OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 19 2017

The Honorable Paul Ryan
Speaker of the House
U.S. House of Representatives
H-209, The Capitol
Washington, DC 20515

Dear Mr. Speaker:

The enclosed report responds to section 721(e) of the National Defense Authorization Act for Fiscal Year 2007 (Public Law 109-364), which requires the Secretary of Defense to conduct a longitudinal study on the effects of Traumatic Brain Injury (TBI) incurred by members of the Armed Forces serving in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM, and to submit a report on the 3rd, 7th, 11th, and 15th years of such a study. The legislation also requires that each report include both cumulative outcomes and recommendations for legislative, programmatic, or administrative action to improve long-term care and rehabilitation programs and services for members of the Armed Forces with TBI. This report is the 7-Year Update. The 3-Year Update was sent to Congress on June 18, 2013; the 11-Year Update will be submitted in 2021.

This report addresses a range of issues. It indicates that Posttraumatic Stress Disorder, acute stress, depression, and sleep disruption complicate TBI recovery. It also shows that assessment and care delivery should be interdisciplinary and tailored to the unique needs of each patient. Furthermore, the report reveals that some patients fail to engage in care after a TBI despite having significant symptoms. Finally, it conveys that since family caregivers of Service members and veterans with TBI face a significant burden, many feel ill equipped to fulfill their role.

Thank you for your interest in the health and well-being of our Service members, veterans, and their families. A similar letter is being sent to the President of the Senate and the congressional defense committees.

Sincerely,

A. M. Kurta
Performing the Duties of the Under Secretary of
Defense for Personnel and Readiness

Enclosure:
As stated

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 19 2017

The Honorable Rodney P. Frelinghuysen
Chairman
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

The enclosed report responds to section 721(e) of the National Defense Authorization Act for Fiscal Year 2007 (Public Law 109-364), which requires the Secretary of Defense to conduct a longitudinal study on the effects of Traumatic Brain Injury (TBI) incurred by members of the Armed Forces serving in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM, and to submit a report on the 3rd, 7th, 11th, and 15th years of such a study. The legislation also requires that each report include both cumulative outcomes and recommendations for legislative, programmatic, or administrative action to improve long-term care and rehabilitation programs and services for members of the Armed Forces with TBI. This report is the 7-Year Update. The 3-Year Update was sent to Congress on June 18, 2013; the 11-Year Update will be submitted in 2021.

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Sincerely,

A. M. Kurta
Performing the Duties of the Under Secretary of
Defense for Personnel and Readiness

Enclosure:
As stated

cc:
The Honorable Nita M. Lowey
Ranking Member

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 19 2017

The Honorable William M. "Mac" Thornberry
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

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Sincerely,

A. M. Kurta
Performing the Duties of the Under Secretary of
Defense for Personnel and Readiness

Enclosure:
As stated

cc:
The Honorable Adam Smith
Ranking Member

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 19 2017

The Honorable John McCain
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The enclosed report responds to section 721(e) of the National Defense Authorization Act for Fiscal Year 2007 (Public Law 109-364), which requires the Secretary of Defense to conduct a longitudinal study on the effects of Traumatic Brain Injury (TBI) incurred by members of the Armed Forces serving in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM, and to submit a report on the 3rd, 7th, 11th, and 15th years of such a study. The legislation also requires that each report include both cumulative outcomes and recommendations for legislative, programmatic, or administrative action to improve long-term care and rehabilitation programs and services for members of the Armed Forces with TBI. This report is the 7-Year Update. The 3-Year Update was sent to Congress on June 18, 2013; the 11-Year Update will be submitted in 2021.

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Sincerely,

A. M. Kurta
Performing the Duties of the Under Secretary of
Defense for Personnel and Readiness

Enclosure:
As stated

cc:
The Honorable Jack Reed
Ranking Member

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 19 2017

The Honorable Thad Cochran
Chairman
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The enclosed report responds to section 721(e) of the National Defense Authorization Act for Fiscal Year 2007 (Public Law 109-364), which requires the Secretary of Defense to conduct a longitudinal study on the effects of Traumatic Brain Injury (TBI) incurred by members of the Armed Forces serving in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM, and to submit a report on the 3rd, 7th, 11th, and 15th years of such a study. The legislation also requires that each report include both cumulative outcomes and recommendations for legislative, programmatic, or administrative action to improve long-term care and rehabilitation programs and services for members of the Armed Forces with TBI. This report is the 7-Year Update. The 3-Year Update was sent to Congress on June 18, 2013; the 11-Year Update will be submitted in 2021.

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Thank you for your interest in the health and well-being of our Service members, veterans, and their families. A similar letter is being sent to the Speaker of the House, the President of the Senate, and the other congressional defense committees.

Sincerely,

A. M. Kurta
Performing the Duties of the Under Secretary of
Defense for Personnel and Readiness

Enclosure:
As stated

cc:
The Honorable Patrick J. Leahy
Vice Chairman

OFFICE OF THE UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

JUL 19 2017

The Honorable Michael R. Pence
President of the Senate
United States Senate
Washington, DC 20510

Dear Mr. President:

The enclosed report responds to section 721(e) of the National Defense Authorization Act for Fiscal Year 2007 (Public Law 109-364), which requires the Secretary of Defense to conduct a longitudinal study on the effects of Traumatic Brain Injury (TBI) incurred by members of the Armed Forces serving in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM, and to submit a report on the 3rd, 7th, 11th, and 15th years of such a study. The legislation also requires that each report include both cumulative outcomes and recommendations for legislative, programmatic, or administrative action to improve long-term care and rehabilitation programs and services for members of the Armed Forces with TBI. This report is the 7-Year Update. The 3-Year Update was sent to Congress on June 18, 2013; the 11-Year Update will be submitted in 2021.

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Sincerely,

A. M. Kurta
Performing the Duties of the Under Secretary of
Defense for Personnel and Readiness

Enclosure:
As stated

REPORT TO CONGRESS

Section 721 of the National Defense Authorization Act for Fiscal Year 2007 (Public Law 109–364), 7-Year Update, Longitudinal Study on Traumatic Brain Injury Incurred by Members of the Armed Forces in Operation IRAQI FREEDOM and Operation ENDURING FREEDOM

June 2017

The estimated cost of this report or study for the Department of Defense is approximately $6,600.00 in Fiscal Years 2016-2017. This includes $0 in expenses and $6,600 in Department of Defense labor.
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INTRODUCTION

Section 721 of the John Warner National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2007 (Public Law 109–364), requires that the Secretary of Defense (SecDef) "conduct a longitudinal study on the effects of Traumatic Brain Injury (TBI) incurred by members of the Armed Forces serving in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM on the members who incur such an injury and their families." Congress directed that the study run for 15 years and that reports be submitted on the 3rd, 7th, 11th, and 15th years in consultation with the Secretary of Veterans Affairs. In 2009, the SecDef directed the Defense and Veterans Brain Injury Center, a component of the Defense Centers of Excellence for Psychological Health and TBI, to address this Congressional mandate.

In compliance with the SecDef's direction, the Department of Defense (DoD) supports two component studies. The first, the 15-Year Studies, consists of three sub-studies: (1) the Natural History Study (Comprehensive Pathway and Brief Pathway); (2) the Family Caregiver Study (Longitudinal Family Caregiver Study and TBI Caregiver Quality of Life Development Study); and (3) the Archival Studies. Each sub-study targets specific subsets of Service members, veterans, and their families. The second component study, Improved Understanding of Medical and Psychological Needs in Veterans and Service Members with Chronic TBI (IMAP), launched approximately two years ago. IMAP supplements the infrastructure of the Department of Veterans Affairs (VA) TBI Model Systems Program lifetime study to examine the rehabilitation and health care needs of Service members and veterans with TBI.

The 3-Year Update, submitted to Congress in 2013, introduced the methodology for the 15-Year Studies. The current report summarizes the findings from the past seven years of the 15-Year Studies and the past two years of IMAP. Leading up to this report, the DoD collaborated closely with the VA, yielding more comprehensive data to answer the mandate. Study investigators continue to revise and refine study procedures to collect data effectively and efficiently.

Background

DoD defines a TBI as a traumatically induced structural injury or physiologic disruption of brain function as a result of an external force, with accompanying alteration of mental status, loss of memory for events immediately before or after the injury, or a loss of consciousness of any length. Most TBI is mild and most individuals who sustain a mild TBI will recover fully. However, those with a moderate to severe TBI or multiple mild TBIs experience varied and sometimes prolonged recoveries.

Dissemination Activities

Researchers have published 73 peer-reviewed manuscripts and 177 abstracts using data from the 15-Year Studies and IMAP (see Appendix A for cited manuscripts and abstracts). They have also given 194 conference presentations.

YEAR 7 STUDY OUTCOMES

Section 721 of the NDAA for FY 2007 (Public Law 109–364), requires that the longitudinal study of TBI address four elements informing study design, data collection, and data analysis for the 15-Year Studies and IMAP. The following sections present research findings by each element.

Element 1: The Long-Term Physical and Mental Health Effects of TBIs Incurred by Members of the Armed Forces during Service in Operation IRAQI FREEDOM or Operation ENDURING FREEDOM.

Physical and Mental Health Outcomes Following TBI

Mild TBI

The majority of Service members and veterans who sustain a mild TBI recover fully within days or weeks. The remaining minority may demonstrate persistent cognitive, behavioral, and physical deficits that impact daily activities, behaviors, or relationships. Cognitive abilities in these Service members and veterans generally improve in the first year after injury, but in some, these abilities do not return to expected levels. Moreover, some patients exhibit a delayed decline in physical and mental health (e.g., headaches, fatigue, pain, anger, anxiety, and depression) that starts in the year after the injury and persists over several years.[1]

Following a mild TBI, female Service members and veterans report a higher number and a greater severity of post-concussion (e.g., nausea, sensitivity to light, change in taste, smell and appetite, fatigue, and poor sleep) and Posttraumatic Stress Disorder (PTSD) symptoms (e.g., poor concentration, trouble remembering a stressful event, and disturbing memories, thoughts, or images) than males do.[2]

Some specific behavioral outcomes, such as insomnia and tobacco use, occur more frequently after mild TBI.[3] Insomnia was more prevalent in patients with mild TBI than in those with moderate to severe TBI. It correlates with higher risk for depression and anxiety and with worse overall self-reported mental health and neurobehavioral symptoms.

Reliance on subjective rating scales complicates assessment of symptoms in patients with mild TBI.[4] Individual responses to rating scales can vary and may not accurately reflect symptoms or disabilities. Post-concussion symptoms overlap with other psychiatric and medical illnesses and are seen in patients with injuries other than TBI, which further confounds interpretation.[5]

Moderate to Severe TBI

Service members and veterans with moderate or severe TBI have worse mental health and cognitive outcomes compared to healthy peers and combat-wounded peers without a TBI.[6] Patients often enter care through inpatient hospitalization; re-hospitalization in the first year after moderate to severe TBI is common, particularly for those with more severe injuries or those who sustained their injuries in a deployed setting.[7] Care needs can persist years after the injury as more than a third of moderate to severe TBI patients require long-term caregiver supervision.[8]

1 Brickell, French, Lange, Bailie, et al. 2016, in press; Lange, French, Lippa, et al. 2016; Brickell, Lange, et al. 2016
2 Brickell et al. 2014; Brickell, Lippa, et al. 2016; Bailie et al. 2015
3 Farrell-Carnahan et al. 2015; French, Brickell, Sullivan, et al. 2015; Silva et al. 2016
4 Lange et al. 2012; Lippa et al. 2015; Lange, French, Brickell, et al. 2016
5 French, Brickell, et al. 2016, in press; Brickell, French, Lange, et al. 2016; Lippa, Lange, et al. 2016
6 Lippa, Lange, et al. 2017, in press; French, Lange, et al. 2016, in press; French et al. 2017, in press
7 Tran et al. 2017, in press
8 Bailey et al. 2016, submitted; Tran et al. 2017, in press

Obstructive sleep apnea—even in patients who lack the traditional risk factors—and change in weight are two additional frequent outcomes.[9] Service members and veterans who were overweight at the time of the injury were most likely to gain additional weight.

Moderate and severe TBI, however, do not affect the relationship status for a majority of patients in the first two years after injury. Yet the following characteristics correlate with divorce among those patients married at the time of injury: being young, lower level of education, history of mental health treatment prior to TBI, and higher cognitive function.[10]

Risk Factors for Poor Long-Term Physical and Mental Health Outcomes

There are four risk factors for poor long-term outcomes.

- Co-morbid PTSD. Service members and veterans with PTSD and TBI, compared to those with TBI alone, report more anger, anxiety, depression, pain, fatigue, headaches, cognitive and other bodily complaints, and poor control of emotions and behavior.[11]

- Low resilience. Service members and veterans with low resilience (i.e., ability to bounce back or adapt well after adversity, trauma, tragedy, or stress) exhibit more neurobehavioral symptoms and lower cognitive performance.[12]

- Minor bodily injuries. Service members and veterans with minor bodily injuries demonstrate worse neurobehavioral outcomes and experience PTSD more commonly than those with severe bodily injuries.[13]

- Self-reported mental health symptoms. Service members and veterans who report mental health symptoms are at an increased risk of long-term mental and physical health concerns.[14]

Element 2: The Health Care, Mental Health Care, and Rehabilitation Needs of Such Members for Such Injuries after the Completion of Inpatient Treatment through the DoD, the VA, or Both.

The most severely injured individuals require inpatient rehabilitation for TBI. Their subsequent transition to home and community involves specialized and enduring care.

Medical Care Needs

Common medical conditions requiring care include chronic pain (headache, as well as back and neck pain), sleep apnea, hypertension, orthopedic fractures, sexual dysfunction, high cholesterol, and respiratory illness.[15] Although rehabilitation needs most commonly prompt re-hospitalization, Service members and veterans also report seeking hospitalization for orthopedic injuries, seizures, infections, psychiatric illness, general medical illness, non-seizure neurologic

9 Holcomb et al. 2016
10 Stevens et al. 2016, in press
11 Lange, Lippa, French, Gartner, Dilay, et al. 2016, in press; Lippa, Brickell, et al. 2017, in press
12 Brickell et al. 2015; French, Brickell, Graham, et al. 2015; Merritt, Lange, and French 2015
13 French, Brickell, and Lange 2012; Lange et al. 2011; French et al. 2014; Brickell et al. 2013
14 Lange, Lippa, French, Gartner, Dilay, et al. 2016, in press; Lippa, Brickell, et al. 2017, in press; Lippa, Brickell, et al. 2016, in press; Lippa, Lange, et al. 2016, in press; Lippa, Brickell, et al. 2016
15 Nakase-Richardson, 2016

disease, and obstetric-gynecological conditions.[16] Furthermore, a high rate of sleep disorders and an increase in tobacco use make access to sleep medicine services and smoking cessation programs essential.[17]

Mental Health Care Needs

Access to mental health care beyond the early phases to mid-phases of recovery (e.g., employment assistance, social reintegration, access to transportation services) is vital. It mitigates the risk of delayed onset mental health symptoms.[18] Some families, for example, may need ongoing family or couples therapy for several years after TBI. Likewise, those characteristics correlated with divorce among couples married at the time of injury (i.e., youth, less education, mental health treatment prior to TBI, and higher cognitive function) may serve as triggers for prioritizing couples therapy.

Rehabilitation Needs

Rehabilitation after inpatient hospitalization addresses cognitive, behavioral, and physical deficits, as well as vocational needs affecting community reintegration.[19] Service members and veterans in need of rehabilitation may require a wide variety of services, including home and family assessments and treatment strategies to mitigate difficulties with community reintegration, transition to civilian life, financial competence, housekeeping, shopping, and cooking.[20] Rehabilitation needs may also include the assessment of community mobility, access to driver training programs, compensatory skills training, and adapted transportation and mobility services. In fact, nearly half of Service members and veterans with moderate to severe TBI require this kind of rehabilitation.[21] Cognitively-impaired individuals who engage in pathologic substance use may also require addiction services adapted to their needs.[22]

Element 3: The Type and Availability of Long-Term Care Rehabilitation Programs and Services Within and Outside the DoD and the VA for Such Members for Such Injuries, Including Community-Based Programs and Services and In-Home Programs and Services.

The Military Health System (MHS) and the Veterans Health Administration (VHA) partner with community-based organizations to implement programs that support treatment, rehabilitation, and long-term care of Service members and veterans with TBI. These programs also support Service members' and veterans' delicate transition from the MHS to the VHA and their transition into home- and community-based programs.

These programs cover a range of venues:

- TBI program clinics and intensive outpatient programs, such as the National Intrepid Center of Excellence and Intrepid Spirit Centers, provide outpatient care.

16 Tran et al. 2017, in press
17 Holcomb et al. 2016; Silva et al. 2016
18 McGarity et al. 2016
19 Nakase-Richardson et al. 2016)
20 Ibid.
21 McGarity et al. 2016
22 Nakase-Richardson et al. 2016

- Military Treatment Facilities and the VA Polytrauma/TBI System of Care Network provide inpatient and outpatient care across the nation.

- The VA Polytrauma Rehabilitation Centers and the Polytrauma Transitional Rehabilitation Programs offer comprehensive, interdisciplinary rehabilitation in inpatient, outpatient, and community settings to improve community reintegration, including returning to stable employment (or volunteering if incapable of competitive employment), completing higher education, and living independently in the community.[23]

These programs also cover a range of unique health care and rehabilitation needs across the spectrum of TBI severity; however, they do not reach all Service members and veterans. In the first year following mild and moderate TBI, for example, approximately two-thirds of Service members and veterans report receiving one or more of the following: mental health treatment, physical rehabilitation, and clinical care coordination services.[24] However, the inability to get a referral or schedule an appointment, dissatisfaction with services, poor access to services, time constraints, and concerns about negative effects on their career discourage others from accessing these types of care.[25]

Family caregivers of a Service member or veteran with a TBI require continuing support, especially if they provide care in acute recovery and for an extended period. However, only about a third of family caregivers receive this help.[26] Moreover, caregivers of Service members or veterans with mild TBI have greater difficulty accessing services compared to caregivers of those with moderate or severe TBI.[27]

Element 4: The Effect on Family Members of a Member Incurring TBI.

Patients with persistent symptoms after TBI may require significant caregiver support. The majority of caregivers are women, many of whom care for dependent children in addition to their spouse or partner.[28] Caregivers typically provide assistance for 11–24 hours a day, seven days a week. They help Service members or veterans with physical and medical needs, cognitive functioning, psychological well-being, social interaction, communication, daily activities, and financial management.[29]

This substantial burden puts caregivers at risk of poor health-related quality of life. Many have cited a lack of available resources that prepared them for this responsibility, and about half cite a decline in physical health, mental health, and social functioning (e.g., no time for themselves, depression, stress and anxiety, exhaustion, poor sleep, negative effects on family life).[30] The severity of the TBI for the Service member or veteran correlates with quality of life for the caregiver. Those who care for a Service member or veteran with moderate to severe TBI tend to have a worse quality of life.[31]

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23 Ibid.
24 Lange, French, Bailie, et al. 2016
25 Ibid.
26 Brickell, French, Bailie, et al. 2016
27 Brickell, French, Lange, and Lippa 2017, in press; Brickell, French, Bailie, et al. 2016; Brickell, Carlozzi, et al. 2017, in press
28 Brickell, French, Bailie, et al. 2016
29 Ibid.
30 Brickell, Carlozzi, et al. 2017, in press; Brickell, Lange, et al. 2017, in press; Brickell, French, Lange, and Lippa 2017, in press; Brickell, French, Bailie, et al. 2016
31 Brickell, Carlozzi, et al. 2017, in press

The negative effects of caregiving can extend to children. Although deployment itself can affect a child's behavioral, physical, emotional, and social functioning, a Service member's or veteran's TBI has a substantially greater negative influence on grades, behavior, physical health, emotional health, and participation in social activities.[32]

Caregiving parents face additional difficulties because they are not eligible for TRICARE services. They report struggling to address their own health care needs because they are unable to make appointments at the same facilities where their children receive care.

CONCLUSIONS AND RECOMMENDATIONS

1. PTSD, acute stress, depression, and sleep disruption complicate TBI recovery and impact prognosis.

- Patients should receive comprehensive, integrated, state-of-the-science medical care, including mental health care and rehabilitation services to address changing needs throughout the continuum of recovery.

2. Reporting patterns with self-report rating scales vary widely. Subjective symptoms after TBI occur in other injuries and illnesses, further clouding interpretation of these metrics.

- Clinicians should use validity testing, subscale scoring, and individual clinical assessment when interpreting self-report rating scales in patients with mild TBI.

- Research should develop objective metrics (e.g., biomarkers) to complement self-reported data and thereby improve care delivery and program evaluation.

3. Women and men have different patterns of presentation and recovery after TBI.

- As women become more active in combat-related deployments, research should include them proportionally to explain clinical differences between men and women who have sustained a TBI.

4. Patients suffering from moderate and severe TBI require care for medical comorbidities, mental health symptoms, rehabilitation, vocational training and support, caregiver or family assistance, and community reintegration services after discharge from the hospital.

- To reduce the risk of fragmented care and improve access to services, the regimen of assessment and care delivery should be interdisciplinary and tailored to accommodate each patient.

- To decrease readmissions, post-discharge clinical monitoring of hospitalized patients should be improved.

5. Most patients use programs and services available within the MHS and VHA after a TBI; however, some fail to engage in care despite their needs.

32 Lange, Lippa, French, Gartner, Driscoll, et al. 2017, in press

- Education, outreach, and novel methods of care delivery, such as use of technology solutions for remote patient monitoring, should address patient concerns about access to care.

- TBI patients needing supervised environments for years beyond injury should have access to residential brain injury treatment in an age-appropriate setting and community-based extended care services.

6. Family caregivers report a significant burden caring for a Service member or veteran diagnosed with a TBI. Many caregivers not receiving services as part of a comprehensive TBI rehabilitation program feel unequipped to fulfill their role.

- Family caregivers should have access to the following types of assistance: education about available services, help with caregiving duties, respite care, support groups, financial support, training programs designed to increase caregiving skills, and increased support to allow time to improve physical and mental health as well as social functioning.

APPENDIX A: CITATIONS

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