Congress to exercise its oversight function while programs are implemented and research is conducted.

Ongoing Issues in Access to Care

The National Defense Authorization Act for Fiscal Year 2008 (P.L. 110-181) facilitated access to care by extending the period of enhanced enrollment eligibility for OEF/OIF veterans.[44] However, a veteran's own behavior—whether intentional or not—may interfere with his or her ability to access the VA health care system and thus be properly diagnosed. Some veterans may choose not to disclose symptoms of TBI because they believe that being diagnosed with a TBI would affect their ability to stay in the National Guard or Reserves, or affect other future employment plans.[45] Similarly, some servicemembers leaving war zones may not disclose mental health symptoms, or may downplay such symptoms, in order to avoid any delay in their return home.[46] Some veterans may not be fully aware of changes in their functioning due to TBI.[47] Cognitive impairments due to TBI may compromise veterans' ability to seek care or navigate the system.[48]

[42] Ibid., pp. 20-21.

[43] Defense and Veterans Brain Injury Center, *Current DVBIC Studies*, http://www.dvbic.org/research/browse/current-dvbic-studies.

[44] For details of enrollment, see CRS Report R42747, *Health Care for Veterans: Answers to Frequently Asked Questions*, by Sidath Viranga Panangala and Erin Bagalman

[45] U.S. Government Accountability Office, Mild Traumatic Brain Injury Screening and Evaluation Implemented for OEF/OIF Veterans, but Challenges Remain, 08-276, February 2008.

[46] Tanielian and Jaycox, eds. *Invisible Wounds of War*.

[47] Rodney D. Vanderploeg et al., "Awareness Problems Following Moderate to Severe Traumatic Brain Injury: Prevalence, Assessment Methods, and Injury Correlates," *Journal of Rehabilitation Research & Development*, vol. 44, no. 7 (2007), pp. 937-950.

[48] Henry L. Lew et al., "Persistent Problems after Traumatic Brain Injury: The Need for Long-Term Follow-up and Coordinated Care," *Journal of Rehabilitation Research & Development*, vol. 43 (2006), pp. vii-x.

Ongoing Issues in Identification of TBI

In addition to facilitating access to care, P.L. 110-181 contributed to the identification of TBI by directing the Secretaries of the VA and DOD to propose medical codes to indicate TBI on medical records; this law also contributed to identification of TBI by requiring the VA Secretary to establish and maintain a TBI Veterans Health Registry. The Traumatic Brain Injury Act of 2008 (P.L. 110-206) also contributed to identification of TBI by involving HHS in tracking the incidence and prevalence of TBI among veterans. Ongoing issues in identification of TBI among OEF/OIF veterans at VA medical facilities generally fall into two categories—the screening instrument and how it is used.

Because the VA modified an existing screening instrument, the VA is responsible for establishing its *validity* and *reliability* for use with a slightly different population (i.e., OEF/OIF veterans receiving care from the VA, rather than servicemembers returning from OEF/OIF). Clinical *validity* refers to both how well the screening instrument identifies patients with TBI (i.e., sensitivity) and how well it identifies patients without TBI (i.e., specificity). At least one study has found that the sensitivity of the screening instrument is high[49] and specificity is poor[50] to moderate.[51] Because a positive screen is followed by a more thorough evaluation, sensitivity is more important than specificity in the screening instrument.

Reliability is the ability of the screening instrument to yield the same results if administered repeatedly to the same person. A small, preliminary study of test-retest reliability found that most items in the screening instrument do not have good reliability.[52] A larger study found that the screening instrument has high test-retest reliability.[53] Another VA study has been completed, but results have not yet been published.[54]

The VA is also responsible for ensuring that the screening instrument is used as intended, by properly trained staff. Early investigations found that some providers used the screening instrument before being trained,[55] and that some OEF/OIF veterans were not screened or had delayed screenings because staff were not aware of procedures.[56] The VA is currently tracking completion and timeliness of TBI screenings and follow-up evaluations.[57]

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[49] Heather G. Belanger et al., "Validity of the Veterans Health Administration's Traumatic Brain Injury Screen," *Archives of Physical Medicine and Rehabilitation*, vol. 93, no. 7 (July), pp. 1234-1239; and K.T. Donnelly et al., "Reliability, Sensitivity, and Specificity of the VA Traumatic Brain Injury Screening Tool," *Journal of Head Trauma Rehabilitation*, E-pub ahead of print 2011.

[50] Donnelly et al., "Reliability, Sensitivity, and Specificity of the VA Traumatic Brain Injury Screening Tool"

[51] Belanger et al., "Validity of the Veterans Health Administration's Traumatic Brain Injury Screen."

[52] Sarah A. Van Dyke, Bradley N. Axelrod, and Christian Schutte, "Test-Retest Reliability of the Traumatic Brain Injury Screening Instrument," *Military Medicine*, vol. 175, no. 12 (2010), pp. 947-949.

[53] Donnelly et al., "Reliability, Sensitivity, and Specificity of the VA Traumatic Brain Injury Screening Tool."

[54] Department of Veterans Affairs (Babcock-Parziale, Judi - Principal Investigator), *Evaluation of VA's TBI Clinical Reminder and Secondary Level Evaluation*, ClinicalTrials.gov Identifier: NCT00852527, http://clinicaltrials.gov/ct2/show/NCT00852527.

[55] U.S. Government Accountability Office, VA Health Care: Mild Traumatic Brain Injury Screening and Evaluation Implemented for OEF/OIF Veterans, But Challenges Remain, GAO-08-276, February 2008, http://www.gao.gov.

[56] VA Office of Inspector General, Office of Audits & Evaluations, *Veterans Health Administration Audit of Community-Based Outpatient Clinic Management Oversight*, VAOIG-09-02093-211, July 28, 2010, http://www.va.gov/oig/52/reports/2010/VAOIG-09-02093-211.pdf.

[57] VA Quality Enhancement Research Initiative (QUERI), *Polytrauma/Blast-Related Injuries QUERI Center Strategic*
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Ongoing Issues in Treatment of TBI

Several laws have addressed treatment of TBI provided by either professionals or family caregivers. The Veterans Health Programs Improvement Act of 2004 (P.L. 108-422) resulted in the establishment of the Polytrauma System of Care. The Caregivers and Veterans Omnibus Health Services Act of 2010 (P.L. 111-163) built on work initiated under the National Defense Authorization Act for Fiscal Year 2007 (P.L. 109-364) in training family caregivers for veterans; P.L. 111-163 also enabled the VA to utilize non-VA facilities under certain circumstances.

An ongoing issue in treatment of TBI is coordination of care. Programs intended to improve coordination of care between VA and DOD may face their own coordination challenges. A 2011 report by the GAO identified challenges the Federal Recovery Coordinator Program is facing, including in coordination with other programs.[58] Because the majority of enrollees are enrolled in at least one other program for wounded servicemembers or veterans, the program must coordinate not only among care providers, but also among other care coordinators. Having multiple care coordinators increases the potential for duplication of effort, conflicting treatment goals, or failure to address issues (if each coordinator thinks someone else is handling the issue).

Ongoing Issues in TBI Research

Congress has appropriated funds for many research projects related to TBI. For example, the National Defense Authorization Act for Fiscal Year 2008 (P.L. 110-181) required the VA to collaborate with the TBI rehabilitation research community, grantees of the National Institute of Disability and Rehabilitation Research (within the Department of Education), the Defense and Veterans Brain Injury Center, and other governmental entities engaged in TBI rehabilitation.

The large number of studies conducted by the VA, DOD, and HHS (including both the Centers for Disease Control and Prevention and the National Institutes of Health) raises questions for some about potential duplication of effort, gaps in the research, dissemination of research findings, and translation of research into practice. While duplication of effort may seem wasteful, replicating studies is a normal part of the research process; ideally, the replicated studies yield the same results as the original study and thus increase confidence in the findings. The direction of subsequent research is often guided by identifying gaps in the existing research. Dissemination of research findings is necessary in order for the findings to be useful, and strong findings should be translated into practice in order to improve care.

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Plan: FY2013 through FY2015, November 2012, p. 19, http://www.queri.research.va.gov/about/strategic_plans/ptbri.pdf.

[58] U.S. Government Accountability Office, DOD and VA Health Care: Federal Recovery Coordination Program Continues to Expand but Faces Significant Challenges, GAO-11-250, March 23, 2011. See also U.S. Congress, House Committee on Veterans' Affairs, Subcommittee on Health, *The Federal Recovery Coordination Program: From Concept to Reality*, 112th Cong., 1st sess., May 12, 2011; U.S. Congress, House Committee on Veterans' Affairs, Subcommittee on Health, *The Federal Recovery Coordination Program: Assessing Progress Toward Improvement*, 112th Cong., 1st sess., October 6, 2011; and U.S. Government Accountability Office, *Federal Recovery Coordination Program: Enrollment, Staffing, and Care Coordination Pose Significant Challenges*, GAO-11-572T, May 13, 2011, http://www.gao.gov/products/GAO-11-572T.

Appendix A. OEF/OIF Veterans with TBI, by State

Table A-1. Number of OEF/OIF Veterans Diagnosed with TBI-Related Conditions at VA Medical Facilities, FY2002-FY2010, by State of Residence

Alabama	766	Nevada	286
Alaska	258	New Hampshire	232
Arizona	1,049	New Jersey	480
Arkansas	1,106	New Mexico	292
California	5,084	New York	1,934
Colorado	1,158	North Carolina	1,842
Connecticut	280	North Dakota	219
Delaware	91	Ohio	1,389
District Of Columbia	93	Oklahoma	1,203
Florida	2,383	Oregon	706
Georgia	1,725	Pennsylvania	1,350
Hawaii	361	Rhode Island	129
Idaho	244	South Carolina	379
Illinois	1,116	South Dakota	224
Indiana	816	Tennessee	1,017
Iowa	369	Texas	4,075
Kansas	693	Utah	221
Kentucky	1,243	Vermont	163
Louisiana	505	Virginia	1,050
Maine	185	Washington	1,645
Maryland	493	West Virginia	256
Massachusetts	636	Wisconsin	704
Michigan	790	Wyoming	147
Minnesota	1,028		
Mississippi	331	Puerto Rico	459
Missouri	796	Other	577
Montana	363	Unknown	336

Source: U.S. Department of Veterans Affairs, in response to a CRS request.

Notes: Status as an OEF/OIF veteran is based on OEF/OIF deployment rosters from the DOD Defense Manpower Data Center with the last out-of-country dates through August 2010. Diagnoses were made during outpatient visits and hospitalizations at VA medical facilities between FY2002Q1 and FY2010Q4. TBI-related conditions are defined by VA Environmental Epidemiology System as the following ICD-9-CM codes: 310.2, 800, 801, 802, 803, 804, 850, 851, 852, 853, 854, 950. Each veteran may be diagnosed in the VA medical system with multiple TBI-related conditions, but is counted only once in the table. State of residence taken from first record of deployment in support of OEF/OIF. Due to the duration of OEF/OIF and repeated deployments, a number of the veterans who died in-theater may have previously accessed VA health care services and may therefore be included in these counts.

Appendix B. Past Congressional Action

Table B-1 summarizes provisions of public laws that address TBI among veterans, beginning with the 108th Congress and ending with the 112th Congress. Note that many of the laws listed in **Table B-1** do not focus on the VA, but include provisions relevant to veterans. For example, the National Defense Authorization Act for Fiscal Year 2007 (P.L. 109-364) primarily addresses the DOD, but is included because the panel it requires the DOD Secretary to establish is responsible for developing curricula for training family members in the provision of care and assistance to veterans (and servicemembers) with TBI. Similarly, the Traumatic Brain Injury Act of 2008 (P.L. 110-206) primarily addresses HHS, but is included because of a requirement that the HHS Secretary report on activities and procedures that can be implemented by the Centers for Disease Control and Prevention (CDC) to improve the collection and dissemination of epidemiological studies on the incidence and prevalence of TBI in veterans.

Table B-1. Congressional Action on TBI Among Veterans, 2004-2012

(Excludes provisions focused on servicemembers rather than veterans)

Public Law	Short Title	Key Provisions Related to TBI Among Veterans
P.L. 108-422	Veterans Health Programs Improvement Act of 2004	Directs the VA to designate an appropriate number of cooperative centers for clinical care, consultation, research, and education activities on polytrauma (i.e., the Polytrauma System of Care).
P.L. 109-364	John Warner National Defense Authorization Act for Fiscal Year 2007	Requires the DOD Secretary to establish a Traumatic Brain Injury Family Caregiver Panel to develop curricula for training family members in the provision of care and assistance to servicemembers and veterans with TBI.
P.L. 110-161	Consolidated Appropriations Act, 2008	Authorizes the VA Secretary to transfer up to $5 million to the HHS Secretary for the Graduate Psychology Education Program to support increased training of psychologists in the treatment of TBI, PTSD, and related disorders. [Same provision appears in P.L. 110-329 and P.L. 111-117.]
P.L. 110-181	National Defense Authorization Act for Fiscal Year 2008	Extends the period of enhanced eligibility for OEF/OIF veterans. Directs the VA and DOD Secretaries to propose codes for inclusion in the ICD to ensure that veterans and servicemembers with TBI receive a medical designation concomitant with the injury. Requires the VA Secretary, in selecting locations for an assisted-living services pilot program, to give special consideration to rural areas and locations with a high concentration of TBI. Requires the VA Secretary to establish and maintain a TBI Veterans Health Registry, including information about each OEF/OIF veteran who exhibits symptoms associated with TBI and applies for care or files a claim for disability compensation from VA. The VA is to notify veterans in the registry of significant developments in research on health consequences of OEF/OIF service. Requires the VA to collaborate with the TBI rehabilitation research community, grantees of the NIDRR of the Department of Education, the DVBIC, and other governmental entities engaged in TBI rehabilitation. Requires that each veteran with TBI receive an individualized plan for rehabilitation and community reintegration.

Public Law	Short Title	Key Provisions Related to TBI Among Veterans
P.L. 110-206	Traumatic Brain Injury Act of 2008	Requires the HHS Secretary to report on activities and procedures that can be implemented by the CDC to improve the collection and dissemination of compatible epidemiological studies on the incidence and prevalence of TBI in veterans.
P.L. 110-329	Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009	Authorizes the VA Secretary to transfer up to $5 million to the HHS Secretary for the Graduate Psychology Education Program to support increased training of psychologists in the treatment of TBI, PTSD, and related disorders. [Same provision appears in P.L. 110-161 and P.L. 111-117.]
P.L. 111-117	Consolidated Appropriations Act, 2010	Authorizes the VA Secretary to transfer up to $5 million to the HHS Secretary for the Graduate Psychology Education Program to support increased training of psychologists in the treatment of TBI, PTSD, and related disorders. [Same provision appears in P.L. 110-161 and P.L. 110-329.]
P.L. 111-163	Caregivers and Veterans Omnibus Health Services Act of 2010	Directs the VA Secretary to establish a program of comprehensive assistance for family caregivers of eligible veterans, including those with TBI. Once fully implemented, the program will include instruction and training in personal care services; ongoing technical support; counseling; and lodging and subsistence while accompanying the veteran for VA medical care. The program will also allow additional assistance for the primary personal care provider, including mental health services, respite care, and a monthly stipend comparable to that provided to commercial caregivers in that geographic area. Authorizes the VA Secretary to utilize non-VA facilities (that meet accreditation standards) for the care and treatment of veterans with TBI, and to contract with non-VA providers for specialized residential care and rehabilitation services to veterans with TBI who would otherwise require nursing home admission. Directs the VA Secretary to establish the Committee on Care of Veterans with TBI, to continually assess VA capabilities to meet the treatment and rehabilitation needs of veterans with TBI.
P.L. 112-154	Honoring America's Veterans and Caring for Camp Lejeune Families Act of 2012	Defines rehabilitative services and includes them among services in existing programs for longer-term rehabilitation and use of non-VA facilities for rehabilitation. Directs the VA Secretary to execute an initiative of teleconsultation for the provision of TBI (and PTSD) assessments while ensuring that VA facilities are able to use non-VA facilities for such assessments under specified conditions.

Source: CRS analysis of data from the Legislative Information Service.

Notes: TBI = Traumatic Brain Injury; OEF/OIF = Operation Enduring Freedom and Operation Iraqi Freedom (including Operation New Dawn); VA = Department of Veterans Affairs; DOD = Department of Defense; HHS = Department of Health and Human Services; CDC = Centers for Disease Control and Prevention; ICD = International Classification of Diseases; DVBIC = Defense and Veterans Brain Injury Center; NIDRR = National Institute of Disability and Rehabilitation Research.

Author Contact Information

Erin Bagalman
Analyst in Health Policy
ebagalman@crs.loc.gov, 7-5345

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