

WORKING P A P E R

Invisible Wounds

Predicting the Immediate and Long-Term Consequences of Mental Health Problems in Veterans of Operation Enduring Freedom and Operation Iraqi Freedom

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Preface

Since October 2001, approximately 1.64 million U.S. troops have been deployed for Operations Enduring Freedom and Iraqi Freedom (OEF/OIF) in Afghanistan and Iraq. Early evidence suggests that the psychological toll of these deployments—many involving prolonged exposure to combat-related stress over multiple rotations—may be disproportionately high compared with the physical injuries of combat. In the face of mounting public concern over post-deployment health care issues confronting OEF/OIF veterans, several task forces, independent review groups, and a Presidential Commission have been convened to examine the care of the war wounded and make recommendations. Concerns have been most recently centered on two combat-related injuries in particular: post-traumatic stress disorder and traumatic brain injury. Many recent reports have referred to these as the signature wounds of the Afghanistan and Iraq conflicts. With the increasing incidence of suicide and suicide attempts among returning veterans, concern about depression is also on the rise.

The work described in this working paper focuses on post-traumatic stress disorder, major depression, and traumatic brain injury, not only because of current high-level policy interest but also because, unlike the physical wounds of war, these conditions are often invisible to the eye, remaining invisible to other servicemembers, family members, and society in general. All three conditions affect mood, thoughts, and behavior; yet these wounds often go unrecognized and unacknowledged. The effect of traumatic brain injury is still poorly understood, leaving a large gap in knowledge related to how extensive the problem is or how to address it.

RAND reviewed the existing empirical literature on the known and projected consequences of post-traumatic stress disorder, major depression, and traumatic brain injury, examining this literature for its ability to support projections about the likely outcomes for OEF/OIF veterans and their families. This working paper presents the results of our review as of December 2007. Portions of this material have been included in a larger monograph examining PTSD, depression, and TBI among OEF/OIF veterans (see Tanielian and Jaycox, Eds, *Invisible Wounds of War: Psychological and Cognitive Injuries, Their Consequences, and Services to Assist Recovery*, RAND, MG-720-CCF, 2008). These results should be of interest to mental health treatment providers; health policymakers, particularly those charged with caring for our

nation's veterans; and U.S. service men and women, their families, and the concerned public. All the research products from this study are available at <http://veterans.rand.org>.

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Abstract

What are likely to be the short-term and long-term consequences of the mental health and cognitive injuries sustained by troops during OEF and OIF? To address this question, this review draws upon the existing literature, extrapolates where necessary to the current conflicts, and makes policy recommendations.

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Epigram

"Let us not forget the importance of talking about these invisible wounds so they can heal and not permanently scar and interfere with our lives."

- Maj. Gen. Gale S. Pollock, acting Army surgeon general and commander for U.S. Army Medical Command, May 28, 2007

Executive Summary

Introduction

The aftermath of every war includes caring for those maimed or wounded in battle. Although Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are still ongoing, there are already several reasons to expect that the needs of service members returning from these conflicts may be especially great. First, as many observers have noted, the pace of deployment in the current conflicts has been unprecedented in the history of the all-volunteer force. Second, whereas in the recent past being deployed has not necessarily meant being deployed to the field of battle, more of today's armed forces are being exposed directly to combat (Mental Health Advisory Team, 2006). Third, due to advances in medical technology, more service members are surviving experiences that would have led to death in prior wars. Thus, not only are more service members being exposed to dangerous conditions, but more of them are likely to be returning from their service bearing the scars of their experiences.

As service members begin to return from Afghanistan and Iraq, those with physical wounds and impairments may be easily identified and assigned to treatment. Yet the scars of battle are not always physical. Increasingly, military leaders and policy-makers have been acknowledging the fact that exposure to combat can damage the mental, emotional, and cognitive faculties of service members, even if their physical integrity remains intact. Between the mental and emotional problems associated with exposure to combat and the cognitive impairments associated with traumatic brain injuries, substantial numbers of returning service members may suffer from significant wounds that are invisible to the eye. Although there is an emerging consensus that mental health problems stemming from service in OEF and OIF are likely to have severe and broad consequences if left untreated, allocating resources toward particular treatments and interventions requires a detailed understanding of what the consequences of these problems are likely to be.

To inform current discussions of how best to serve those returning from the current conflicts, the goal of this report is to draw upon the available literature to describe the likely immediate and emergent consequences of the invisible wounds of war, i.e., the mental, emotional, and cognitive injuries sustained during OEF and OIF. In reviewing this literature, our aim was to understand, based on existing research, what to expect the impact of these problems

will be on service members, their families, and society at large, and to understand not only the immediate concerns but those that might emerge over time. To address these goals, we conducted a search of the research literature on the correlates and consequences of the three major mental and cognitive disorders that are being assessed most extensively in service members returning from combat: major depressive disorder (MDD) and depressive symptoms, post-traumatic stress disorder (PTSD), and traumatic brain injury (TBI). When possible, our review addressed research that has examined these issues within military populations. When research that directly addressed the military was unavailable, we reviewed and have extrapolated from the extensive bodies of research that have examined the correlates and consequences of these disorders in civilian populations.

Prevalence of Mental Health Problems in Returning Service Members

To map the current landscape of mental health problems among members of the military, we began this review by identifying epidemiologic studies on mental health subsequent to deployment to Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). In total, we identified 12 independent studies that have provided specific evidence of the prevalence of depression, PTSD, and brain injury among troops deployed to OEF and OIF. Together, these studies support several broad generalizations. First, PTSD is the most prevalent mental health disorder among deployed service members, and affects roughly 5 to 15% of service members, depending on who is assessed and when they are assessed. Second, the prevalence of depression among service members ranges from 2 to 10%, and also depends on who is assessed and when they are assessed. Third, because many studies employ the same screening tools, prevalence estimates across studies are generally comparable. Thus, variability across studies is likely due to differences in study samples or the time of assessment. Fourth, because different studies have been conducted at different time periods during and post-deployment, comparing across studies suggests that the prevalence of PTSD and depression increases as the time since returning from deployment increases. Fifth, across studies, service members who experience combat exposure and who have been wounded are more likely to meet criteria for PTSD. Finally, service members deployed in OIF and OEF are more likely to meet criteria for mental health problems relative to non-deployed troops, though those deployed to Iraq have higher rates of mental health problems than those deployed to Afghanistan. Although it has been deemed a “signature” wound of the current conflicts, data on the prevalence of traumatic brain injury is lacking. The analysis and

publication of prevalence data from the mandatory TBI screens required for all service members post-deployment will be crucial for understanding the burden that brain injury poses on the US military.

Theoretical Perspectives on the Consequences of Mental Health Disorders

Although emotional, cognitive, and neurological disorders are sources of individual suffering in their own right, they are likely to have broader consequences for individual development and for society at large. From the perspective of understanding how these disorders impact the lives of those who suffer from them, there are likely to be developmental processes common to all three. At least two prominent perspectives have highlighted ways that mental, emotional, and cognitive impairments may affect the life course. The stress-diathesis model, originally developed as a framework for understanding the etiology of schizophrenia, builds from the premise that individuals vary in their levels of diathesis, where a diathesis refers to an aspect of individuals and their circumstances that increases their vulnerability to disease. The central insight of the model is that the presence of a diathesis is, by itself, insufficient to bring about a mental health disorder. Rather, vulnerable individuals will be most likely to experience the onset of problems when they are confronted by stress, and may function normally in the absence of stress. Although stress-diathesis models were designed and have mostly been applied toward understanding the etiology of mental disorders, the principles of the model apply equally well to understanding the consequences of these disorders. From this perspective, the presence of a disorder such as MDD, PTSD, and TBI may be considered a diathesis. For any outcome or negative consequence of experiencing these disorders, an individual will be most at risk to the extent that: a) the individual is characterized by other sources of vulnerability as well, and b) the individual encounters stressful or demanding events that tax resources and energy that are already limited by the disorder and other diatheses.

Whereas the stress-diathesis model offers a powerful framework for understanding who may be at risk for problems and when those problems are likely to occur, lifespan developmental models described two distinct mechanisms to account for how mental disorders may give rise to further difficulties throughout the life course. The first mechanism is *interactional continuity*, the idea that enduring qualities of an individual affect the way that individual interacts with others, who generally respond in kind. Interactional continuity highlights the ways that mental and cognitive disorders, to the extent that they impair interpersonal functioning, can have lasting

consequences for how individuals make their way in the world. A second mechanism is *cumulative continuity*. Cumulative continuity is the idea that behaviors and choices at each stage of life have consequences that accumulate to shape and constrain an individual's options at subsequent stages of life. Whereas interactional continuity focuses on interpersonal relationships and their immediate consequences for the individual, cumulative continuity highlights the ways that the immediate symptoms of a disorder may lead to a cascade of negative consequences that substantially affect later stages of the individual's life.

To guide the empirical review that follows, we describe a general framework that incorporates elements from the stress-diathesis model and the life-span developmental perspective. The model begins by acknowledging that even individuals who share a common diagnosis may have symptoms that range from mild to severe. The extent of the impairments arising from post-combat mental health disorders has direct, negative consequences for individual outcomes. Yet, a service member's resources and vulnerabilities can alter the immediate consequences of mental disorders. Sufficient resources can act as a buffer, protecting individuals and minimizing the immediate consequences of mental disorders, whereas significant vulnerabilities and other sources of stress can exacerbate the negative consequences of a disorder. Over the lifespan, the immediate consequences of these disorders may themselves have long-term consequences for individuals and their family members.

Comorbidity and Other Mental Health Problems

The stress an individual experiences with one disorder may place that individual at greater vulnerability or risk for developing a secondary disorder. Indeed, co-occurring disorders are common among individuals with TBI, depression, and PTSD, and often result in more negative outcomes than individuals experiencing any of the disorders alone. For all diagnoses, anxiety disorders are the most common co-occurring mental disorder; for TBI, co-occurring chronic pain is also common. Individuals with co-occurring mental, medical, and substance use disorders have been shown to have more severe symptoms, require more specialized treatment, have poorer outcomes to treatment, and more disability in social and occupation functioning than individuals with either disorder alone. These individuals also tend to have more severe and complex symptoms, require specialized treatment, and often experience more distress associated with their disorders. An ongoing issue in this literature is the extent to which symptoms of different disorders overlap, something that would lead to inflated estimates of comorbidity.

Research that examines symptom constellations of multiple disorders would be able to examine this overlap directly. Future research also should use standard diagnostic criteria to assess each condition and strengthen the integrity of comparisons among them. If rates of comorbidity continue to be prevalent among OEF and OIF returnees, treatment centers will need to adapt protocols for effectively screening, assessing, and treating co-occurring diagnoses.

Suicide

Alongside the concern over elevated rates of mental disorders upon returning from Iraq and Afghanistan, many are concerned about elevated rates of suicides among service members. There is consistent evidence that depression, PTSD, and TBI all increase the risk for suicide. PTSD, for example, is more strongly associated with suicide ideation and attempts than any other anxiety disorder. Psychological autopsy studies have consistently shown that a large number of suicide cases had a probable depressive disorder. Persons with TBI have a higher risk of suicide than persons without TBI.

Physical Health and Mortality

Persons with PTSD and depression face an increased risk of death relative to their similarly aged counterparts without these conditions. This increased risk appears to be driven by two primary causes: increases in the risk of death from unnatural causes (e.g., homicide, suicide, and unintentional injuries) and from cardiovascular disease. The impact of TBI on mortality is also pronounced because these injuries can, in and of themselves, be life-threatening. When asked about their own health, persons with PTSD, depression, and TBI are consistently more likely to endorse physical problems. The link between PTSD, depression, and TBI and negative physical health outcomes may partially be explained by increases in other types of health-risk behaviors that influence health outcomes. For example, there is a clear link between most psychiatric disorders, including PTSD and depression, and smoking.

Substance Use and Abuse

Among individuals with PTSD, MDD, and TBI, co-occurring substance use disorders are common and are often associated with more severe diagnostic symptoms and poorer treatment outcomes. These findings suggest that individuals with this comorbidity may be more difficult to treat and may present with more challenging and unique sequelae in treatment (Ouimette,

Brown, & Najavits, 1998). Some research has directly addressed the temporal ordering of substance abuse and other mental disorders, revealing that, whereas substance abuse often follows from PTSD, it often precedes depression and TBI. . Knowing that pre-injury substance use precedes depression and TBI in most cases suggests that efforts to curb alcohol and drug use in service members may reduce rates of depression and TBI indirectly. It is likely pre-injury substance use needs to be identified and integrated within treatment goals. Research on integrated treatment efforts to treat both substance use and comorbid conditions has provided preliminary evidence that outcomes are improved in integrated versus distinct mental health and substance use programs. Therefore, understanding the complexities of the conditions soldiers are returning with would allow more likelihood of successful amelioration of symptoms.

Labor-Market Outcomes: Employment and Productivity

PTSD, depression, and TBI have all been associated with labor market outcomes. Specifically, there is compelling evidence indicating that these conditions will impact returning service members return to employment, their productivity at work, and their future job prospects as indicated by impeded educational attainment. However, these findings should be interpreted cautiously. Most studies of these associations have been cross-sectional; it is not yet clear that these mental conditions are underlying causes of the labor market outcomes observed. In fact, working has many benefits in and of itself, ranging from enhancing social interactions to promoting self-esteem and expanding economic self-sufficiency. Thus, poor performance in the workplace can influence the development of mental health symptoms or enhance symptoms that may already exist.

Homelessness

The prevalence of homelessness is higher among veteran than non-veteran populations, but this may be due to risk factors common to the general population rather than those specific to the military setting. Mental illness and cognitive dysfunction are prevalent among homeless people, and those with mental illness experience more severe negative consequences (e.g., poorer physical health, decreased utilization of services, difficulty reintegrating into society). While it is unclear the degree to which our current military cohort will experience homelessness, increasing rates of PTSD, MDD, and TBI may act as a precursor to homelessness if the proper financial, emotional, and structural supports are not in place. Consistent with the structural theory of

homelessness, which states that one of the causes of homelessness is the lack of societal resources, an approach to decreasing rates of homelessness may be to apply more structural supports and interventions among those screened to be at highest risk.

Marriage, Parenting, and Child Outcomes

The effects of post-combat mental disorders inevitably extend beyond the afflicted service member. As service members go through life, their impairments cannot fail to impact those they interact with, and those closest to the service member are likely to be the most severely affected. Indeed, a broad empirical literature has documented the range of negative consequences that post-combat mental disorders have had on the families of service members returning from prior conflicts. In general, research on the consequences of mental disorders for families has identified direct and indirect routes through which these consequences come about. In the direct route, the specific interpersonal deficits suffered by service members have immediate effects on their loved ones and family members, e.g., difficulties with emotion regulation predicting greater risk of physical violence in the home. In the indirect route, the other direct consequences of a service member's disorder (e.g., the inability to sustain employment) themselves have negative consequences for the service member's family (e.g., financial hardship, deprivation). Indeed, each of these disorders has been linked independently to difficulties maintaining intimate relationships, and these deficits account for greatly increased risk of distressed relationships, intimate partner violence, and divorce among those afflicted. In addition, the interpersonal deficits that interfere with emotional intimacy in the romantic relationships of service members with these disorders appear likely to interfere with their interactions with their children as well. Thus, the impact of post-combat mental disorders may extend beyond the lifespan of the afflicted service member to stretch across generations.

Recommendations for Future Research

Address causal relationships. The model proposed here suggests that the experience of a post-combat mental disorder is a cause of negative outcomes for service members, in that they account for the experience of negative outcomes that the service member would not have experienced in the absence of the disorder. The research reviewed in this report is consistent with this position, but the vast majority has not been capable of ruling out alternative interpretations. Most of this research has relied on cross-sectional and retrospective designs, i.e.,

research participants have been contacted on a single occasion and asked to report on their experience of psychiatric symptoms and their functioning in other life domains. Supporting causal statements about the impact of mental illness will at minimum require longitudinal research, i.e., studies that assess individuals on multiple occasions to determine the temporal ordering of symptoms and outcomes. Longitudinal research that successfully follows service members from pre-deployment, through post-deployment, and into post-service would provide crucial insights into the etiology and consequences of combat-related mental illness. In the absence of such data, the existing research supports conclusions about how mental disorders are associated with subsequent negative outcomes for service members, but not about whether the disorders may be considered causes of those outcomes.

Assessment and diagnosis. Although research on the prevalence of PTSD, depression, and TBI after service in OEF and OIF has relied on only a small number of assessment tools, research on the consequences of these disorders has used a vast array of instruments and strategies. Some research has examined associations between each disorder and outcomes shortly after combat, whereas other research, especially research on veterans of Vietnam, have examined these associations years or even decades after the veterans had their combat experiences. Understanding how mental disorders affect the lives of afflicted service members will require greater attention to how and when these disorders are assessed.

Generalizing across services and components. Research on the implications of mental disorders in veterans of Vietnam rarely specifies the component of the military (i.e., active duty or Reserves) or the service within which the veteran served. Because different segments of the military are likely to have different experiences and have access to different sources of support, careful attention to service and component will be important in future research to understand the mental health implications of OEF and OIF. To inform the future allocation of resources between Reservists and active duty members, research that directly compares the prevalence and consequences of mental disorders across the services and across the components is needed.

Gathering population data. Virtually all of the data on the implications of post-combat mental disorders come from treatment, clinical, and help-seeking samples. Because those who seek treatment are likely to differ from those who do not, these samples form an inadequate basis from which to draw conclusions about the military as a whole. Systematic assessments of the entire military population will provide a more accurate sense of the distribution of post-combat

mental disorders and their consequences, and thus a more accurate view of the true costs of the current conflicts.

Recommendations for Policy and Intervention

Facilitate service members seeking and receiving treatment. The most powerful message of the accumulated research on the lives of individuals afflicted with PTSD, depression, or TBI is that, on average, these disorders are associated with great suffering and impaired functioning across multiple domains. To the extent that effective treatments for these disorders can be found, any efforts that connect afflicted service members with those treatments therefore has the potential to promote the well-being of afflicted service members substantially. One step toward that goal is to eliminate any stigma associated with service members asking for and receiving assistance for mental disorders. One possibility in this regard would be to provide concrete incentives for seeking treatment, upholding treatment for mental disorders as something that military not only accepts but rewards. A second step is to ensure that treatments are accessible to all service members suffering from mental disorders. Achieving this goal will require attending to the different ways that service members in the active duty and Reserves currently access mental health services.

Early interventions are likely to pay long-term dividends. The model described in this report emphasizes the accumulation of negative outcomes over time, suggesting that the immediate consequences of mental disorders, if left untreated, themselves can give rise to long-term consequences. To the extent that the research reviewed here supports this cascade, then it is crucial that programs and policies directed toward afflicted service members intervene early, to prevent the cascade of negative consequences from occurring. Frequent assessments of service members' mental health and early detection of problems be central to this effort. Waiting for service members themselves to seek treatment may be too late, as service members may be motivated to seek treatment only after their impairments have resulted in negative consequences.

Policies that promote resilience may be as effective as programs that target the symptoms of mental disorders directly. A second implication of the model described herein is that the consequences of a mental disorder are affected as much by the circumstances of the afflicted individual as by the severity of the individual's symptoms. The support for this idea throughout the research reviewed in this report suggests that policies aimed at alleviating the suffering of afflicted service members expand their focus beyond simply treating the disorders. To the extent

that financial security is a source of protection, then improved financial service for veterans may play an important role in mitigating the negative consequences of post-combat mental disorders. To the extent that close relationships with family members serve as a source of social support for afflicted service members, then treatment programs that address these relationships directly may be warranted. Overall, the connections among the various symptoms and consequences of each of these disorders points toward an integrated approach to treatment. Programs that account for multiple aspects of service members' lives may be more effective than programs that attempt to address specific domains independently

1. Introduction

Concerns about the Invisible Wounds of War

The aftermath of every war includes caring for those maimed or wounded in battle. Although Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are still ongoing, there are already several reasons to expect that the needs of service members returning from these conflicts may be especially great. First, as many observers have noted, the pace of deployment in the current conflicts has been unprecedented in the history of the all-volunteer force (Belasco, 2007; Bruner, 2006). Not only is a higher proportion of the armed forces being deployed, but deployments have been longer, redeployment to combat has been common, and breaks have been few and far between (Hosek, Kavanagh, & Miller, 2006). Second, whereas in the recent past being deployed has not necessarily meant being deployed to the field of battle, more of today's armed forces are being exposed directly to combat (Mental Health Advisory Team, 2006). Third, the number of casualties in the current conflicts is higher than for any military operation since Vietnam (3606 deaths and 26,558 wounded as of July 8, 2007, via <http://icasualties.org/oif/>). Fourth, due to advances in medical technology, more service members are surviving experiences that would have led to death in prior wars (Regan, 2004; Warden, 2006). For example, throughout the war in Vietnam, the survival rate for those injured in combat was 76%. In the current conflicts, the survival rate (as of the end of 2004) was 87% (Gawande, 2004). Thus, not only are more service members being exposed to dangerous conditions, but more of them are likely to be returning from their service bearing the scars of their experiences. As Dr. Jeffrey Drazen, editor-in-chief of the *New England Journal of Medicine* and an adviser to the U. S. Department of Veterans Affairs, noted recently, "If we left Iraq tomorrow, we would have the legacy of all of these people for many years to come" (quoted in Marchione, 2007).

As service members begin to return from Afghanistan and Iraq, those with physical wounds and impairments may be easily identified and assigned to treatment. Yet the scars of battle are not always physical. Increasingly, military leaders and policy-makers have been acknowledging the fact that exposure to combat can damage the mental, emotional, and cognitive faculties of service members, even if their physical integrity remains intact. Evidence

from a number of sources confirms that those who have served in OEF and OIF are returning from combat reporting relatively high rates of mental health problems. For example, the recent Mental Health Advisory Team (MHAT) report noted that, among a recent cohort of soldiers and Marines being screened for mental health problems after deployment to Iraq, 20% of soldiers and 15% of Marines screened positive for either anxiety, depression, or acute stress (Mental Health Advisory Team, 2006). Other studies of returning service members note rates of mental health problems that are in the same range or higher, especially for post-traumatic stress disorder (PTSD) (Adler, Huffman, Bliese, & Castro, 2005; Hoge, Castro, Messer, McGurk, Cotting et al., 2004). In addition to mental health problems arising from the experience of combat, significant numbers of service members are also returning from battle with traumatic brain injuries (TBI) as a result of their proximity to the blasts from improvised explosive devices (IED). Systematic measurement of TBI has only recently been instated by the military, but already these injuries have been called the “signature wound” of the current conflicts (e.g., Altmire, ; Marchione, 2007).

Thus, between the mental and emotional problems associated with exposure to combat and the cognitive impairments associated with traumatic brain injuries, substantial numbers of returning service members may suffer from significant wounds that are invisible to the eye. Even as the scope of these invisible wounds begins to take shape, those working closely with returning service members have raised alarms about the potential consequences of mental and cognitive impairments for service members, their families, and society. With respect to mental and emotional problems, “chronic postservice mental health problems such as PTSD represent a significant public health concern” (Maguen, Suvak, & Litz, 2006, p. 141). With respect to traumatic brain injuries, William Perry, PhD, president of the National Academy of Neuropsychology (NAN) has predicted that “We’re going to have a large population of individuals with significant brain impairments who are going to have difficulty navigating through everyday life” (quoted in Munsey, 2007, p. 34). Concerns about the future loom especially large with these mental and cognitive disorders because, unlike physical wounds that generally improve over time, these invisible wounds may fester, especially if they are left undetected and untreated. As Perry observes, “We don’t know how this is going to manifest two or three decades from now...So, I think it’s a wakeup call to [psychologists] that you’re going to be seeing these folks” (quoted in Munsey, 2007, p. 35).

The Challenge of Predicting the Future

Although there is an emerging consensus that mental health problems stemming from service in OEF and OIF are likely to have severe and broad consequences if left untreated, allocating resources toward particular treatments and interventions requires a detailed understanding of what the consequences of these problems are likely to be. For example, if it can be reasonably assumed that service members will manifest any mental or cognitive disorders immediately upon return from deployment, then initial assessments will be sufficient to identify those who may require extra support. In contrast, if there are reasons to expect delayed reactions to deployments, then continued assessments of returning service members would be warranted. Similarly, recommended treatment and policy options would differ depending on the range of outcomes likely to be affected by service members' mental, emotional, and cognitive deficits.

Yet, despite the value in projecting the likely consequences of mental health problems suffered by returning service members, making these projections is complicated for several reasons. First, the mental health problems of returning service members may wax and wane over time. The short-term correlates of these problems may differ from the long-term and emergent consequences. Moreover, even with treatment, symptoms may fluctuate for individuals, clouding attempts to predict future consequences. Second, existing data on those who have served in OEF and OIF is limited. Not only have the mental health problems of these service members yet to be studied extensively, but there has not yet been sufficient time to evaluate how service members and their families may be affected in the long run.

Recognizing these complications, and the limitations inherent in any attempt to predict the future, there remain several legitimate bases for projecting the likely short-term and long-term consequences of the mental health problems experienced by veterans of OEF and OIF. First, an extensive and rich body of research has followed up on the long-term consequences of traumatic experiences during the war in Vietnam. To the extent that the results of these studies can be generalized to veterans of the current conflicts, they provide a reasonable foundation to guide projections. Second, the disorders that are the focus of current concerns for returning service members have each been studied extensively in civilian populations. To the extent that the developmental paths of civilians with these disorders may generalize to describe the likely development of service members and former service members, then these literatures may also serve as a basis for projecting forward.

Goals and Scope of This Report

To inform current discussions of how best to serve those returning from the current conflicts, the goal of this report is to draw upon the available literature to describe the likely immediate and emergent consequences of the invisible wounds of war, i.e., the mental, emotional, and cognitive injuries sustained during OEF and OIF. In reviewing this literature, our aim was to understand, based on existing research, what to expect the impact of these problems will be on service members, their families, and society at large, and to understand not only the immediate concerns but those that might emerge over time. We want to provide the best possible sense of the likely costs to society of these problems, the duration of the consequences, and a sense of the range of services likely to be needed.

To address these goals, we conducted a search of the research literature on the correlates and consequences of three major mental and cognitive disorders: major depressive disorder (MDD) and depressive symptoms, post-traumatic stress disorder (PTSD), and traumatic brain injury (TBI). We have focused on these three disorders for several reasons. First, these are the three disorders that are being assessed most extensively in service members returning from combat. Second, there are obvious mechanisms that might link each of these disorders to specific experiences in war, i.e., depression can be a reaction to loss, PTSD a reaction to trauma, and TBI a reaction to injury.

When possible, our review addressed research that has examined these issues within military populations. When research that directly addressed the military was unavailable, we reviewed and have extrapolated from the extensive bodies of research that have examined the correlates and consequences of these disorders in civilian populations. These literatures are massive and extend back decades, thus a comprehensive review would be beyond the scope of this report. Instead, we have been selective, identifying and drawing upon the best that this literature has produced. When possible, we have favored longitudinal research that follows individuals over time. Because the military recruits from the population over 18 years old, we have not included research on children or adolescents with these disorders, focusing exclusively on research on adults. In every section, we direct the interested reader to recent literature reviews for additional information.

With respect to potential outcomes, we cast a wide net, seeking to understand the full range of needs and challenges that service members suffering from these disorders are likely to

face. Accordingly, we reviewed literature on the following outcomes: other mental health problems, suicide, physical health, mortality, employment, productivity, earnings, wealth, homelessness, marriage, childbearing, parenting, crime, and substance abuse.

Defining Terms

To provide a foundation for the review that follows, we offer a brief description of the diagnostic criteria used to define the three main disorders to be addressed in this report: post-traumatic stress disorder (PTSD), major depression (MDD), and traumatic brain injury (TBI).

Post-Traumatic Stress Disorder

Post-traumatic stress disorder is an anxiety disorder that occurs after a traumatic event in which there was a threat of serious injury or death, and the individual's response involved intense fear, helplessness, or horror. In addition, the disorder is marked by the following symptoms occurring for more than one month and causing significant distress and/or impairment: re-experiencing the event, avoidance of stimuli relating to the event, numbing of general responsiveness, and hyperarousal (diagnostic-criteria from the DSM-IV-TR are presented in Table 1.1) (American Psychiatric Association & American Psychiatric Association Task Force on DSM-IV, 2000). Among civilians, approximately 8% of the population meets criteria for PTSD during their lifetime (Kessler, Sonnega, Bromet, Hughes, & et al., 1995b) and in one community sample, 9% of persons exposed to a trauma met criteria for PTSD later in life (Breslau, Kessler, Chilcoat, Schultz, Davis et al., 1998a). The median duration of PTSD associated with a single trauma ranges from three to five years (Kessler et al., 1995b), though when one considers that a person can experience multiple traumas in his or her life, each carrying its own risk of PTSD, a typical person with PTSD may experience symptoms lasting for more than two decades (Breslau et al., 1998a; Kessler, 2000).

Major Depression

Major Depressive Disorder (MDD) is a type of mood disorder that consists of several pervasive depressive symptoms that interfere with everyday life functioning. More than a passing sadness that is common to everyone, individuals with MDD experience a persistent constellation of symptoms that occur most of the day and nearly everyday for at least a two-week

period. Individuals experience either depressed mood, in ability to experience pleasure, or loss of interest in almost all activities almost every day for two weeks (American Psychiatric Association et al., 2000). Other symptoms can include significant weight loss or gain (e.g., a change of more than 5% when not dieting) or a decrease in appetite, insomnia or hypersomnia, psychomotor agitation or retardation, fatigue or loss of energy, feelings of worthlessness or excessive or inappropriate guilt, diminished ability to think or concentrate or significant indecisiveness, and recurrent thoughts of death, suicidal ideation, or suicidal attempts or plans. Symptoms related to MDD are not due to a medical condition or to normal reactions to bereavement. In contrast to bipolar depression or mania, which is characterized with elevated mood and energy, MDD is a unipolar depression marked by sad mood and loss of energy. In the United States, about 16% of the adult population meet criteria for major depressive disorder at some point in their lives (Kessler, Berglund, Demler, Jin, Koretz et al., 2003). The average duration of a depressive episode ranges by symptom severity: in the National Comorbidity Survey, the average depressive episode lasted approximately 4 months, with more severe cases lasting close to half of the year (Kessler et al., 2003).

Traumatic Brain Injury

Traumatic brain injury is generally described as a trauma to the head that either temporarily or permanently disrupts the brain's function ("Traumatic Brain Injury," 2007). Disruptions in brain functioning can include decreased level of consciousness, amnesia, or other neurological or neuropsychological abnormalities. TBI can also be marked by skull fracture or intracranial lesions (Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999). Brain injuries can be caused by an object that pierces the skull and enters brain tissue, which is defined as a penetrating injury, or when the head hits an object but the object does not break through the skull (closed head injury) (National Institute of Neurological Disorders and Stroke (U.S.), 2002). A further category particularly relevant to deployed service members is blast injury. There are three types of injuries to the brain that can be caused by a blast: primary blast injuries caused by wave-induced changes in atmospheric pressure; secondary blast injuries when objects put in motion by the blast that hit people; and tertiary blast injuries when individuals themselves put in motion by the blast then hit some object (Warden, 2006). Blast injury causes the majority of traumatic brain injury during times of war (Warden, 2006).

In addition to these definitions, traumatic brain injury can be further categorized by the symptoms that the injury causes. The majority of TBI seen in the civilian population is *Mild TBI*. The American Congress of Rehabilitation Medicine defines minor TBI as an injury resulting in any period of loss of consciousness for up to 30 min, any loss of memory for events immediately before and after the accident for as much as 24 hours, any alteration of mental state at the time of the accident (dazed, disoriented, or confused), or any focal neurological deficits that may or may not be transient (Ruff, 2005). Injured persons do not meet criteria for minor TBI, however, if loss of consciousness exceeds 30 minutes, posttraumatic amnesia persists longer than 24 hours, or if the Glasgow coma scale value falls below a level of 13 by 30 minutes after the injury (Ruff, 2005). In those cases, individuals typically are defined as having *Moderate to Severe TBI*. Persons with moderate or severe TBI meet criteria for mild TBI but also tend to experience headaches that get worse or do not go away; repeated vomiting or nausea, convulsions or seizures, inability to awaken from sleep; dilation of one or both pupils of the eyes, slurred speech, weakness or numbness in the extremities, loss of coordination, and/or increased confusion, restlessness, or agitation. Because traumatic brain injuries range so widely, it is difficult to estimate the typical duration of symptoms. For instance, among collegiate football players with concussions that tended to result in cognitive impairments and balancing problems, symptoms generally resolved within a week after the injury (McCrea, Guskiewicz, Marshall, Barr, Randolph et al., 2003) though among trauma patients with mild TBI, recovery times may be longer (Iverson, 2005). Recovery for moderate to severe TBI, on the other hand, varies widely by the severity of the injury itself, the resulting disabilities, and an individual's rehabilitation program, though most improvements will happen within the first two years after an injury (Corrigan, Smith-Knapp, & Granger, 1998).

Organization of This Report

The subsequent chapters of this report map out the likely social impact of mental health problems in service members returning from OEF and OIF. The first two chapters provide a general context for understanding these implications. Thus, Chapter 2 reviews available data on the prevalence of mental health problems in returning service members, noting the consistencies and limitations of these data, and offering recommendations for immediate priorities for future research documenting the extent of these problems. Chapter 3 describes two theoretical

perspectives that can help to explain how specific symptoms arising from these disorders may give rise to broader short-term and long-term consequences, and offers a single integrated framework that informs each of the more specific chapters that follow.

Each of the next seven chapters reviews the existing empirical literature documenting associations between post-combat mental disorders and a specific domain of functioning. Chapter 4 examines associations among MDD, PTSD, and TBI, as well as between each of these disorders and other psychiatric problems. This chapter points out that, as easy as it is to focus on one disorder at a time, the disorders rarely occur independently. The co-occurrence of multiple problems in returning service members will need to be recognized in any treatment plan or policy. Chapter 5 examines suicide rates as a function of these disorders. Chapter 6 examines how the experience of these disorders predicts a variety of indicators of physical health, as well as longevity and mortality. Chapter 7 reviews research linking mental health disorders to substance use and abuse among service members and veterans. Chapter 8 addresses labor market outcomes, reviewing an extensive literature that has documented lower earnings, lower productivity, and less consistent employment individuals who have been afflicted with mental health problems. Chapter 9 reviews the literature on homelessness in veterans, highlighting the role of post-combat mental health problems in that outcome. Finally, whereas each of these chapters focuses on the implications of these disorders for service members, Chapter 10 reviews the evidence that these disorders also affect those close to the service member, including spouses and children. Through their effects on parenting, post-combat mental disorders may have consequences that extend beyond the current generation.

The last chapter, Chapter 11, summarizes themes that emerge across multiple domains of this report, and offers concrete recommendations for future research and for policies and interventions aimed at minimizing the negative consequences of post-combat mental disorders.

2. Prevalence of Mental Health Problems in Returning Service Members

As Kessler (2000) has noted: “Any assessment of the societal impact of a disorder must begin with a consideration of prevalence” (p. 4). By critically reviewing the current epidemiologic studies on mental health subsequent to deployment to Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), we aim specifically to address multiple questions of both scientific and political importance. These questions include: How widespread are mental health problems in the military currently? How do rates of mental health problems differ among troops deployed in OIF, those deployed in OEF, and non-deployed troops? How long do problems and associated symptoms last? How are problems distributed across the services of the military? Are there differences by, gender, ethnicity, rank, or service? What are rates of comorbidity?

This chapter reviews and describes the best available data on the prevalence of mental health problems suffered by service members in the current conflicts. Unlike previous conflicts such as the Vietnam or Gulf Wars, where prevalence studies were generally conducted years after veterans returned home, in the current conflicts epidemiologic studies are being conducted throughout the course of the deployment cycle, i.e., a week before being deployed, while troops are in theater, and immediately upon their return. Comparisons of prevalence rates obtained across these multiple assessments may provide unique insights into mental health problems in the military in general and how the experience of mental problems may be related to deployment. In sum, this chapter describes the current landscape of mental health problems among members of the military deployed to OIF and OEF, in hopes of highlighting where future problems, vulnerabilities, and resource needs may lie.

Methods

Epidemiologic studies addressing the prevalence of mental health and neurological problems among service members in OEF and OIF were identified by searching peer-reviewed journals for relevant articles using systematic search approaches on PubMed and PsycINFO databases. Search terms included: Military, War, Veterans, Combat, OIF, OEF, Iraq, Afghanistan, Prevalence, PTSD (Stress disorders, Post-Traumatic), Depression/Depressive disorder, Traumatic Brain Injury, Mental disorders, Mental health. Keywords were used to

search titles, abstracts, and the text of articles, with no publication year restrictions. In addition to database searches, additional reference lists of identified pertinent articles were examined in a cited reference search that identified government reports as well as peer-reviewed articles. Studies were considered eligible for inclusion only if the study population included U.S. military populations deployed to OIF or OEF (or corresponding U.K. deployments), and if the reported study outcomes included prevalence figures for PTSD, depressive disorders, or TBI.

Results

In total, we identified 16 independent studies that have provided specific evidence of the prevalence of depression, PTSD, and brain injury among troops deployed to OEF and OIF. Table 2.1 summarizes the characteristics and results of each of these studies. Below, we provide an overview of the results of studies that have assessed service members prior to deployment, in theater, and shortly upon return from deployment. We then identify and elaborate upon themes that emerged from an analysis of the group of studies as a whole.

Mental Health Pre-deployment

Two studies have assessed mental health in service members prior to their deployment to Iraq. Vasterling et al. (Vasterling, Proctor, Amoroso, Kane, Heeren et al., 2006) found that approximately 75 days prior to deployment, the mean score on the PCL-17 was around 29 on a scale that ranged from 17 to 85 where cutoffs of 44 or 50 are generally recommended to maximize diagnostic efficiency (i.e., overall accuracy of correctly classifying individuals with and without a disorder) (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). This study did not present the percent who meet criteria for probable PTSD or levels of depression pre-deployment. These authors also showed that prior to deployment there was no difference in the prevalence of head injury with loss of consciousness for more than 15 minutes between service members who did get deployed and a comparison group that did not, with an estimated prevalence around 5%. Hoge et al. (Hoge et al., 2004) assessed 2530 Army soldiers one week prior to their deployment and reported that 5% screened positive for PTSD and a similar proportion screened positive for depression when questions referenced the past month (according to the strict criteria defined above).

Mental Health in Theatre

In July 2003 and three times thereafter (January, 2005; May, 2006; November, 2006), the US Army Surgeon General chartered Mental Health Advisory Teams (MHAT) to assess OIF-related mental health issues. Although not peer-reviewed, these reports are relevant because they are the only ones that assessed the prevalence of PTSD and depression among troops in theater (United States. Dept. of the Army. Office of the Surgeon General., 2004, 2005, 2006a, 2006b). The MHAT reports use the term “acute stress” -- but not PTSD -- to describe PTSD-like symptoms reported in a combat zone (United States. Dept. of the Army. Office of the Surgeon General., 2004, 2005, 2006a, 2006b). Prevalence estimates of acute stress were around 15% at all MHAT assessments, except in 2004 (MHAT-II) when the prevalence of acute stress was around 10%. Rates of depression in theater also were relatively constant across the MHAT samples, with between 5% and 9% of troops meeting probable diagnostic criteria.

Mental Health Post-deployment

The remaining studies estimated the prevalence of disorders post-deployment, but varied with respect to the average interval between deployment and assessment. Together, these studies generally reveal that estimated prevalence of PTSD and depression increases as the time since return from deployment increases.

In April 2003, the Department of Defense mandated that immediately upon returning from deployment all servicemembers complete a Post Deployment Health Assessment (PDHA) questionnaire. Servicemembers generally fill out these questionnaires before leaving the country in which they are deployed or within 2 weeks of returning home (Hoge, Auchterlonie, & Milliken, 2006). Three studies used data from samples that were assessed with the PDHA (Hoge et al., 2006; Martin, 2007; Milliken, Auchterlonie, & Hoge, 2007). Only one study included soldiers from OEF and estimated that 5% of those servicemembers screened positive for PTSD (Hoge et al., 2006). All three studies indicated that approximately 10% of those returning from OIF screened positive for PTSD, though one study indicated that those who filled out the PDHA out of theater were more likely to screen positive for PTSD than those who completed the form in theater (Martin, 2007). One study indicated that 1% of those returning from OEF and 2% of those returning from OIF screened positive for depression (Hoge et al., 2006), though a separate analyses among those who completed a follow-up survey six months later indicated that 4% of

National Guard and Reserve troops returning from OIF and 5% of Active Component troops met criteria for depression on the PDHA (Milliken et al., 2007). The PDHA has four questions to screen for PTSD and two questions to screen for depression: these limited screeners have low specificity and positive predictive value, meaning that many persons without these disorders screen positive and that these estimates are likely to be inflated.

In 2006, the Department of Defense began assessing returning service members again 3-6 months after returning from deployment, using the Post-Deployment Health Reassessment (PDHRA). Among one cohort of 88,235 soldiers who completed both the PDHA and PDHRA, 16.7% of active component service members and 24.5% of National Guard and Reserve components screened positive for PTSD on the PDHRA (compared to 11.8% and 12.7%, respectively, who screened positive for PTSD on the PDHA). The proportion screening positive for depression among this cohort also increased from 4.7% to 10.3% of Active component soldiers and 3.8% to 13.0% of National Guard and Reservists (Milliken et al., 2007). In separate analyses using the PDHRA, 16% of approximately 96,934 service members screened positive for PTSD. Approximately 94% of those who had PDHRA assessments had linked PDHAs; of those who screened positive for PTSD on the PDHRA, 29.9% had screened positive for PTSD on the PDHA meaning that approximately two-thirds of persons with PTSD were new, or incident, cases.

Another cohort of service members assessed at multiple times upon returning from deployment was a sample of wounded soldiers evacuated from combat between March 2003 and September 2004 (Grieger, Cozza, Ursano, Hoge, Martinez et al., 2006). At one-month post-injury, 4% met criteria for PTSD and a similar proportion met criteria for depression, while 2% met criteria for comorbid PTSD and depression. At 4 months, the proportion of persons meeting criteria for PTSD and depression increased: 12% and 9%, respectively, while 8% met criteria for comorbid PTSD and depression. At 7 months, 12% met criteria for PTSD and 19% met criteria for depression, while 6% met criteria for comorbid PTSD and depression (Grieger et al., 2006).

All other studies employed cross-sectional survey designs. Hoge et al. (Hoge et al., 2004) studied the prevalence of PTSD and depression among an army sample 3 to 4 months post-OEF deployment, and separate Army and Marine samples 3 to 4 months post-OIF deployment. Using strict diagnostic criteria, 6% of the post-OEF soldiers met criteria for PTSD and 7% met criteria for depression. Thirteen percent of the Army sample met criteria for PTSD post-OIF and 8% met

criteria for depression; among Marines, 12% met criteria for PTSD and 7% met criteria for depression post-OIF.

The remaining studies generally assessed symptoms at least 1 year after returning from deployment. When assessed at least 1-year after returning from home from Iraq and neighboring areas, 4% of troops from the United Kingdom met criteria for PTSD and 20% met criteria for an “unspecified” common mental disorder (Hotopf, Hull, Fear, Browne, Horn et al., 2006). Studies of US troops, however, produce much larger estimates. Hoge et al. (Hoge, Terhakopian, Castro, Messer, & Engel, 2007) found 17% of Army soldiers met criteria for PTSD one year after returning home. Vasterling et al. (Vasterling et al., 2006) did not specify how long after returning from home soldiers were assessed, though the study methods make it appear that the post-deployment assessments occurred around 1.5 years after returning. When assessed, 12% met criteria for PTSD and 25% met criteria for depression. Taken together, these studies reveal that the prevalence of both PTSD and depression seems to increase as the time since returning from deployment increases.

Studies by Kolkow (Kolkow, Spira, Morse, & Grieger, 2007), Seal (Seal, Bertenthal, Miner, Sen, & Marmar, 2007), Rosenheck and Fontana (Rosenheck & Fontana, 2007) and Abt Associates (Abt Associates Inc., 2006) neglect to indicate when their assessments took place, and in all three studies it is more likely that service members with widely ranging intervals since returning were combined in the samples. Seal and colleagues (Seal et al., 2007) reviewed records of veterans specifically from OIF and OEF who sought any type of inpatient or outpatient care at a Veterans Administration (VA) health care facility between September 2001 and September 2005. Among 103,788 veterans with VA records, 13% had a diagnosis code for PTSD and 5% had a diagnosis code for depression. Rosenheck and Fontana (Rosenheck et al., 2007) also reviewed VA records but were not able to specifically identify those who were OIF or OEF veterans. Instead, their sample identified those as probable OIF veterans by identifying individuals born after 1972 and who had their first VA outpatient encounter occurred in 1991 or after. Among these individuals, there was a 232% increase in PTSD diagnoses between 2003 and 2005. Abt Associates mailed surveys between July and December of 2004 to Active component service members who had deployed to Iraq on or after January, 2003 and returned from theater by February, 2004, meaning that assessments generally occurred 6 to 12-months from returning from deployment. Among the 43% of 3,329 deployed service members who responded to the

survey, 7.3% met screening criteria for PTSD. Due to the unique sample used by Kolkow and colleagues (Kolkow et al., 2007), we present prevalence estimates from those samples further below.

Emergent Themes

- There is limited research on the prevalence of Traumatic Brain Injury, due both to assessment difficulties and restrictions on the release of such information.

Research on the prevalence of Traumatic Brain Injury among returning troops is sparse. Our review identified only one peer-reviewed study that has attempted to estimate the prevalence of TBI. Vasterling and colleagues (Vasterling et al., 2006) asked respondents whether they suffered a head injury with a related loss of consciousness lasting more than 15 minutes. In their sample, 7.6% of deployed troops reported having such an injury during a time period that included the duration of their deployment compared to a prevalence of 3.9% among non-deployed service members during a corresponding interval. The only other reference we found that indicated the prevalence of TBI among deployed service members was taken from reports that document reasons for medical evacuations from OEF and OIF (Fischer & Library of Congress. Congressional Research Service., 2006). As of March 31, 2006, there were 1,179 TBIs among evacuees, 96% of which were sustained in OIF and 4% in OEF. This report, published by the Congressional Research Service, provides no information on how it defines TBI, and whether these numbers represent cases of mild TBI.

Methodological constraints may hinder efforts to estimate the prevalence of TBI in epidemiologic surveys. While identifying penetrating brain injuries is a relatively straightforward procedure, estimating the prevalence of closed head injuries (when an object hits the head but does not break the skull) and primary blast injuries (injuries caused by wave-induced changes in atmospheric pressure) is difficult, though these sorts of injuries are anecdotally noted as extremely prevalent among returning service members (Murray, Reynolds, Schroeder, Harrison, Evans et al., 2005; Warden, 2006). In addition, definitions for TBI, particularly mild TBI, are relatively broad, and symptoms often overlap with those of other conditions (Colarusso, 2007).

The other source of information on the prevalence of TBI comes from post-deployment screenings performed at select military bases. To our knowledge those estimates have not yet been presented in peer-reviewed publications. According to a report described in the USA

Today, 10% of 7909 marines with the 1st Marine division at Camp Pendleton in California suffered brain injuries and 84% of 500 troops who suffered concussions were still suffering symptoms an average of 10 months after the injury (Zoroya, 2006). At Fort Irwin, also in California, 1490 soldiers were screened, and almost 12% suffered concussions during their combat tours (Zoroya, 2006). We also found one report that indicated that at least one location, the Walter Reed Army Medical Center Defense and Veterans Brain Injury Center, which is one of the eight Defense and Veterans Brain Injury Center (DVBIC) sites, screens anyone for TBI who was medically evacuated due to an injury caused by a blast, motor vehicle accident, falls, or gunshot wound to head or neck (Warden, 2006). When released, this will be an important source of data, but it is also likely to be limited. Because those with the most severe bodily injuries take medical precedence after an attack or mass casualty blast, this type of screening may overlook persons with mild to moderate closed head injuries (Warden, 2006).

In May of 2007, the Congressional Brain Injury Task Force required that the Department of Defense screen all US troops for traumatic brain injury both before and after they are deployed. This is a relatively new initiative, and results from these assessments have not yet been made public or analyzed systematically. This represents an important source of information on the prevalence of TBI among returning service members, and will contribute significantly to the current lack of prevalence data for this condition.

- Multiple studies have relied on common screening tools, facilitating comparisons across studies.

With respect to prevalence, there are generally three methods used to identify “caseness” in psychiatric epidemiology: diagnostic codes from case registries among those in treatment contact, screening tools that identify persons with probable disorders, and fully or semi-structured diagnostic interviewers, administered by trained lay interviewers and clinicians, respectively (Jablensky, 2002). No study identified in the current review used structured diagnostic interviews, which are generally considered the “gold standard” in psychiatric epidemiology (Jablensky, 2002). Eleven studies used screening tools and one relied on diagnostic codes from medical records.

To assess post-traumatic stress disorder, studies generally used the 17-item PTSD Checklist (PCL), which has been validated in numerous studies (Blanchard et al., 1996). Thresholds for meeting probable PTSD diagnostic criteria using this screening tool vary: Seven

studies required that subjects report at least one intrusion symptom, three avoidance symptoms, and one hyperarousal symptom each categorized at the moderate level and that the total score be at least 50 on the entire scale that ranges from 17 to 85; one study required subjects only to have a total score of at least 50. The MHAT-I study does not contain the definitional criteria that would typically be included in scientific studies. However, in this study, the authors write that persons defined as having probable acute stress had to endorse “several” items on the PCL at the moderate level *and* report that symptoms caused functional impairment (e.g., symptoms affected their work).

To assess depression, the majority of studies used service members’ self-reports on the Patient Health Questionnaire-9 (PHQ-9). As per its name, the PHQ-9 is a 9-item questionnaire that asks patients how often they have been bothered by each of 9 problems (e.g., trouble falling or staying asleep, or sleeping too much) and can respond not at all, several days, more than half the days, or nearly every day during a specified period of time (typically in the past 2 weeks). Generally, if four of the nine items occur more than half the days or nearly every day, and include reports of depressed mood and anhedonia, the respondent is considered to have met screening criteria for probable diagnostic criteria for major depressive disorder, though strict criteria requires respondents to report impairment in work, at home, or in interpersonal functioning (Hoge et al., 2004). The sensitivity of the PHQ-9 ranges from 83% to 98%, and the specificity ranges from 80% to 90%, depending on the cut-off value used. One study (Vasterling et al., 2006) used the 9-item version of the Center for Epidemiologic Studies Depression Inventory (Santor & Coyne, 1997).

Finally, three studies analyzed data from the Post-Deployment Health Assessment (PDHA) and/or Post-Deployment Health Reassessment (PDHRA) (Hoge et al., 2007; Martin, 2007; Milliken et al., 2007). In both the PDHA and PDHRA, a four-item subscale of the PCL was used to screen for PTSD, and endorsing 2 of the 4 items was considered a positive screen for PTSD. Prior research indicates that a score of 2 or more on this four-item scale results in a sensitivity of 0.91 and specificity of 0.72 (Prins, Ouimette, Kimerling, Cameron, Hugelshofer et al., 2003). The PDHA also contains two questions from the PHQ-9, those relating to depressed mood and anhedonia. A positive response to one of these questions is validated as increasing the risk for depression (Kroenke, Spitzer, & Williams, 2003) and was used in this way in two studies (Hoge et al., 2007; Milliken et al., 2007).

- The samples studied varied, but most employed samples of active duty Army soldiers with limited generalizability.

Army soldiers comprise the largest share of military personnel in OEF and OIF (O'Bryant, Waterhouse, & Library of Congress. Congressional Research Service., 2006, 2007) and are also the most frequently studied service members with respect to deployment-related mental health. Grieger et al. (Grieger et al., 2006), Hoge et al. (Hoge et al., 2007), Vasterling et al. (Vasterling et al., 2006), and the first three MHAT reports focused exclusively on Army soldiers. Marines were the next most frequently studied population: Hoge et al. (Hoge et al., 2004), Milliken et al. (Milliken et al., 2007) and MHAT-IV focused on samples of both Army soldiers and Marines. In MHAT-IV, fewer Marines than soldiers screened positive for depression, though rates of acute stress were comparable in the two services. In the only study to focus exclusively on Navy personnel, Kolkow et al. (Kolkow et al., 2007) studied mental health outcomes of US Naval Military Health Care Providers. They found that at an unspecified point post deployment, 9% met criteria for probable PTSD and 5% met criteria for depression. However, this sample was very unique because it focused on a convenience sample of naval health care providers, and is not likely representative of other military, or even of other navy, samples. One analysis of the PDHA and PDHRA looked at all armed force personnel (Martin, 2007) and found that army soldiers were more likely to screen positive for PTSD than members of other military services, and that those in health professions were more likely than those in combat occupations to screen positive for PTSD. The survey of deployed personnel by Abt Associates (Abt Associates Inc., 2006) sampled members of all branches of the military in the US, while Hotopf et al. (Hotopf et al., 2006) sampled members of all armed force personnel in the UK. Seal et al. (Seal et al., 2007) and Rosenheck and Fontana (Rosenheck et al., 2007) looked at all armed force personnel accessing medical care in the VA.

Only a handful of studies can be considered generalizable to all troops deployed in OIF or OEF. Hoge et al. (Hoge et al., 2006) studied the records of all Army soldiers and marines who completed the PDHA between May 1, 2003 and April 30, 2004; Martin (Martin, 2007) studied the records of all service members who completed the PDHA in 2005 and a subsample of those who completed the PDHRA. Milliken (Milliken et al., 2007) analyzed PDHA and linked-PDHRA assessments for Marines and Army soldiers members. Abt Associates (Abt Associates Inc., 2006) and Hotopf et al. (Hotopf et al., 2006) devised random samples of US and UK service

members, respectively, who were deployed to Iraq for a set time interval. Both also assessed comparison samples of service members who were not deployed during that time.

In all other cases, samples were focused on specific military *units* that were scheduled or likely to be deployed (Hoge et al., 2004; Vasterling et al., 2006), were deployed with a high likelihood of combat exposure or operational stress (MHATs I-IV), or had returned from deployment (Hoge et al., 2004; Hoge et al., 2007). Studying military units post-deployment is likely to systematically exclude service members who are at highest risk for mental health problems, such as those with severe injuries or those who have separated for military service. One study employed a convenience sample of Army respondents wounded and evacuated to Walter Reed Army Medical Center (Grieger et al., 2006) and another utilized a convenience sample of US Naval Health Care Providers on staff at the Naval Medical Center San Diego (Kolkow et al., 2007). In fact, Hotopf hypothesizes that sampling procedures may be the underlying reason why rates of PTSD in his UK sample are so much lower than among the US samples. They suggest that the US samples may focus on troops more likely to have combat roles than a random sample of all service members encompassing those in both combat service and combat service support, such as administrative or nursing services (Hotopf et al., 2006). The chart review of veterans seeking treatment in the VA also has limited generalizability because it does not include veterans who either do not seek care, do not seek care at the VA, or are no longer eligible for care at the VA.

In addition to these limitations with respect to generalizability, most studies suffer from other limitations common to many epidemiologic studies. For example, within the post-deployment studies, those with the most significant mental health problems may be unavailable, unable, or unwilling to participate in the survey, a bias that leads to more conservative estimates of prevalence than is actually the case. In the UK study and the study by Abt Associates, although both assessed a random sample designed to be generalizable to all deployed military personnel, participation rates were low (Abt Associates Inc., 2006; Hotopf et al., 2006). The same problem applies to longitudinal studies, where those persons lost to follow-up are likely to be systematically different than those who participated in follow-up assessments. Although both studies that analyzed data from the PDHRA present the proportion who had completed PDHAs, neither present the proportion of those with PDHAs who are missing PDHRAs, and it is unclear who is being missed in the PDHRA (Martin, 2007; Milliken et al., 2007). In analyses by

Vasterling and colleagues (Vasterling et al., 2006), only 72% and 80% of those who did and did not deploy, respectively, participated in wave 2 of the study. Separation from military service was the most common reason for non-response in that sample, while many also did not respond because they were re-deployed or on-leave. In the sample of wounded service members, 72% of those interviewed at wave 1 were assessed at four-months, and only 61% were assessed at 7 months, while only 50% were interviewed at all three assessments, though the authors report no differences in probable depression or PTSD at 1-month among those lost to follow-up (Grieger et al., 2006).

The timing of surveys is also an important consideration in post-deployment epidemiologic studies. The PDHA, for example, is administered immediately upon troops' return home where there may be a disincentive for reporting mental health symptoms (i.e., delaying the return to one's family and friends). In addition, many symptoms of psychiatric disorders may develop over time, and not be present immediately upon returning. Thus, analyses using this instrument (Hoge et al., 2006) are likely to yield underestimates, though the PDHRA was developed to address this issue (United States. Dept. of Defense., 2006) and does indicate generally higher prevalence estimates than the PDHA.

- Regardless of the sample, measurement tool, or time of assessment, combat duty and being wounded were consistently associated with positive screens for mental disorders, mostly PTSD.

Many studies asked service members about combat exposure, such as having been shot at, handling dead bodies, knowing someone who was killed, killing enemy combatants, or discharging ones' weapon. When measures such as these were included in multivariate regression models, they were consistently associated with increased likelihood of screening positive for PTSD (Grieger et al., 2006; Hoge et al., 2006; Hoge et al., 2004; Hotopf et al., 2006; Kolkow et al., 2007; United States. Dept. of the Army. Office of the Surgeon General., 2006b), though in the longitudinal study of wounded soldiers combat exposure was associated with PTSD one-month after injury but not at 4 or 7 months (Grieger et al., 2006). Combat exposure was only associated with depression in two studies (Hoge et al., 2007; United States. Dept. of the Army. Office of the Surgeon General., 2006b). In one study that contained samples of service members from both OEF and OIF, combat experience was only associated with PTSD in the OIF sample (Hoge et al., 2006). Having suffered and injury or being wounded was also associated

with an increased likelihood of PTSD across studies (Hoge et al., 2006; Hoge et al., 2004; Hoge et al., 2007). Among soldiers who were wounded, higher levels of physical symptoms were associated with both PTSD and depression at 4 and 7 months post-injury, and high levels of physical symptoms at 1 month predicted PTSD at 7 months (Grieger et al., 2006).

Aside from these consistent correlates of PTSD, studies also highlighted features that appeared to increased risk of reporting PTSD or depression among their samples. Young age, such as being under 25, was associated with PTSD in two studies (Grieger et al., 2006; Seal et al., 2007). In MHAT-I and in the study by Abt Associates (Abt Associates Inc., 2006), reports of low personal and unit morale and lower unit cohesion were both linked with increased reports of mental health symptoms. In analysis of one year of data from the PDHA, those in medical occupations and those in the Reserve component were the most likely to screen positive for PTSD (Martin, 2007). Having been deployed more than once was associated with acute stress in MHATs-III and IV and with depression in MHAT-III, while being deployed for more than 6-months was associated with both acute stress and depression in MHAT-IV.

- When comparisons are available, service members deployed to OIF appear to be at higher risk for PTSD than service members deployed to OEF.

Many studies attempted to draw comparisons between groups of service members to identify variables associated with differences in the prevalence of disorders across groups. In studies that included service members deployed in OIF and OEF or another location, those deployed to Iraq were consistently more likely to report PTSD, although this is likely due to increased likelihood of combat exposure among service members in Iraq (Abt Associates Inc., 2006; Hoge et al., 2006; Hoge et al., 2004; United States. Dept. of the Army. Office of the Surgeon General., 2004). The results of the MHAT reports were compared with appropriate subsamples to discern if, over time, rates of mental disorders increased or decreased among service members in Iraq. In 2004 (MHAT-II), rates of PTSD were lower than they were in 2003 (MHAT-I), though rates of depression were not significantly different. There were no differences between rates of either PTSD or depression in MHAT-I and MHATs III and IV.

Other studies attempted to investigate whether deployment has a *causal* influence on mental health outcomes. In order to properly to conduct such an assessment, one would need to conduct a longitudinal study among a cohort of soldiers assessed both before and after deployment. We found only one such study (Vasterling et al., 2006), though the study did not

present whether the prevalence of PTSD or depression increased among the sample post-deployment. Other studies have compared rates of mental health outcomes among different samples to assess whether rates of mental health outcomes are different among those who have served in Iraq or Afghanistan and those about to be deployed (Hoge et al., 2004), or among service members who were not deployed at the same time (Abt Associates Inc., 2006; Hotopf et al., 2006). Hoge et al. (Hoge et al., 2004) found post-OIF deployment units had higher rates of PTSD and depression than units scheduled to deploy to Iraq in one week's time, and the study by Abt Associates (Abt Associates Inc., 2006) found that 7.3% of deployed active component service members screened positive relative to 4.1% of non-deployed active component personnel, and that mean continuous scores on the PCL were also higher among deployed service members relative to the non-deployed group. On the other hand, Hotopf and colleagues (Hotopf et al., 2006) found no difference in PTSD or other mental health outcomes among those deployed in TERIC-1 and non-deployed service members. Thus, although studies have generally provided evidence that the prevalence of mental health problems is greater post-deployment, no study has yet been able to provide evidence of a causal relationship.

Discussion

Assembling and critically reviewing the existing epidemiologic studies that have examined mental health problems among service members deployed to Iraq or Afghanistan allowed us to address several specific objectives.

Consistencies and Inconsistencies across Studies

The assembled research to date on the prevalence of post-combat mental disorders in OEF and OIF supports several broad generalizations. First, PTSD is the most prevalent mental health disorder among deployed service members, and affects roughly 5 to 15% of service members, depending on who is assessed and when they are assessed. Second, the prevalence of depression among service members ranges from 2 to 10%, and also depends on when and who is assessed. Third, because many studies employ the same screening tools, prevalence estimates across studies are generally comparable. Thus, variability across studies is likely due to differences in study samples or the time of assessment. Fourth, because different studies have been conducted at different time periods during and post-deployment, comparing across studies

suggests that the prevalence of PTSD and depression increases as the time since returning from deployment increases. Fifth, across studies, service members who experience combat exposure and who have been wounded are more likely to meet criteria for PTSD. Finally, service members deployed in OIF and OEF are more likely to meet criteria for mental health problems relative to non-deployed troops, though those deployed to Iraq have higher rates of mental health problems than those deployed to Afghanistan.

For the purposes of allocating funds and services, policy makers will want to know the actual number of returning service members likely to meet diagnostic criteria for PTSD, depression, and TBI by the end of OEF and OIF, whether or not these individuals seek treatment. Providing this number, however, is difficult due to the methodological limitations of the epidemiological studies we have reviewed. Studies with the most sensitive screening criteria have not been conducted among samples representative of the entire deployed population, and those studies that are most generalizable (Hoge et al., 2006; Martin, 2007; Milliken et al., 2007) uses a screening tool that is likely to include persons without PTSD or depression. If we apply the range of prevalence estimates for PTSD (5 to 15%) and depression (2 to 10%) to the 1.5 million service members who have already been deployed, we can estimate that the number of service members returning home with PTSD will range from 75,000 to 225,000 and with depression from 30,000 to 150,000. The precise number, however, is dependent upon how many of all deployed service members are at increased risk for these outcomes, specifically the percentage of those deployed with direct combat experience and those who have been wounded. It is worthwhile to note, however, those studies that are most generalizable estimated that the prevalence of PTSD fell almost midway in this range and at the lower end of the range for depression. If we were to use the median value between the range of service members likely to have PTSD, we would arrive at a figure of 150,000 service members. As we reiterate throughout this chapter, we do not yet have a basis for estimating numbers for TBI.

Strengths and Limitations of the Existing Studies

From a methodological perspective, these studies all have strengths that should be noted and replicated in future studies. As mentioned above, researchers often use the same screening tools, which have been validated and thereby minimize the likelihood of misclassification. Thus, although samples differ, we can examine studies collectively and draw general conclusions (e.g.,

that the prevalence of disorders increases over time). In addition, the current research tends to focus on combat troops. Although we note this as a limitation for other reasons below, the current studies tell us that this group of service members is at greatest risk for psychological problems and therefore warrants special attention.

Despite these strengths, if the reviewed studies are to guide the allocation of mental health services for military personnel in the United States it is imperative to recognize two common limitations of these studies, and the implications that these limitations have on prevalence estimates. First, in all but two a handful of studies (Abt Associates Inc., 2006; Hoge et al., 2006; Hotopf et al., 2006; Martin, 2007; Milliken et al., 2007), generalizability is weak. This means that prevalence estimates are specific to the troops in the respective samples. The current samples, including longitudinal assessments that are considered to be the most generalizable (Martin, 2007; Milliken et al., 2007), are likely to exclude service members with the highest likelihood of mental problems, such as those with serious injuries or those who have separated from military service. This type of bias is likely to yield *lower* prevalence estimates than is actually the case. On the other hand, by focusing on troops most likely to be in combat situations, current studies may be systematically excluding those service members deployed but serving in combat support or combat services support roles. This bias may therefore yield prevalence estimates *higher* than is actually the case. We discuss below one strategy to address these types of biases by employing a random sample of all deployed service members.

Second, all of the current studies used screening tools to measure the prevalence of psychological problems. Screening tools are typically short and simple to administer but are not equivalent to diagnostic procedures. The two screening tools most often used in the current studies, the PCL and PHQ-9, have very high specificities (will likely screen out most non-cases) and acceptable sensitivities (i.e., are likely to miss some cases) (Blanchard et al., 1996; Spitzer, Kroenke, & Williams, 1999). Fully structured diagnostic instruments are improvements upon screening tools for diagnosing individuals with disorders, though may also have problematic sensitivity and specificity (Kendler, Gallagher, Abelson, & Kessler, 1996). Semi-structured interviews, which rely on professional, clinical assessment, are not generally practical for community-based epidemiologic surveys, though can be used as the second stage of a two-phased design for those persons identified as probable cases via a screening tool (Jablensky, 2002).

Future Research Directions

We have reviewed what we believe to be the “first wave” of epidemiologic studies designed to assess psychological problems among service members in theater, immediately upon their return, and closely thereafter. These studies are a significant advance in both psychiatric epidemiology and military medicine. Future studies should use these to guide their research designs, but should improve upon them by addressing the limitations noted above. Specifically, epidemiologists and those conducting epidemiologic studies should address three specific gaps in the current research.

1. Epidemiologic studies should employ random sample designs to generalize to all deployed service members. Targeted research on troops engaged in combat is warranted and important. However, research on representative samples of all deployed service members regardless of their type of service is encouraged to provide prevalence estimates that can be generalized to all deployed service members. From a policy perspective, this will aid in the correct allocation of mental health services for military personnel. In addition, future research should make targeted efforts to engage deployed service members that are no longer active in the military, including those who have separated as well as those who have suffered significant wounds. Together, these efforts will confront those issues that are likely to yield biased estimates among the existent studies.

2. Research should address causal associations between deployment and subsequent mental health problems. Studies have been conducted on service members pre-deployment, in theater, and post-deployment, and some have compared rates of mental health problems at these different stages of service. Only one study (Vasterling et al., 2006) followed a cohort of service members from a time period prior to deployment to post-deployment, but this study did not examine whether rates of PTSD or depression increased after being deployed. A quasi-experimental research design that assesses the same service members prior to deployment and post-deployment will aid in determining whether the risk of developing adverse psychological outcomes increases after serving in conflict.

3. Research should directly examine the prevalence of Traumatic Brain Injury. Finally, although it has been deemed a “signature” wound of the current conflicts, data on the prevalence of traumatic brain injury is lacking. Results from screenings at Camp Pendleton and Fort Irwin

have not been subjected to the peer-review process, and it is not clear how these samples generalize to other service members. Also unknown are the psychometric properties of the screening instrument, and whether it is reliable and valid. Significant efforts are needed to identify cases of TBI, particularly mild TBI, in community-based epidemiologic surveys. The analysis and publication of prevalence data from the mandatory TBI screens required for all service members post-deployment will be crucial for understanding the burden that brain injury poses on the US military.

Conclusion

The studies identified in this critical review represent substantial advances in our understanding of the immediate consequences of serving in war for the mental well-being of service members. Mental health outreach and service allocation for deployed troops should occur both in theater and immediately upon their return home and should be based on the prevalence estimates presented here. Targeted interventions should focus on those who served in combat roles and those who are physically wounded. In addition, research conducted many years after previous conflicts such as Vietnam (Dohrenwend, Turner, Turse, Adams, Koenen et al., 2006) and the first Gulf War (Stimpson et al., 2003) have produced prevalence estimates equal to if not higher than those presented here. This may be due to the emergence of symptoms overtime (i.e., a “delayed” PTSD) or increases in treatment seeking behaviors. Regardless of its cause, we hypothesize that the need for mental health services for service members deployed to Iraq and Afghanistan will increase over time. Policy makers may therefore consider the estimates presented in these studies to underestimate the burden that PTSD, depression, and TBI will have on the agencies that will be called upon to care for these service members now and in the near future.

Table 2.1 Studies of mental health in service members returning from OEF and OIF

Citation: Grieger TA, Cozza SJ, Ursano RJ, Hoge C, Martinez PE, Engel CC, Wain HJ. **Posttraumatic stress disorder and depression in battle-injured soldiers.** American Journal of Psychiatry, 2006 Oct; 163(10):1777-83; quiz 1860.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studies	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Convenience sample of first Army soldiers wounded in combat and evacuated to Walter Reed Army Medical Center between March 2003 and September 2004	613	Longitudinal	Standardized screening instruments were administered 1 month (n=613), 4, (n=395/72%) and 7 months (n=301/61%) following injury. 243 (50%) soldiers completed all three assessments.	<p>PTSD (past month): PCL-17 (strict criteria of Hoge, 2004)</p> <p>Depression: PHQ (presence of 5 or more of 9 symptoms 'more than half the days' or 'nearly every day' in the past 2 weeks and presence of depressed mood or anhedonia among those symptoms)</p> <p>Other: War exposure, deployment length, somatic symptom severity</p>	Depression PTSD	<p>PTSD 1 month: 4.2% 4 months: 12.2% 7 months: 12.0%</p> <p>Depression 1 month: 4.4% 4 months: 8.9% 7 months: 19.3%</p> <p>PTSD + Depression 1 month: 2.0 4 months: 7.6% 7 months: 6.3%</p> <p>In the longitudinal cohort, 78.8% (26 of 33) of those positive for PTSD or depression at 7 mos screened negative for both conditions at 1 month.</p>	<p><u>At 1 month:</u> Under age 25 more likely to meet PTSD and depression criteria than over 25; married soldiers more likely to meet criteria for PTSD and depression than unmarried; High combat exposure more likely to meet PTSD criteria, not depression.</p> <p>High levels of physical problems were associated with increased odds of PTSD and depression at 1 month, 4 months, and 7 months.</p> <p>Sociodemographics and combat exposure not associated with PTSD or depression at 4 or 7 months.</p> <p><u>Longitudinal Sample:</u> Among those without PTSD/depression at 1-month, high levels of physical problems at 1 month predicted PTSD & depression at 7 months.</p>	N/A	<p>Generalizability: Sample is severely injured with low numbers of female soldiers and exclusion of patients with low cognitive abilities</p> <p>Low retention: Bias if non-respondents/loss to follow-up significantly different</p> <p>Outcomes: Self-report</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. **Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care.** New England Journal of Medicine. Jul 2004; 351(1):13-22.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Convenience sample of 3 Army units and 1 Marine Corps unit	6,201	Cross-sectional	Anonymous survey administered to 1 Army unit 1-week pre-OIF deployment (n=2,530), 1 Army units 3-4 months post-OIF deployment (n=894), 1 Marine Unit 3-4 months post-OIF deployment (n=815) and 1 Army unit 3-4 months post OEF deployment (n=1,962)	<p>Depression & General Anxiety (past month): PHQ Strict: Broad criteria + impairment in work, at home, or in interpersonal functioning categorized as "very difficult"</p> <p>PTSD (past month): PCL-17 Broad: At least 1 intrusion, 3 avoidance, and 2 hyperarousal at the moderate level Strict: Broad criteria + total score of at least 50</p> <p>OTHER: Current stress, emotional problems, alcohol misuse, family problems, use of professional mental health services in the past month or year, barriers to mental health treatment</p>	Depression PTSD	<p>PTSD (Broad %/Strict %) Pre-OIF Army: 9.4/5.0 Post OIF Army: 18.0/12.9 Post OIF Marines: 19.9/12.2 Post OEF Army: 11.5/6.2</p> <p>Depression (Broad %/Strict %) Pre-OIF Army: 11.4/5.3 Post OIF Army: 15.2/7.9 Post OIF Marines: 14.7/7.1 Post OEF Army: 14.2/6.9</p>	<p>Combat experience (being shot at, handling dead bodies, knowing someone who was killed, or killing enemy combatants) was strongly correlated with all mental disorders.</p> <p>Being wounded or injured was positively associated with rates of PTSD</p>	Post OIF deployment units were significantly more likely to report experiencing PTSD and depression than pre-OIF deployment units and post-OEF deployment unit	<p>Comparison groups: Pre-deployed and post-deployed groups are different samples; baseline distress may be heightened immediately before deployment</p> <p>Generalizability: Sample excludes severely wounded or those who may have been removed from units; not randomly selected</p> <p>Outcomes: Self-report</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Hoge CW, Auchterlonie JL, Milliken CS. **Mental health problems, use of mental health services, and attrition from military service after returning from deployment to Iraq or Afghanistan.** JAMA 2006 Mar 1;295(9):1023-32.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Army & Marines	303,905	Prospective	Administrative records: post-deployment health assessment (conducted immediately upon returning from any deployment) and administrative data on health care visits among all military personnel OEF (n=16,318) OIF (n=222,620) other locations (n=64,967)	PTSD: 4-item PC-PTSD (from PDHA; positive endorsement of 2 or more items) Depression: 2-item PHQ (from PDHA) OTHER: Other mental health problem (4 items from PDHA), referral for a MH reason (from PDHA), health care utilization (from DMSS), attrition from military service (administrative records)	Depression PTSD	PTSD: OIF: 9.8 OEF: 4.7 Other: 2.1 Depression: (% endorse 1 item/% endorse both items) OIF: 4.5/1.6 OEF:2.5/1.0 Other: 1.9/0.8	Combat experience (witnessing person being wounded or killed or engaging in direct combat during which they discharged their weapon) was positively associated with PTSD among OIF veterans Hospitalization during deployment was associated with a mental health problem Female OIF veterans were slightly more likely to report a mental health concern	Post OIF deployment was associated with increased odds of reporting any mental health concern versus those deployed to OEF or other locations	Outcomes: Self-report, and screening tools with low specificity and positive predictive value

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Hoge CW, Terhakopian A, Castro CA, Messer SC, Engel CC. Association of post-traumatic stress disorder with somatic symptoms, health care visits, and absenteeism among Iraq war veterans. *American Journal of Psychiatry*. 2007 Jan;164(1):150-3.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Convenience sample of four Army combat infantry brigades	2,863	Cross-sectional	Anonymous survey administered 1 year post OIF deployment	PTSD: (past month): PCL -17 (strict criteria of Hoge, 2004) Comorbid Depression (past month): PHQ OTHER: Alcohol misuse, self-rated health status, sick call visits, missed work days, somatic symptoms	PTSD (Comorbid depression)	PTSD: 16.6%	Injury was associated with higher rate of PTSD (OR=2.97, 95% CI=2.36, 3.73)	PTSD was associated with lower perceptions of general health, more sick call visits, missed work days, more physical symptoms, and higher somatic symptom severity	Outcomes: Self-report Generalizability: Sample based only on soldiers from combat infantry units; sample not randomly selected and may by design exclude severely injured/medically ill

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Hotopf M, Hull L, Fear NT, Browne T, Horn O, Iversen A, Jones M, Murphy D, Bland D, Earnshaw M, Greenberg N, Hughes JH, Tate AR, Dandeker C, Rona R, Wessely S. **The health of UK military personnel who deployed to the 2003 Iraq war: a cohort study.** *Lancet.* 2006 May 27;367 (9524):1731-41.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	UK armed forces personnel. Service (Royal Navy including Royal Marines, Army, Royal Air Force [RAF])	17,499	Cross-sectional	Questionnaire Random sample of regular service members and reservists, by TELIC 1 population (deployed to Iraq/surrounding areas Jan 18, to June 28, 2003) and Era population (serving in armed forces on March 31, 2003) Response rate was 61% (n=4,722 in the deployed sample, and n=5,550 in the non-deployed sample)	PTSD: PCL-17 (score of 50 or greater) Common mental disorder: General Health Questionnaire 12 (GHQ-12; Score of 4 or greater) OTHER: Alcohol use disorders (WHO Alcohol Use Disorders Identification Test (AUDIT), service information, experiences before, on, and after deployment, current health, background info (including past med history & adversity in early life)	PTSD	PTSD Deployed: 4% Not deployed: 4% Common mental disorder Deployed: 20% Not Deployed: 20%	Combat duties were associated with increased rates of PTSD symptoms No evidence that later deployments, which were associated w/ escalating insurgency & UK casualties, were associated w/ poorer MH outcomes	In general, there were no significant differences in PTSD and other mental health outcomes for deployed versus non-deployed service members Reservist status modified the effect of deployment, whereby deployed reservists were more likely to report common mental disorders & fatigue than non-deployed reservists, though this was not seen for regular service members	Outcomes: Self-report

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Kolkow TT, Spira JL, Morse JS, Grieger TA. **Post-traumatic stress disorder and depression in health care providers returning from deployment to Iraq and Afghanistan.** *Mil Med.* 2007 May;172(5):451-5.

Type of Report (e.g., Peer reviewed; Gov't report)	Sample (Which service (e.g., Army, Navy, etc.))	N	Design (e.g., prospective, cross-sectional, retrospective)	Assessment (e.g., survey, med record)	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	US Military Health Care Providers - Naval (previously deployed to Iraq or Afghanistan)	102	Cross-sectional	Anonymous, internet-based survey administered to military personnel "on staff" (at naval Medical Center San Diego); 36% response rates among those recently deployed to combat areas, based on hospital personnel records	PTSD (past month): PCL-17 (Strict criteria of Hoge, 2004) Depression: PHQ (5 or more of 9 symptoms present 'more than half the days' or 'most days' in the past 2 weeks) OTHER: Direct exposure, perceptions of threat during deployment, mental health service use, severity of physical problems	Depression PTSD	PTSD: 9% Depression: 5%	Non-Caucasian race was associated with PTSD and depression Frequent personal engagement in direct combat or being fired upon by opposition forces was associated with PTSD Threat perception (frequent concern regarding being in danger) had greater risk of PTSD	N/A	Generalizability: Low response rate that may exclude severely wounded/medically ill Outcomes: Self-report Small sample size: Power only to detect large differences

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Mental Health Advisory Team (MHAT-I). U.S. Army, 2003.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Gov't Report	Army (OIF I)	756		Anonymous surveys administered in base camps throughout Iraq (combat line companies from Brigade Combat Teams, n=577) and Kuwait (areas thought to have high operational stress, n=179) in August-October, 2003	<p>PTSD: Endorse several items as moderate on PCL scale and mark that the problem caused functional impairment (if symptoms affect work)</p> <p>Depression: Endorse several items on PHQ as occurring "more than half the days" and functional impairment (how difficult symptoms make it to do work or get along with people) at "very difficult" or "extremely difficult" level.</p>	Depression PTSD	<p>Acute Stress: 15%</p> <p>Depression: 7%</p> <p>Comorbid depression, anxiety, or acute stress: 9%</p>	Lower personal and unit morale and lower cohesion was associated with reports of mental health symptoms	Relative to samples of pre-deployed troops preparing to deploy or just returning from Afghanistan, OIF troops had higher rates of mental disorders, driven primarily by acute stress	<p>Quality Control: Not peer reviewed</p> <p>Generalizability: Unknown</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Mental Health Advisory Team (MHAT-II). Operation Iraqi Freedom (OIF-II) Mental Health Advisory Team (MHAT-II) Report. U.S. Army, 30 January 2005.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Gov't Report	Army (OIF II)	2,064		Anonymous survey administered between August and October, 2004 to line units from Brigade Combat Teams in Iraq (n=1,595) and battalion level units more likely to experience combat or operational stress in Kuwait (469)	<p>NOTE: <i>Document says see Hoge, 2004 for a description of scales used</i></p> <p>PTSD: Endorse several items as moderate on PCL scale high number of symptoms (i.e., score of at least 50)</p> <p>Depression: Endorse several items on PHQ as occurring "more than half the days" and functional impairment (how difficult symptoms make it to do work or get along with people) at "very difficult" or "extremely difficult" level</p>	Depression PTSD	<p>Acute Stress: 10%</p> <p>Depression: 5%</p> <p>Comorbid depression, anxiety, or acute stress: 13%</p>	<p>Subjects in Kuwait had slightly lower levels of mental health problems than those in Iraq</p> <p>Transportation and support personnel had higher levels of screening positive for each mental health problem relative to soldiers in combat or other units</p>	Lower levels of acute stress relative to MHAT-I, not statistically significant difference for depression	<p>Quality Control: Not peer reviewed</p> <p>Generalizability: Unknown</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Mental Health Advisory Team (MHAT-III). Operation Iraqi Freedom 04-06 Report. U.S. Army, 29 May 2006.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Gov't Report	Army (OIF 04-06)	1,124		Anonymous survey delivered to sample of soldiers from 9 Brigade Combat Teams located at 13 Forward Operating Bases and associated units throughout Iraq (i.e., in theater) in October and November 2005	<p>PTSD: PCL-17 (score positive on each of 3 symptoms [avoidance, hyperarousal, and intrusive thoughts] and score at least 50).</p> <p>Depression: Meet DSM-IV-TR criteria & endorse functional impairment at "very difficult" or "extremely difficult" level</p>	Depression PTSD	<p>Acute Stress Symptoms: 14%</p> <p>Depression: 8%</p> <p>Any psychological problems: 17%</p>	<p>Multiple deployment (e.g., 1 or more prior deployments to Iraq) was associated with higher levels of acute stress (18.4%) relative to those on first deployment (12.5%)</p>	Relative to the MHAT-II Iraqi only samples, MHAT-III sample (OIF 04-06) had significantly higher levels of depression and any psycho-logical problem; no difference relative to MHAT-I Iraqi only sample	<p>Quality Control: Not peer reviewed</p> <p>Generalizability: Unknown</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Mental Health Advisory Team (MHAT-IV). U.S. Army, 17 November 2006.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Gov't Report	Army, Marines (OIF 05-07)	1,767 (Army: n=1,320; Marines: n=447)		Anonymous survey delivered to sample of soldiers and marines line companies, primarily from brigade combat teams (Army) and regimental combat teams (marines) and support units and the corps and division sample from all Iraqi regions where significant US ground force existed in May 2007	<p>PTSD: PCL-17 (score positive on each of 3 symptoms [avoidance, hyperarousal, and intrusive thoughts] and score at least 50).</p> <p>Depression: Meet DSM-IV-TR criteria & endorse functional impairment at "very difficult" or "extremely difficult" level</p>	Depression PTSD	<p>Depression (% Marines/% Soldiers) 4/ 9</p> <p>Acute Stress (% Marines/% Soldiers) 14/17</p> <p>Any mental health problem (% Marines/% Soldiers) 15/20</p>	<p>Level of combat (low, med, high) related to positive screen for anxiety, depression, or acute stress</p> <p>Multiple deployment (e.g., 1 or more prior deployments to Iraq) was associated with higher levels of acute stress (OR=1.6), depression (OR=1.7), anxiety (OR=1.2), or any mental health problem</p> <p>Deployment for more than 6 months was positively associated with acute stress, depression, anxiety, and any mental health problem relative to deployment for less than 6 months</p>	No differences among soldiers relative to MHAT-I and MHAT-III; marines screening positive for depression had lower levels than soldiers in MHAT-I, MHAT-III, and soldiers in MHAT-IV.	<p>Quality Control: Not peer reviewed</p> <p>Generalizability: Unknown</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Seal KH, Bertenthal D, Miner CR, Sen S, Marmar C. **Bringing the war back home: mental health disorders among 103,788 US veterans returning from Iraq and Afghanistan seen at Department of Veterans Affairs facilities.** Archives of Internal Medicine. Mar 12 2007; 167(5): 476-82.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	OEF/OIF veterans	103,788	Retrospective Study	Medical record review of new users of the VA healthcare system included in the VA OEF/OIF Roster database; thus, all participants have been separated from OEF/OIF service, adjusted to maximize likelihood that VA visit occurred post-OEF/OIF deployment	ICD-9-CM mental health diagnoses codes	PTSD	<p>PTSD: 13%</p> <p>Depression: 5%</p> <p><i>25% received MH diagnosis(es), of whom 56% had >=2 distinct MH diagnoses</i></p>	<p>Younger OEF/OIF veterans were at greatest risk for receiving MH/PTSD diagnoses compared w/ veterans >=40 yrs (e.g., 18-24 years olds more likely to receive 1 or more mental health diagnosis (RR=3.32) and PTSD (RR=5.04).</p>	N/A	<p>Generalizability: Sample restricted to only veterans who have left the service and sought treatment at VA</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Vasterling JJ, Proctor SP, Amoroso P, Kane R, Heeren T, White RF. **Neuro-psychological outcomes of Army personnel following deployment to the Iraq war.** JAMA. 2006 Aug 2;296(5):519-29.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Random sample of soldiers of Army battalion-level units originating in Fort Hood, Texas and Fort Lewis, Washington	1,457	Prospective cohort-controlled	Assessments conducted by a civilian examiner team at military installations at two time points (pre-OIF deployment, between April and December 2003, n=1,368) and post-OIF deployment (between January and May 2005, n=1,028). After exclusions, n=961, participants categorized as deployed (n=654) or not deployed during that time (307)	<p>PTSD: PCL</p> <p>Depression: Center for Epidemiological Studies Depression Inventory, 9-item version (CES-D)</p> <p>Functional Neurocognitive Health: 4-item version of the Medical Outcomes Study Cognitive Functioning Scale (MOS-CF)</p> <p>Deployment experiences: Deployment Risk and Resilience Inventory (DRRI; modified)</p> <p>State affect: Profile of MoodStates (POMS)</p> <p>Variety of performance-based neuro-psychological tests</p>	PTSD TBI Depression	<p>PTSD (with impairment) Deployed: 11.6%</p> <p>Depression Deployed: 25.0%</p> <p>Head Injury with related loss of consciousness Deployed: 7.6% Not-deployed: 3.9%</p>	N/A	N/A	<p>Comparison Groups: Rates of PTSD and depression not presented for non-deployed</p> <p>Outcomes: Self-report; validity of measure for TBI does not include non-concussive blast exposures</p> <p>Generalizability: Sample only included active duty Army soldiers</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Department of Defense Task Force on Mental Health. (2007). **An achievable vision: Report of the Department of Defense Task Force on Mental Health.** Falls Church, VA: Defense Health Board.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Gov't Report	NA	NA	NA	NA	NA		<p>"More recent data from the Post-Deployment Health Re-Assessment (PDHRA), which is administered to service members 90 to 120 days after returning from deployment, indicate that 38 percent of Soldiers and 31 percent of Marines report psychological symptoms. Among members of the National Guard, the figure rises to 49 percent (U.S. Air Force, 2007; U.S. Army, 2007; U.S. Navy, 2007)."</p> <p>Ref's: RDHA: http://www.pdhealth.mil/dcs/pdhra.asp. U.S. Air Force, 2007; U.S. Army, 2007; U.S. Navy, 2007; DOD Task Force on Mental Health Data Call. Unpublished raw data.</p>			

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Okie S. **Traumatic brain injury in the war zone.** N Engl J Med. 2005 May 19;352(20):2043-7.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Journalistic article	NA	NA	NA	NA	NA	TBI	<p>1) Avg 22% of all OEF/ OIF wounded have a TBI</p> <p>2) Rate of TBI is higher than in previous wars "According to the Joint Theater Trauma Registry, compiled by the U.S. Army Institute of Surgical Research, 22 percent of the wounded soldiers from these conflicts who have passed through the military's Landstuhl Regional Medical Center in Germany had injuries to the head, face, or neck. This percentage can serve as a rough estimate of the fraction who have TBI," according to Deborah L. Warden, a neurologist and psychiatrist at Walter Reed Army Medical Center who is the national director of the Defense and Veterans Brain Injury Center (DVBIC). Warden said the true proportion is probably higher, since some cases of closed brain injury are not diagnosed promptly.</p>			

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Milliken CS, Auchterlonie JL, Hoge CW. **Longitudinal assessment of mental health problems among active and reserve component soldiers returning from the Iraq War.** JAMA 2007 Nov 15; 298(18): 2141-2148.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Active Duty Army and Army National Guard and Reserve Soldiers returning from OIF	88,235	Retro-spective	Post-deployment health assessment (conducted immediately upon returning from any deployment); administrative data on health care visits; and post-deployment health re-assessment (conducted 3-6 months after return from deployment)	<p>PTSD: 4-item PC-PTSD (from PDHA; positive endorsement of 2 or more items)</p> <p>Depression: 2-item PHQ (from PDHA)</p> <p>Other: Other mental health problem (4 items from PDHA), referral for a MH reason (from PDHA), suicidal ideation (from PDHA), alcohol use disorder (2-item screen)</p>	PTSD Depression	<p><u>PTSD (1 month)</u> Active: 11.8% Reserve: 12.7%</p> <p><u>Depression (1 month)</u> Active: 4.7% Reserve: 3.8%</p> <p><u>PTSD (6 months)</u> Active: 16.7% Reserve: 24.5%</p> <p><u>Depression (6 months)</u> Active: 10.3% Reserve: 13.0%</p>	N/A	Higher rates among National Guard and Reserve More than 2x as many new PTSD cases on PDHRA (at 6 months) than on PDHA (at 1 month)	<p>Generalizability: Only Army, no Marines represented</p> <p>Outcomes: Self-report, and screening tools with low specificity and positive predictive value</p> <p>Attrition/Retention: Proportion of individuals with initial assessment who completed follow-up is not disclosed. Differences between those who complete follow-up and those who do not are not addressed.</p>

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Abt Associates, Inc. **2003-2004 Active Duty Health Study: Final Report.** 30 December 2006. Falls Church, VA: TRICARE Management Activity, Health Program Analysis and Evaluation Directorate.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Report	Stratified, random sample of active duty service members who deployed to Iraq or Afghanistan on or after January 2003 and returned from theater by February 2004	2761 (1419 deployed, 1342 non-deployed)	Cross-sectional	Survey and, administrative records: post-deployment health assessment (conducted immediately upon returning from any deployment) and post-deployment health re-assessment (conducted 3-6 months after return from deployment)	PTSD: PTSD checklist- Military Version Quality of Life: SF-36 Cognitive functioning: Medical Outcomes Study cognitive functioning scale Deployment Social Support: Unit Cohesion/ Deployment Social Support Instrument, Deployment Risk and Resilience Inventory (DRRI)	PTSD	PTSD: Deployed: 7.3% Non-deployed: 4.1%	Unit Cohesion scores were negatively associated with PTSD scores Mean scores of all quality of life domains and cognitive functioning for deployed active duty service members with PTSD were much lower than for those deployed active duty service members without PTSD	Deployed service members were more likely to screen positive for PTSD than non-deployed service members.	Generalizability: Active duty only, no Reserve or National Guard represented; low response rate to a mail survey that may be less likely to capture those who are more severely impaired

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Rosenheck RA, Fontana, AF. **Recent trends in VA treatment of post-traumatic stress disorder and other mental disorders.** Health Affairs, November/December 2007; 26(6):1720-7.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Peer reviewed	Veterans receiving VA care in 1997, 1999, 2001, 2003, & 2005; OIF/OEF veterans were identified as being born after 1972 and having their first VA outpatient encounter after 1991	>1 M	Retro-spective Study	Medical record review of users of the VA healthcare system	PTSD: ICD-9- PTSD diagnosis code Other mental diagnosis: ICD-9 code	PTSD Other mental disorder	<u>Average annualized percent increase in PTSD diagnoses among OIF/OEF sample:</u> 1997-2001: 31.2 2001-2003: 31.6 2003-2005: 232.1	N/A	Most of the increase in PTSD treatment between 1997 and 2005 in the VA represents increased service use of veterans from earlier eras.	Generalizability: Sample restricted to only veterans who have sought treatment at VA Misclassification: Approximated sample of OIF/OEF veterans excludes older

Table 2.1 Studies of mental health in service members returning from OEF and OIF (cont'd)

Martin C. **Routine screening and referrals for PTSD after returning from Operation Iraqi Freedom in 2005, US Armed Forces.** MSMR: Medical Surveillance Monthly Report. Sept/Oct 2007; 14(6): 2-7.

Type of Report <i>(e.g., Peer reviewed; Gov't report)</i>	Sample <i>Which service (e.g., Army, Navy, etc.)</i>	N	Design <i>(e.g., prospective, cross-sectional, retrospective)</i>	Assessment <i>(e.g., survey, med record)</i>	Outcome Measures	Disorders Studied	Results	Correlates of Mental Disorders	Relative Comparisons	Critique
Army Medical Surveillance Activity publication	US Armed Forces returning from OIF in 2005	91,408	Retrospective	Administrative records: post-deployment health assessment (conducted immediately upon returning from any deployment) and post-deployment health re-assessment (conducted 3-6 months after return from deployment)	PTSD: 4-item PC-PTSD (from PDHA; positive endorsement of 2 or more items)	PTSD	PTSD (PDHA): 10.5%	The following were associated with positive screens for PTSD: Younger age Army soldiers (relative to other services) Reservists (relative to active component) Junior enlisted servicemembers (relative to mid or senior level enlisted, or officers) Servicemembers in health occupations relative to those in combat occupations Those who completed the PDHA out of theater were more likely to screen positive for PTSD than those who completed the PDHA in theater.	48.1% of those who received clinical diagnoses of PTSD within 6 months of returning from OIF deployment screened positive on the PDHA 29.9% of those who screened positive on the PDHRA screened positive on the PDHA	Quality control: not peer reviewed Generalizability: Unknown Outcomes: Self-report, and screening tools with low specificity and positive predictive value Attrition/ Retention: Proportion of individuals with initial assessment who completed follow-up is not disclosed. Differences between those who complete follow-up and those who do not are not addressed.

3. Theoretical Perspectives on the Consequences of Mental Health Disorders

Although emotional, cognitive, and neurological disorders are sources of individual suffering in their own right, they are likely to have broader consequences for individual development and for society at large. Before reviewing the empirical research that has documented those consequences, this chapter describes existing theoretical perspectives that explain how mental health disorders may give rise to additional problems and deficits over the life of an afflicted individual. We recognize at the outset that MDD, PTSD, and TBI are distinct disorders, with different etiologies, symptoms, and recommended treatments. Nevertheless, from the perspective of understanding how these disorders impact the lives of those who suffer from them, there are likely to be developmental processes common to all three. The goal of this chapter is to provide a brief summary of prominent perspectives that have highlighted ways that mental, emotional, and cognitive impairments may affect the life course, and then to assemble elements from these perspectives into a general framework to guide the empirical reviews that follow in subsequent chapters.

The Stress-Diathesis Model

A common starting point for theories of illness and resilience is the stress-diathesis model first articulated by Zubin and Spring (1977). Originally developed as a framework for understanding the etiology of schizophrenia, the model builds from the premise that individuals vary in their levels of diathesis (Brewin, 1998; Hèanninen & Aro, 1996), where a diathesis refers to an aspect of individuals and their circumstances that increases their vulnerability to disease. Individual sources of vulnerability include pre-existing mental health problems, lack of education, experiences of criminal behavior or substance abuse, and a family history of mental disorders. Circumstantial sources of vulnerability include poverty, social isolation, lack of adequate employment, and physical distance from resources and potential avenues of support. As the model has been applied to a broad range of disorders, diatheses are typically characterized as relatively stable over time, and indeed some diatheses (e.g., parental history of divorce, childhood history of abuse) are unchangeable.

The central insight of the stress-diathesis model is that the presence of a diathesis is, by itself, insufficient to bring about a mental health disorder. Many people with significant vulnerabilities live comfortably without experiencing any problems. The model accounts for the timing of mental health disorders by suggesting that vulnerable individuals will be most likely to experience the onset of problems when they are confronted by stress, and may function normally in the absence of stress. In this view, stressors are concrete events that make demands on the individual's resources and energy. Because individuals with significant diatheses are deficient in resources, for these individuals serious disorders are most likely to begin during periods that demand resources. The reverse is also assumed: given a population of individuals exposed to a specific stressor, the more vulnerable among them will be at higher risk of developing a disorder (Kendler, Gardner, & Prescott, 2002).

Although stress-diathesis models were designed and have mostly been applied toward understanding the etiology of mental disorders, the principles of the model apply equally well to understanding the consequences of these disorders. From this perspective, the presence of a disorder such as MDD, PTSD, and TBI may be considered a diathesis. For any outcome or negative consequence of experiencing these disorders, an individual will be most at risk to the extent that: a) the individual is characterized by other sources of vulnerability (diathesis) as well, and b) the individual encounters stressful or demanding events that tax resources and energy that are already limited by the disorder and other diatheses. Thus, for example, this model suggests that a service member returning from combat with a particular disorder is most likely to experience negative consequences of that disorder to the extent that the service member has other diatheses as well and encounters stressful events and circumstances. Put another way, given a particular level of impairment, those individuals who are also vulnerable in other ways are likely to experience a greater number and a broader range of additional consequences.

The stress-diathesis model has a number of important implications for minimizing negative consequences in service members who suffer from mental health disorders. First, with respect to identifying those in greatest need, it will be insufficient to assess only impairments arising from the disorder. According to this perspective, understanding individual vulnerability requires assessing not only the disorder, but also other possible sources of vulnerability, such as access to social support, the experience of other mental or physical illnesses, and the quality of family relationships. Second, with respect to protecting those in need, the model suggests that

programs and policies that reduce vulnerability to further negative consequences (e.g., by ensuring extended health care, promoting post-service employment, etc.) may be as effective as treatments that directly address the symptoms of the disorder.

Life-span Developmental Perspectives

Although the stress-diathesis model offers a powerful framework for understanding who may be at risk for problems and when those problems are likely to occur, the model is silent regarding how mental disorders give rise to further difficulties throughout the life course. Understanding the mechanisms through which mental and cognitive impairments may lead to other negative consequences requires models that directly address how impairments at one stage of life give rise to cumulative consequences over time.

Theories of lifespan development, of which there are many (e.g., Baltes, 1987; Ceci & Hembrooke, 1995; Zoccolillo, Pickles, Quinton, & Rutter, 1992), offer a number of insights into these issues. Here we review one prominent perspective developed by Caspi, Elder, and their colleagues (e.g., Caspi, 1987; Elder, Pavalko, & Hastings, 1991) that can offer unique insights into the immediate and emergent consequences of mental disorders in returning service members. This approach builds on research that assessed individuals multiple times over the course of their entire lives, from shortly after birth or during childhood in the 1920s and 30s, through their adulthoods during the 40s and 50s (during which time many served in the military), on through later life at the end of the 20th century. By examining ratings of these individual's personalities and experiences at different stages of their lives, the researchers identified and described two distinct mechanisms to account for how these individuals developed and changed across time (Caspi, Bem, & Elder, 1989). The first mechanism is *interactional continuity*, the idea that enduring qualities of an individual affect the way that individual interacts with others, who generally respond in kind. Thus, aggressive individuals behave in ways that beget aggressive responses, and withdrawn individuals behave in ways that exacerbate their isolation. As a result of this form of continuity, the interpersonal relationships of both types of individuals tend to suffer and get worse over time (Caspi, Elder, & Bem, 1987, 1988). Interactional continuity highlights the ways that mental and cognitive disorders, to the extent that they impair interpersonal functioning, can have lasting consequences for how individuals make their way in the world.

A second mechanism described by this perspective is *cumulative continuity*. Cumulative continuity is the idea that behaviors and choices at each stage of life have consequences that accumulate to shape and constrain an individual's options at subsequent stages of life. Whereas interactional continuity focuses on interpersonal relationships and their immediate consequences for the individual, cumulative continuity highlights the ways that negative consequences can emerge over time. For example, service members who are aggressive and uncontrolled upon return from deployment are likely to suffer professionally and socially. Especially after they separate from the structured environment of the military, the consequences of their behavior may accumulate, limiting their options for productive employment. Constrained economically, their options for maintaining and supporting successful family relationships are similarly limited (Caspi et al., 1987). Thus, over time, the immediate symptoms of a disorder may lead to a cascade of negative consequences that substantially affect later stages of the individual's life.

Applied specifically to service members suffering from mental disorders, the lifespan developmental perspective suggests that impairments observed immediately after a return from combat may have consequences for a broad range of outcomes through two primary mechanisms. First, a disorder alters the way the service member interacts with intimates, family members, and professional colleagues, impairing these relationships. Second, a disorder gives rise to concrete outcomes (e.g., incarceration, substance abuse, unemployment) that have implications for situations that the individual and his or her family members will face later in life.

Identifying specific mechanisms through which mental, cognitive, and emotional impairments may affect adult development has specific implications for developing treatments and supportive programs. First, to the extent that many of the negative consequences of these disorders are mediated by their direct impact on interpersonal functioning, treatments that emphasize interpersonal functioning (e.g., communication, effective problem-solving) may have broad benefits for individuals. Second, to the extent that the short-term negative consequences of these disorders (e.g., increased rates of substance abuse, criminal behavior, marital dissolution) themselves have long-term consequences that are even harder to treat (e.g., implications for wealth, mortality, and children's outcomes), treatments that focus on preventing short-term problems may have long-term benefits as well.

Integration: A Model of the Consequences of Post-Combat Mental Health Disorders

A general framework for understanding the consequences of post-combat mental health disorders would incorporate elements from the stress-diathesis model and the life-span developmental perspective. That is, a comprehensive framework should account for: a) who among the afflicted is most vulnerable to experiencing other negative consequences, b) when those consequences are likely to occur, and c) the mechanisms through which those consequences come about. To guide the empirical review that follows, we have assembled elements of both models into a general framework that addresses these issues. Our integrative model is presented in Figure 3.1. The logic of the model can be expressed as a series of propositions, each of which is elaborated upon below.

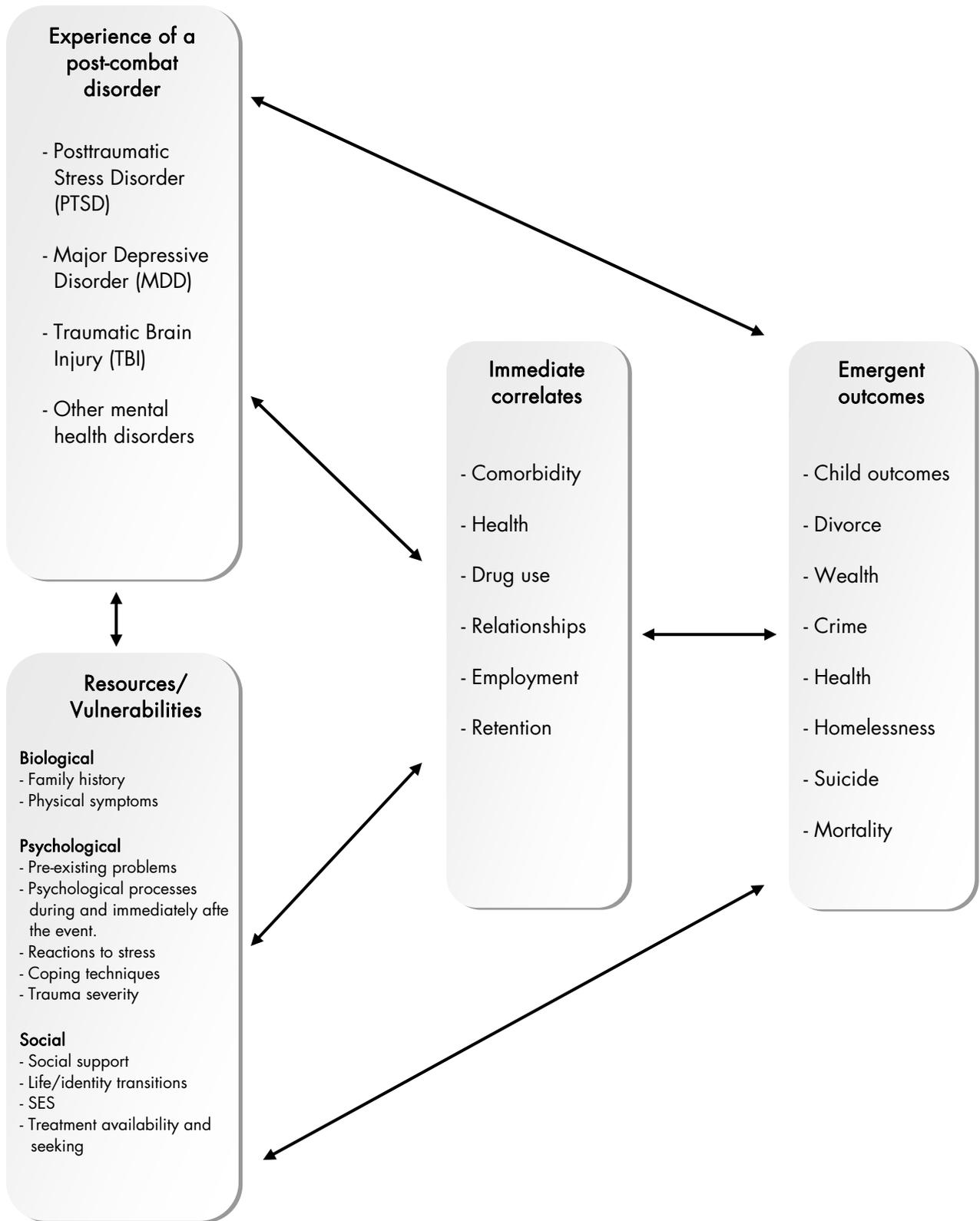


Figure 3.1 A Model of the Consequences of Post-Combat Mental Health Disorders

Among service members afflicted by post-combat mental health disorders, levels of symptomatology and impairment vary across individuals.

The model begins by acknowledging that even individuals who share a common diagnosis may have very different experiences. As we noted in the previous chapter, some individuals experience only a single disorder, whereas others experience multiple disorders. The degree of symptoms can range from mild to severe. There is some reason to expect that the full range of symptoms that a service member is experiencing may not be fully known until that individual has returned from combat, because the highly structured military environment may serve to mask some symptoms. As Dr. Gregory O'Shanick, national medical director for the Brain Injury Association of America, has noted, "You see somebody in the military when their lives are organized for them, you may not notice mild traumatic brain injury in [its] fullest form when they're on active duty...But when they come back home and their external structure isn't there, that's where you may see things become much more evident in terms of brain injury" (Colarusso, 2007). The greater the total impairment observed immediately post-combat, the greater the likelihood of short-term and long-term negative consequences should those symptoms fail to receive treatment.

The impairments arising from post-combat mental health disorders have direct, negative consequences for individual outcomes.

To the extent that mental disorders are defined by a specific set of impairments, it is not difficult to imagine how the experience of those impairments may limit effective functioning in a number of important life domains. Problems with emotional regulation, a symptom of all three of the disorders addressed here, should affect relationships with family members and employers. Difficulties concentrating should affect workplace performance and health maintenance behaviors. Impaired impulse control should affect substance abuse and illegal behavior. Indeed, the subsequent chapters of this review will reveal substantial evidence for all of these effects.

The severity of the immediate consequences of post-combat mental health disorders depends on the individual's level of resources and vulnerabilities.

For ease of presentation, the model divides resources and vulnerabilities into three general categories: biological, or those located in the genetic inheritance of the individual (e.g., family history, pre-existing psychopathology), psychological, or those that stem from the

behavior and cognition of the individual (e.g., coping styles, temperament), and social, or those located in the environment of the individual (e.g., presence or absence of social support, financial constraints, family members).

Drawing from lifespan developmental perspectives, the model describes three ways that these resources and vulnerabilities can alter the immediate consequences of mental disorders. First, sufficient resources can act as a buffer, protecting individuals and minimizing the immediate consequences of mental disorders. A supportive family, for example, may tolerate a service member's emotional dysregulation, minimizing the impact of this symptom on marital and child outcomes. Adequate education may compensate for deficits that might otherwise prevent professional advancement. With resources such as these, problems that might otherwise have cumulative effects over time can be addressed early, preventing post-combat impairments from affecting other life domains.

Second, significant vulnerabilities and other sources of stress can exacerbate the negative consequences of a disorder. Whereas an inability to concentrate may be a nuisance for a service member in a supportive social network, the same problem may be life-threatening for a service member with other serious health problems, dependent family members, or other issues that require constant management. Neglect of such issues can lead to more long-term negative consequences, the indirect effects of untreated mental disorders.

Third, the model points out that resources and vulnerabilities can themselves be affected by a service member's disorders. For example, consistent with the idea of interactional continuity, individuals whose ability to communicate and manage anger effectively have been impaired are likely to manage the immediate consequences of their impairments more poorly, and this inefficient coping is likely to have immediate negative consequences of its own.

Over the life-span, mental disorders have both direct and indirect consequences for other domains of functioning.

The model draws direct links between the experience of a post-combat disorder and both immediate and long-term consequences, recognizing that some impairments arising from these disorders (especially TBI) may be permanent, directly affecting multiple domains throughout the life of the afflicted service member. The model also notes that the immediate consequences of these disorders may themselves have long-term consequences for individuals and their family members. For example, to the extent that post-combat mental disorders contribute to substance

abuse or criminal behavior in the service member, the consequences of those behaviors can have long-term effects on the health and life-time earnings of the service member, as well as cross-generational effects through their impact on the service member's children. Finally, the model positions resources and vulnerabilities again between the immediate consequences of a disorder and its long-term consequences. Just as resources and vulnerabilities can buffer or exacerbate the immediate consequences of a disorder, so can they buffer or exacerbate the long-term effects of those immediate consequences on the life of the afflicted service member.

The immediate and emergent consequences of mental health disorders feed back to affect the course of the disorder.

Each of the arrows in the model is bidirectional, indicating the presumed mutual influence among the constructs in the model. In particular, the model acknowledges that, although the emphasis of the analyses described in this report is on post-combat mental disorders as causes of subsequent short- and long-term consequences, the course of these disorders is also affected by those consequences. For individuals experiencing complex and negative consequences (e.g., family disruption, unemployment, health problems), recovery from the disorders should be slower and relapses more likely.

Evaluating the Integrative Model

The integrative model proposed here describes the consequences of post-combat mental health disorders as a cascade of negative outcomes that, in the absence of intervention, can accumulate to impact a broad range of domains over the lifespan of the afflicted individual. Moreover, the model draws attention to events and circumstances external to the individual (e.g., the presence or absence of other sources of stress and support) that make a negative cascade more or less likely to occur. One implication of this perspective is that early interventions, to the extent that they prevent or ameliorate short-term consequences of these disorders, may have significant indirect long-term benefits. A second implication is that interventions and policies that focus solely on ameliorating the specific symptoms of these disorders may be too narrow. On the contrary, the model suggests that programs that provide afflicted service members with a supportive environment and the means by which to cope with their disorders may prove as effective or more effective at promoting post-combat well-being than interventions that treat the disorder directly.

Although the model encompasses a wide range of variables, it also assumes that the means by which mental disorders may give rise to negative consequences are more or less the same across different disorders, types of resources, and domains of functioning. This reflects a deliberate choice to emphasize breadth over depth. In the chapters that follow, the appropriateness of this choice will become apparent, as each chapter notes the main effects of each disorder on a given set of outcomes, and the evidence that characteristics of afflicted individuals and their environment moderate these effects. The commonalities among the disorders are more notable than the differences, but those differences are discussed throughout this report when they arise. We anticipate that, as research on the course of these disorders develops, the framework proposed here will be refined and revised.

4. Comorbidity and Other Mental Health Problems

The comorbidity of conditions refers to two or more conditions co-occurring simultaneously. Commonly referred to as dual-diagnoses, there are many theories as to why comorbidity occurs including shared, causal, and bidirectional paths of influence among the disorders (Mueser, Drake, & Wallach, 1998). Consistent with the diathesis-stress model described in Chapter 3, the stress an individual experiences with one disorder may place them at greater vulnerability or risk for developing a secondary disorder. The onset of a secondary disorder may be directly (e.g., depression as a result of PTSD severity) or indirectly (e.g., depression as a result of family problems related to PTSD) related to the primary disorder. Consequences related to comorbidity are high and costly. Individuals with co-occurring mental, medical, and substance use disorders have been shown to have more severe symptoms, require more specialized treatment, have poorer outcomes to treatment, and more disability in social and occupation functioning than individuals with either disorder alone (Greenfield, Weiss, Muenz, Vagge, Kelly et al., 1998; Olfson, Fireman, Weissman, Leon, Sheehan et al., 1997; Ormel, VonKorff, Ustun, Pini, & et al., 1994; Shalev, Freedman, Peri, Brandes, Sahar et al., 1998). In this chapter, we summarize the literature examining the comorbidity between PTSD, MDD, and TBI. We then describe the literature on the comorbidity between each of the three conditions and other psychiatric diagnoses, and conclude with implications from this research.

Co-occurring disorders among military personnel returning from Iraq and Afghanistan may be of particular concern because of the high rates of comorbidity found among individuals with PTSD. As noted in Chapter 2, deployed service members are returning with higher rates of PTSD than personnel not deployed to Iraq or Afghanistan. We know from research in the general population that about 88% of men and 79% of women with PTSD also experienced one other disorder in their lifetime and that about half have 3 or more comorbid diagnoses (Kessler et al., 1995b). These rates are supported with another study showing that individuals meeting full criteria for PTSD also had an average of 2.7 other diagnoses and that the number of comorbid disorders increases with PTSD severity (Marshall, Olfson, Hellman, Blanco, Guardino et al., 2001). While little research has examined rates of comorbidity specifically with the current military cohort, rates of PTSD among returnees may provide us with preliminary insights into the comorbidity rates we might anticipate.

PTSD and Depression

Elevated risk for PTSD may impact rates of co-occurring disorders. During times of war, military personnel may be exposed to high levels of trauma and may be at elevated risk of developing PTSD with combat exposure (Kessler, 2000). In one study of Vietnam veterans, about 99% of veterans with PTSD had at least one other psychiatric diagnosis compared with 41% of veterans without PTSD (Kulka, Schlenger, Fairbank, Hough, Jordan et al., 1990). Rates of PTSD and depression comorbidity are also high. In a study examining trauma survivors from a hospital emergency room, 78.4% experienced lifetime depression following a diagnosis of PTSD (Shalev et al., 1998). Less comorbidity research has been conducted with the current military cohort. Among hospitalized soldiers assessed between March 2003 and September 2004, up to seven months after injury, about 6.3% of the sample met criteria for both depression and PTSD (Grieger et al., 2006).

There is some evidence to suggest that individuals with comorbid PTSD and depression have more negative consequences than persons with either diagnosis alone. In one study, veterans in a VA setting with comorbid depression and PTSD had more severe depression, lower social support, more suicide ideation, and more frequent primary care and mental health care visits compared to individuals with depression only (Campbell, Felker, Liu, Yano, Kirchner et al., 2007). Another study found that individuals with these dual diagnoses had more severe symptom severity and lower levels of functioning (Shalev et al., 1998). These consequences are costly to individuals, their families, and society. With more complex symptoms and poorer functioning, individuals are likely to be at risk for social and occupational problems that perpetuate further stressors. In addition, more frequent rates of service utilization suggest that individuals with comorbid PTSD and depression require more treatment visits and/or specialized care, which may have implications for staff training and costs of treatment.

There may be several explanations for comorbidity between PTSD and depression. The risk of developing depression after PTSD may be associated with shared vulnerabilities between the two disorders (Breslau, Davis, Peterson, & Schultz, 2000). Comorbidity, for example, may be related to symptom overlap in diagnoses (Brady, Killeen, Brewerton, & Lucerini, 2000). As seen in Table 4.1, there are at least five PTSD symptoms that are commonly associated with symptoms of MDD, some of which are part of the diagnostic classification of MDD (e.g., diminished interest, sleep problems). In fact, there is evidence to suggest that PTSD and

depression diagnoses may be indistinguishable up to a year after a traumatic event due to shared vulnerabilities and overlapping risk factors, and that the two disorders may be best conceptualized as part of a general stress construct (Ozer, Best, Lipsey, & Weiss, 2003). Rates of overlap between the two disorders may therefore contribute to higher documented rates of comorbidity (Kessler et al., 1995b).

Table 4.1 Major Depression and Posttraumatic Stress Disorder Diagnostic Criteria (American Psychiatric Association et al., 2000)

Posttraumatic Stress Disorder	Major Depression
<p>Exposed to a traumatic event in which both of the following were present:</p> <p>Cluster A:</p> <ul style="list-style-type: none"> (1) event involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others (2) response involved intense fear, helplessness, or horror <p>Cluster B: Re-experiencing</p> <ul style="list-style-type: none"> (1) distressing recollections of the event (2) distressing dreams of the event (3) acting or feeling as if event were recurring (4) intense distress at exposure to cues that symbolize or resemble aspects of the event (5) physiological reactivity to event cues <p>Cluster C: Avoidance</p> <ul style="list-style-type: none"> (1) avoids thoughts, feelings, or conversations associated with the trauma (2) avoids activities, places, or people that arouse recollections of the trauma (3) inability to recall an important aspect of the trauma (4) markedly diminished interest or pleasure in activities* (5) feeling of detachment or estrangement from others* (6) restricted range of affect (7) sense of foreshortened future* <p>Cluster D: Increased arousal</p> <ul style="list-style-type: none"> (1) difficulty falling or staying asleep* (2) irritability or outbursts of anger (3) difficulty concentrating* (4) hyper vigilance (5) exaggerated startle response 	<p>Five or more of the following symptoms during the same 2-week period; one of the symptoms is either depressed mood or loss of interest or pleasure:</p> <ul style="list-style-type: none"> (1) depressed mood (2) markedly diminished interest or pleasure in activities (3) weight loss or weight gain (4) insomnia or hypersomnia (5) psychomotor agitation or retardation (6) fatigue or loss of energy (7) feelings of worthlessness or excessive or inappropriate guilt (8) diminished ability to think or concentrate, or indecisiveness (9) recurrent thoughts of death

* PTSD symptoms often associated with MDD

TBI and Depression

Comorbidity between TBI and depression is common and can be experienced within months following the brain injury (Moldover, Goldberg, & Prout, 2004) and for many years after the injury (Busch & Alpern, 1998). Rates of these co-occurring diagnoses vary between 15% and

61% (Deb, Lyons, Koutzoukis, Ali, & McCarthy, 1999; Kim, Lauterbach, Reeve, Arciniegas, Coburn et al., 2007). Among WWII vets with penetrating head injury, 18.5% had lifetime prevalence of depression compared to those without a head injury (13.4%) (Holsinger, Steffens, Phillips, Helms, Havlik et al., 2002). Individuals with TBI that develop MDD are at higher risk of cognitive disability, anxiety disorders, and poorer quality of life compared to individuals that do not develop MDD (Levin, Brown, Song, McCauley, Boake et al., 2001).

With common physical and cognitive problems associated with TBI alone, symptoms associated with depression such as diminished interest, depressed mood, and sleep difficulties may make it more challenging for an individual with TBI to rehabilitate and to fulfill their medical, job, and social responsibilities. Individuals with this comorbidity experience more functional impairment and perceive their disabilities to be more severe (Fann, Katon, Uomoto, & Esselman, 1995). In addition, this comorbidity is associated with more anxiety and aggressive behavior, and poorer social functioning (Jorge, Starkstein, Arndt, Moser, Crespo-Facorro et al., 2005). Persons who self-reported ever having a serious head injury where they became unconscious for more than 15 minutes were also more likely to also experience increased symptoms of depression, anxiety, negative affect, and suicide ideation (Anstey, Butterworth, Jorm, Christensen, Rodgers et al., 2004).

Early identification of MDD symptoms among individuals with recent TBIs may prevent more severe depression symptoms, negative consequences, and productivity loss. Levin et al. (2005) recommend routine screening and detection within one week of the injury suggesting that individuals may be at heightened risk for developing depression within the first three months of injury. Up to 33% of patients with TBI at a general trauma center developed MDD within the first year of injury, which was significantly higher than the 7.4% of controls with depression, but not TBI (Jorge et al., 2005). Detecting depression symptoms early enhances timeliness of prevention services. Monitoring depression symptoms over time following injury may also be important in preventing depression as a long-term consequence. Evidence suggests that risk for developing depression remains prevalent even after 10 to 50 years after the injury (Holsinger et al., 2002; Seel, Kreutzer, Rosenthal, Hammond, Corrigan et al., 2003).

Risk factors for developing depression include stress, social isolation, maladaptive coping, and lateral lesions (Kim et al., 2007). Depression may indirectly develop years after an injury as a result of TBI-related consequences and maladaptive readjustment (Moldover et al.,

2004). Therefore, routine monitoring of depressive symptoms along with the individual's social adjustment may be important over time.

Rates of comorbidity between TBI and MDD may also be attributed to symptom overlap. Symptoms of TBI such as sleep difficulty, appetite problems, difficulty focusing, and diminished interest in activities are commonly associated with depression symptoms, which makes it challenging to differentiate symptoms of depression from TBI (Babin, 2003; Kim et al., 2007). These rates may also be attributed to maladaptive coping and learned helplessness with TBI, where the risk of developing depression may be directly linked to post-injury adjustment (e.g., coping with cognitive impairments and disability).

TBI and PTSD

The comorbidity between PTSD and TBI has been a controversial and understudied topic. Both conditions have contradictory symptom classifications. One symptom of TBI is the loss of consciousness or amnesia of the traumatic event, while an integral symptom of PTSD is a re-experiencing of the event. Experts in the literature have argued that if individuals with TBI are unconscious at the time of the trauma, they therefore cannot retain the memories of the event to experience subsequent PTSD symptoms. However, recent research suggests that both diagnoses can co-occur either through a subconscious/implicit level or through social reconstruction. Joseph and Masterson (1999) state that there are at least two theories to account for PTSD development after TBI. They suggest that individuals, while unconscious for most of the event, can be conscious even for brief periods of time during the traumatic episode allowing individuals to reconstruct details of the trauma. At this level, "islands of memory" (King, 1997) are retained, perhaps at an implicit level (Bryant, 2001), and trigger re-experiencing symptoms of PTSD. A second theory accounts for individuals that were completely unconscious during the event, but reconstruct their understanding of what happened in order to help cope or adjust to the consequences related to their injury. These individuals may rely on others' reports of the traumatic event, rationalize in their own minds what "must have happened," or combine a subset of both to rationalize the symptoms they are experiencing. They may also use their heightened arousal states to rationalize that something traumatic must have occurred or attribute post-trauma stressors to what must have been a traumatic event (Bryant, 2001).

Because this literature is emerging, there is little data reviewing the consequences related to these two disorders. At a minimum, if an individual is experiencing physical and cognitive problems as a result of their injury in addition to re-experiencing or heightened arousal symptoms related to PTSD, symptom severity and level of functioning may be directly impaired. These individuals may also require more specialized and intensive treatment through rehabilitation for their injuries and mental health services for related symptoms of PTSD. Treatment services for typical PTSD cases may need to be adapted for a TBI population to account for an individual's cognitive deficits.

Comorbidity with Other Psychiatric Disorders

PTSD

Rates of PTSD with other psychiatric disorders are common, with the most common being depression, substance use, and anxiety disorders (Brady et al., 2000). In the National Comorbidity Study, PTSD was comorbid with affective, anxiety, conduct, and alcohol/substance use disorders among men and women (Kessler et al., 1995b). Among patients in primary care with a diagnosis of PTSD, about 65% met criteria for another disorder, with the most common co-occurring diagnoses as phobia, major depression, and bipolar depression (Olfson et al., 1997). Rates of comorbidity also increase as PTSD symptoms increase. Comorbid anxiety disorders (e.g., panic disorder, social phobia, generalized anxiety, or obsessive-compulsive disorder) were associated with increasing PTSD symptoms (Marshall et al., 2001) suggesting that individuals are at risk for co-occurring disorders and negative consequences as PTSD symptoms worsen. As stated earlier, when studying co-occurring disorders, symptom overlap particularly with PTSD, depression, and anxiety disorders may be inflated and have shared vulnerabilities (Brady et al., 2000; Kessler et al., 1995b).

We discussed rates of comorbidity with depression earlier in this chapter and co-occurring alcohol and substance use disorders in Chapter 7. As stated above, anxiety disorders are also comorbid with PTSD. Examples of anxiety disorders include simple phobias (e.g., flying, heights, seeing blood) and social phobias (e.g., performing, being around unfamiliar people), and panic disorder (e.g., recurrent unexpected panic attacks and worry/concern about additional attacks). These three disorders are the most common anxiety disorders associated with PTSD (Brady et al., 2000; Breslau & Davis, 1992; Kessler et al., 1995b). Within the military,

social phobia and current social anxiety have been associated with anxiety, premilitary shame, and homecoming adversity (Orsillo, Heimberg, Juster, & Garrett, 1996). Panic disorder is another anxiety disorder that overlaps with symptoms of PTSD (e.g., hypervigilance) and has been shown to be more common among veterans that were exposed to combat (Deering, Glover, Ready, Eddleman, & Alarcon, 1996). Together, these results suggest that anxiety disorders are very common among individuals with PTSD and that symptom overlap may impact the high comorbidity rates.

TBI

Rates of TBI have been associated with increased risk of psychiatric disorders, specifically anxiety (Moore, Terryberry-Spohr, & Hope, 2006), depressive disorders, and substance use (Anstey et al., 2004; Hibbard, Uysal, Kepler, Bogdany, & Silver, 1998; Silver, Kramer, Greenwald, & Weissman, 2001). These rates may be associated with more complex and severe TBI compared to milder forms of TBI. In a study of individuals with mild TBI, most patients recovered completely, but those that had poorer recovery outcomes were more likely to have depression and anxiety disorders (Mooney & Speed, 2001). Comorbidity among individuals with TBI may challenge the recovery process because of additional psychiatric symptoms that also require treatment.

There is also evidence to suggest that TBI is also comorbid with chronic pain, a condition that has a long and pervasive course after injury. In one study of patients in a brain injury rehabilitation center, 58% of patients with mild TBI and 52% patients with moderate/severe TBI had chronic pain (Lahz & Bryant, 1996). Pain can be localized throughout various areas in the body, but chronic pain in the TBI population is mostly associated with chronic headaches (Lahz et al., 1996) especially in cases where there was a trauma to the head, brain, or neck; these injuries have negative impacts on cognitive functioning and processing (Martelli, Grayson, & Zasler, 1999). Co-occurring TBI and chronic pain has been associated with longer treatment stays than patients with chronic pain alone (Andary, Crewe, Ganzel, Haines-Pepi, Kulkarni et al., 1997). The course of treatment for chronic pain is often difficult for patients. As time increases, the symptoms often do not remit and can affect all areas of the individual's life. Treatment often results in managing and coping with the physical and psychological aspects of chronic pain and requires monitoring and regular reassessment between the clinician and patient (Glajchen, 2001) and may therefore require more resources than standard TBI treatment alone.

Depression

Depression diagnoses are fairly common in the general population and highly comorbid with other diagnoses. Disability is associated with depression, and evidence suggests that about 97% of individuals with past year depression experience some form of role impairment related to their depression with their social, home, and work relationships (Kessler et al., 2003). About 45% of individuals with past year depression diagnoses experience at least a second co-occurring diagnosis (Kessler, Chiu, Demler, & Walters, 2005) with depression rarely being the primary diagnosis (Kessler et al., 2003). As expected, slightly higher rates of comorbidity are found with a treatment seeking population in primary care and psychiatric outpatient settings, with rates of a comorbid disorder being about 65% (Olfson et al., 1997; Zimmerman, Chelminski, & McDermet, 2002). These rates suggest that depression is commonly associated with another disorder, which may perpetuate symptoms of depression and associated consequences and complicate clinical presentation for treatment.

A recent general population study using the National Epidemiologic Survey of Alcoholism and Related Conditions (NESARC) found that MDD within the past year was most commonly associated with personality disorders (38%), anxiety disorders (36%), nicotine dependence (26%), alcohol use disorders (14%), and drug use disorders (5%); comorbidity rates rise when measured against lifetime MDD with exception to the prevalence of personality disorders, which decreased to 31% (Hasin, Goodwin, Stinson, & Grant, 2005). The most common personality disorders were obsessive-compulsive, paranoid, and schizoid disorders; the most common anxiety disorders included specific phobia, generalized anxiety, and social phobia. Accurately assessing and identifying comorbid diagnoses is specifically important for treatment planning and predicting the clinical course of the disorders. Depression severity is significantly and positively correlated with impaired functioning (Hasin et al., 2005), and the complication of co-occurring disorders may undoubtedly have an impact on recovery.

Risk Factors

There is some evidence to suggest that there are multiple determinants that place an individual at greater risk of developing co-occurring disorders. For individuals with TBI, functioning prior to the injury and reactions after the injury has been shown to predict depression post-injury. Premorbid variables such as distress and functioning are associated with depression

(Moldover et al., 2004). Similarly, older age, post-injury stress, social isolation, lack of work/job loss, and maladaptive coping are also associated with depression [reviewed by (Kim et al., 2007)]. The location of the brain injury is also a risk factor for developing depression. Lateral lesions compared to medial lesions have been associated with greater risk of post-injury depression (Paradiso, Chemerinski, Yazici, Tartaro, & Robinson, 1999). Another study examining TBI also found that anxiety and general mental health were moderated by increasing age, number of TBIs, and TBI recency (Anstey et al., 2004). These studies suggest that risk of developing depression is impacted by age, brain injury location, premorbid functioning, and post-injury coping.

Kim and colleagues (Kim et al., 2007) also reviewed the literature on the risk factors associated with developing PTSD after a TBI. They found that losing consciousness at the time of the injury, avoidance coping, being female, left temporal lesions, and recall of injury were associated with developing post-injury PTSD. Age, gender, marital status, combat exposure, deployment length, 1-month PTSD severity, 1-month depression severity, and 1-month physical problem severity predicted 7-month PTSD severity (Grieger et al., 2006). Finally, identity and social adjustment after coping from a traumatic event may also mediate the relationship between PTSD or TBI and depression.

Conclusions and Implications

Co-occurring disorders are common among individuals with TBI, depression, and PTSD, and often result in more negative outcomes than individuals experiencing any of the disorders alone. Among other comorbid diagnoses, anxiety disorders seem to be most common for all diagnoses and chronic pain for TBI. Individuals with co-occurring disorders tend to have more severe and complex symptoms, require specialized treatment, and often experience more distress associated with their disorders. There is little research examining rates of comorbidity among recent returnees of Iraq and Afghanistan. As more research is pursued, it will be important to consider some of the current debates in the literature regarding symptom overlap between the conditions. For example, more research examining the symptom constellations of disorders alone compared to the comorbidity among them may provide a better understanding of how these conditions relate to each other. Further, use of diagnostic criteria to assess for each condition is needed to strengthen the integrity of these comparisons. Depression and PTSD, especially, can

be measured specifically using the DSM-IV compared to self-report measures to increase diagnostic sensitivity.

Clinical practice guidelines and the effectiveness of integrated treatments are also important issues to consider as research in this area grows. If rates of comorbidity continue to be prevalent among OEF and OIF returnees, treatment centers will need to adapt protocols for effectively screening, assessing, and treating co-occurring diagnoses. Existing protocols for PTSD alone, for example, may not suit an individual with cognitive problems associated with severe TBI. Individuals with comorbid diagnoses may need more specialized attention to effectively relieve their complex symptoms. Increasing our understanding of issues related to comorbidity is important in order to provide individuals with the necessary tools to ameliorate the consequences associated with co-occurring disorders.

5. Suicide

Introduction

Suicide represents perhaps the worst possible outcome of having a mental disorder. Alongside the concern over elevated rates of mental disorders upon returning from Iraq and Afghanistan, many are concerned about elevated rates of suicides among service members. This concern is somewhat justified: in 2006, there were 97 suicides in the Army, with close to two-thirds of these having a history of at least one deployment to OIF or OEF (United States. Dept. of the Army. Army Behavioral Health Technology Office., 2007). Suicide is one of the leading cause of death among 10 to 44 year-olds in the United States, though is still relatively rare, with a rate of around 10 per 100,000 persons (Heron & Smith, 2007). Among persons who have committed suicide, the majority have had one or more mental disorders, making psychiatric problems one of the strongest risk factors of this tragic outcome (Harris & Barraclough, 1997).

In this section, we review the unique issues that must be considered when studying suicide. We then review what is known about suicide in the military generally. We continue by studying the relationship between PTSD, depression, and TBI on suicide outcomes, drawing from literature in veteran, military, and civilian samples. Finally, we discuss any characteristics that have been identified that may increase the risk of suicide among individuals with each of these disorders.

Studying Suicide: Conceptual Considerations

It is difficult to assess psychological risk factors for suicide. By definition, cases are deceased and can therefore not be screened for probable disorders or diagnosed as having a disorder. Researchers rely primarily on four strategies to overcome this methodological obstacle. First, medical records among suicide cases are examined to discern if there is a history of psychiatric diagnoses (Teasdale & Engberg, 2001). Psychological autopsies are also performed, in which families and friends of suicide cases are interviewed to discern probable psychiatric disorders (Farberow, Kang, & Bullman, 1990). Researchers may also ask respondents' about suicide ideation and attempts (Kessler, Borges, & Walters, 1999b). Although a small number of people with suicide ideation and prior attempts go on to die from suicide, nonfatal suicide attempts are the strongest predictors of a subsequent fatal attempt (Harris et al., 1997). Finally,

population-based studies can be linked with cause of death registries, such as the National Death Index, to prospectively investigate persons more or less likely to die from suicide (Kaplan, Huguet, McFarland, & Newsom, 2007). However, because suicide is relatively rare, these studies are often underpowered to discern anything but large differences.

Suicide in the Military

There is a longstanding concern about suicide among military personnel. According to the Department of Defense, in 2003 the rate of suicide across the Armed Forces was roughly 10 to 13 (depending on military branch) per 100,000 troops (Allen, Cross, & Swanner, 2005), an estimate that is comparable to the rate of suicide across all ages in the United States (Centers for Disease Control and Prevention. National Center for Injury Prevention and Control., 2007). However, while these figures and others (Lehmann, McCormick, & McCracken, 1995; Rothberg, Bartone, Holloway, & Marlowe, 1990) may indicate that military personnel do not face a risk of suicide different from that of the general population, population-based studies have indicated that male veterans face roughly twice the risk of dying from suicide compared to their civilian counterparts (Kaplan et al., 2007). Analyses focused specifically on veterans of the Vietnam War indicate that these veterans are at increased risk of suicide-related mortality relative to veterans who did not serve in Vietnam, though that this increased risk occurred within 5 years from discharge from active duty, and the difference did not persist after this time (Boehmer, Flanders, McGeehin, Boyle, & Barrett, 2004).

Associations of Depression, PTSD, and TBI with Suicide: Empirical Evidence

Even with these methodological constraints, there is consistent evidence that depression, PTSD, and TBI all increase the risk for suicide. Psychological autopsy studies have consistently shown that a large number of suicide cases had a probable depressive disorder (Cavanagh, Carson, Sharpe, & Lawrie, 2003; Henriksson, Aro, Marttunen, Heikkinen, Isometsa et al., 1993; Isometsa, 2001). In a population-based study of civilians, 16% of those persons with a lifetime history of major depressive disorder had a lifetime history of one or more self-reported suicide attempts (Chen & Dilsaver, 1996). In the National Comorbidity Survey, persons with a lifetime history of a major depressive episode were 10-times more likely to self-report ideating about killing themselves and 11-times more likely to make a nonfatal suicide attempt. The risk was

even greater when the definitional criterion for depression was modified to exclude having thoughts of death, which could have potentially confounding the effect of depression on suicide outcomes (Kessler, Borges, & Walters, 1999c). Among suicides over a 1-year period across the VA medical center, 30% of suicide cases had an unspecified affective disorder, and 40% of patients who had attempted suicide had an affective disorder (Lehmann et al., 1995).

Although not as strongly associated with suicide as depression, PTSD is more strongly associated with suicide ideation and attempts than any other anxiety disorder (Kessler et al., 1999b). In the National Comorbidity Study, two different studies have indicated that persons with lifetime PTSD were significantly more likely to report having thought about killing themselves and to have made an attempt, even after accounting for a variety of potential sociodemographic and mental health confounds (Kessler et al., 1999b; Sareen, Houlahan, Cox, & Asmundson, 2005). Among a sample of 100 Vietnam veterans with PTSD at a VA hospital, 19 had made a suicide attempt and 15 more had been “preoccupied” with thoughts of suicide since the war (Hendin & Haas, 1991). Psychological autopsies have also indicated that PTSD is linked with suicide deaths. In a study of Vietnam veterans, those who died from suicide were more likely to have symptoms of PTSD than a comparison group who died in motor vehicle crashes (Farberow et al., 1990).

In an earlier chapter, we discussed that depression and PTSD influence each other, whereby depression can influence the development of PTSD after a traumatic event and PTSD can increase the risk of depression. In multiple studies, persons with comorbid PTSD and depression were more likely to have suicide outcomes than persons with depression (Oquendo, Brent, Birmaher, Greenhill, Kolko et al., 2005; Oquendo, Friend, Halberstam, Brodsky, Burke et al., 2003) or PTSD alone (Freeman, Roca, & Moore, 2000). However, another study found that refugees reporting exposure to trauma with PTSD but without depression were more likely to report attempting, while those with comorbidity were more likely to report suicidal ideation only (Ferrada-Noli, Asberg, Ormstad, Lundin, & Sundbom, 1998).

Finally, research also has consistently shown that persons with TBI have a higher risk of suicide than persons without TBI. Among outpatients with TBI, 23% reported suicide ideation and 18% reported having had a suicide attempt post-injury (Simpson & Tate, 2002); in a similar sample, 26% of TBI outpatients had made a suicide attempt (Simpson & Tate, 2005). In a community-based sample, persons with self-reported history of a “severe head trauma with loss

of consciousness or confusion” had a higher lifetime risk of having had attempted suicide (Hibbard et al., 1998). Using multiple years of population registry data, Teasdale and Engberg (Teasdale et al., 2001) found that persons with concussions, cranial fractures, and cerebral contusions or traumatic intracranial hemorrhages each had at least a three-times higher incidence rates of suicide mortality than the general population after adjusting for sex and age.

Other Correlates and Modifiers of Suicide Risk

Research on suicide has identified a number of covariates that are either correlated with suicide independent of depression, PTSD, and/or TBI or which modify the risk of these disorders on suicide outcomes.

Demographic Correlates

Sex. In the general population, men are at much higher risk of dying from suicide than females (WISQARS website). The same is true in the armed forces, with men comprising 95% of the Army suicide population but 85% of the total Army population (Allen et al., 2005). However, evidence suggests that depression, PTSD, and TBI has a greater impact on females’ than on males’ risk of suicide. In a study that employed psychological autopsies of suicide deaths in Finland, the prevalence of depression was higher in female cases than it was among male suicide cases (Henriksson et al., 1993). Females with comorbid PTSD and depression were also more likely to report attempting suicide than men with comorbid disorders (Oquendo et al., 2003). In a study that employed data from a Danish population register, the standardized mortality ratio for suicide after a traumatic brain injury was higher for females than it was for males for three different types of head injury (Teasdale et al., 2001). In contrast to these findings, however, the effect of major depression on self-reports of lifetime suicide attempts was larger among men than women in the National Comorbidity Survey (Kessler et al., 1999b).

Race. In the general population, persons of white race are at higher risk of dying from suicide than members of other racial and ethnic groups (WISQARS website). Although Caucasians make up 59% of the total army population, they account for 71% of all suicides (Allen et al., 2005). Veterans of white race had a 3-times greater risk of dying from suicide than non-white veterans (Kaplan et al., 2007).

Age. Trends in suicide by age in the general population are shown in the figure below. Rates generally increase during adolescence and remain relatively constant through middle aged, then begin to decrease at around age 50 but increase again at the older ages (Centers for Disease Control and Prevention. National Center for Injury Prevention and Control., 2007). These same general patterns of suicide are seen among the Army as well. Between 2000 and 2002, close to ½ of Army suicides were among 17 to 21 year-olds and the proportion of suicides generally grew smaller over increasing age categories. There was not a corresponding elevated rate of suicides seen among the elderly, though this is likely due to small numbers of elderly persons with active Army status. On the other hand, there is evidence that male veterans in the general U.S. population are at increased risk of suicide, and that close to 40% of male Veterans in the U.S. population who die by suicide are over age 65 (Kaplan et al., 2007).

Suicide Injury Rates, United States (2004)

Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. Web-based Injury Statistics Query and Reporting System (WISQARS)

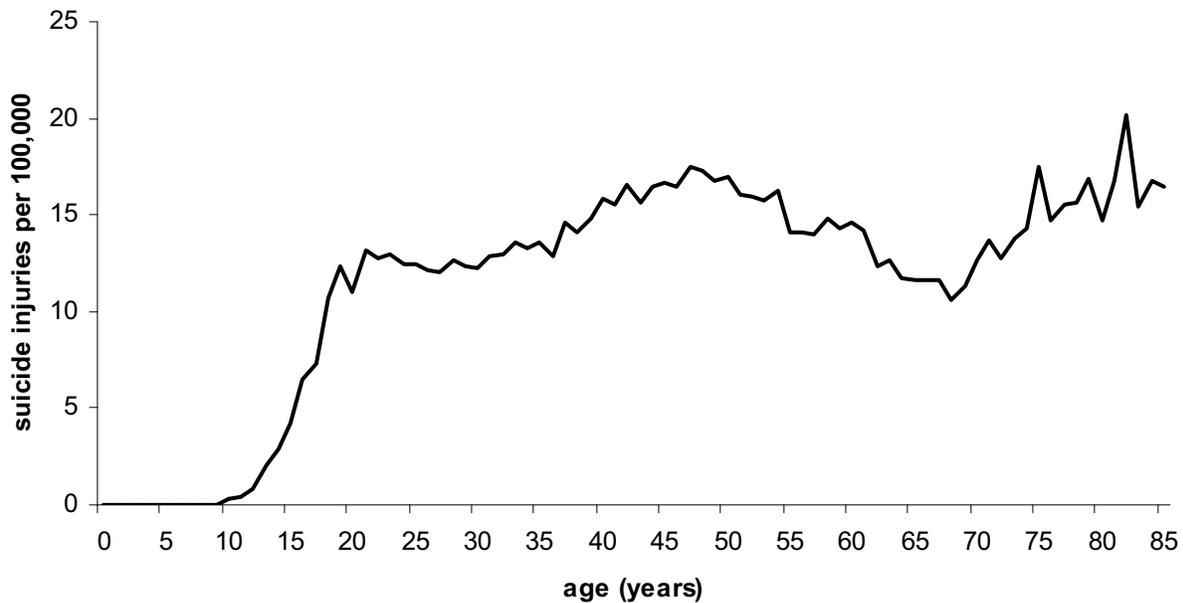


Figure 5.1 Suicide Injury Rates, United States (2004)

Symptoms of depression and TBI

The expression of symptoms for those meeting criteria for depression, PTSD, and TBI varies across individuals. There is some evidence that among persons diagnosed with these conditions, the expression of certain symptoms increases the risk of suicide over the expression of other symptoms. For example, in a psychological autopsy study of suicides during a major depressive episode, suicide cases were less likely to express symptoms of fatigue, difficulties concentrating, or indecisiveness, and that only insomnia was an immediate indicator of risk (McGirr, Renaud, Seguin, Alda, Benkelfat et al., 2007). Different types of TBI have also been differentially linked with suicide; among persons with TBI, those with cerebral contusions or traumatic intracranial hemorrhage than those with concussions or cranial fractures (Teasdale et al., 2001).

Severity of depression, PTSD, and TBI

There is some evidence that as severity of depression, PTSD, and TBI increase, so too does an individual's suicide risk. For instance, higher levels of PTSD symptoms were associated with increased levels of suicide ideation (Marshall et al., 2001). For TBI, one study found that for patients with certain forms of TBI, the length of an individual's hospital stay, which could be a proxy for injury severity, increased the risk of a subsequent suicide (Teasdale et al., 2001). On the other hand, a separate study found no evidence that injury severity contributed to elevated rates of post-injury suicidality (Simpson et al., 2002).

Time Since Injury (TBI)

Evidence of a heightened "risk period" of a suicide outcome after an injury are conflicting. For example, although TBI was associated with subsequent suicide in the Danish registry study, there was no evidence of a post-injury time period in which this risk for suicide was greatest (Teasdale et al., 2001). On the other hand, Boehmer et al. (Boehmer et al., 2004) found that the increased risk of suicide in Vietnam veterans relative to veterans who did not serve in Vietnam was elevated in the first five years after being discharged from active duty.

Combat

In studies of veterans, there is some evidence that combat exposure increases the risk of suicide. For example, Vietnam veterans face an increased risk of suicide mortality relative to Non-Vietnam veterans, though that this increased risk was mainly limited to the first five years after discharge from active duty (Boehmer et al., 2004). The risk of suicide was also greater among veterans hospitalized for a wound or wounded two or more times, which may serve as a proxy for combat trauma (Bullman & Kang, 1996). This increased risk may be particularly modified among those veterans who experience PTSD or with significant combat-related wounds. For example, in a case-control study comparing veterans who died from suicide versus those who died from a motor vehicle accidents, the suicide cases were more likely to have suffered from PTSD but no more likely to report combat exposure (Farberow et al., 1990). Additionally, mortality rates from external causes, which include suicide, were higher among Vietnam theater veterans with PTSD than among Vietnam theater veterans without PTSD (Boscarino, 2006a). One study of veterans with PTSD found that it was not any particular PTSD symptom or cluster of symptoms, but rather combat-related guilt that was the strongest predictor of suicidal behavior (Hendin et al., 1991).

Weapon Availability

Multiple studies have documented that gun ownership is associated with an increase risk of suicide. For example, in a study of completed suicides, having one or two guns in the home was associated with an increased risk of suicide, controlling for multiple possible covariates (Kellermann, Rivara, Somes, Reay, Francisco et al., 1992). Ecological studies have also documented that higher levels of gun ownership rates are associated with increased rates of suicide (Miller, Lippmann, Azrael, & Hemenway, 2007), and that reductions in household firearm ownership rates are correlated with reductions in suicide rates in the United States (Miller, Azrael, Hepburn, Hemenway, & Lippmann, 2006). There is some evidence that owning a gun increases the risk of violent outcomes for persons with PTSD (Freeman, Roca, & Kimbrell, 2003), and we suspect that persons with depression and TBI may also be at risk for suicide if they live in homes where one or more guns are present.

Mental Health Comorbidities

Prior Suicide Attempts. The majority of fatal suicides result from an individual's first attempt (Harris et al., 1997; Isometsa & Lonnqvist, 1998). Nonetheless, nonfatal suicide attempts are the strongest predictors of subsequent fatal suicides, even when controlling for past mood disorders such as depression (Harris et al., 1997) (Joiner, Conwell, Fitzpatrick, Witte, Schmidt et al., 2005). It is reasonable to assume that among persons with depression, PTSD, and TBI, those who have made suicide attempts in the past may be at greater risk of subsequent attempts.

Substance Use Disorders. Across studies, substance use disorders have also consistently been associated with suicide. In their empirical review, Wilcox and colleagues (Wilcox, Conner, & Caine, 2004) found that with respect to suicide, the standardized mortality ratio for substance use disorders was 9 to 14-times higher than it was for those without these disorders, with variation due to the specific substance under study (e.g., alcohol use disorders versus opioid drug use). These findings did vary by sex, with females generally having higher mortality rates from suicide than males with these disorders. Similarly, there is evidence that among people with depression, PTSD, and TBI, suicide risk is elevated among those with substance use disorders. (Mills, Teesson, Ross, & Peters, 2006; Simpson et al., 2005; Waller, Lyons, & Costantini-Ferrando, 1999).

Other. In one large meta-analysis, virtually all mental disorders were found to increase the risk of suicide except mental retardation and dementia (Harris et al., 1997). To the extent that persons with PTSD, depression, or TBI have another comorbid mental disorder, the evidence suggests that they are at even greater risk of suicide (Strauss, Calhoun, Marx, Stechuchak, Oddone et al., 2006). In addition, personality traits such as aggression or hopelessness may also impact the likelihood of suicide among persons with PTSD, depression, and TBI (Freeman et al., 2003; Simpson et al., 2002).

Conclusion

The causes of the increase in suicides among Army soldiers in 2006 should be of concern to policy makers and public health officials. We can conclude that PTSD, depression and TBI are each causally associated with suicide-caused mortality, as well as suicide ideation and attempts. Although this outcome is still relatively rare, it is a tragic consequence of mental illness and

should be prevented. Current efforts should be enhanced and future efforts should be encouraged to prevent suicides among service members deployed to Iraq and Afghanistan.

6. Physical Health and Mortality

We have thus far focused on the mental health consequences of serving in Iraq and Afghanistan. Obviously, service members in these locales face severe risk of physical illness as well, ranging from war-related injuries that can cause death or amputations to infectious disease and respiratory illness (Helmer, Rossignol, Blatt, Agarwal, Teichman et al., 2007). In addition to these direct physical consequences of combat service, there are strong relationships between physical health and mental well-being, signaling that impairment in each of these areas is associated with impairment in the other. In some cases, physical symptoms are expressions of mental conditions. For example, insomnia may be a symptom of depression, or headaches may be symptoms of TBI. Alternatively, physical impairment may lead to mental impairment vis-à-vis limitations in occupational or social functioning, which may foster increased reliance on others to perform basic tasks and compromised access to medical care. Mental health symptoms may also contribute to poor physical health through altered biologic functions (e.g., decreased immune function) or by influencing individual health risk behavior (e.g., smoking, poor diet).

This chapter summarizes relationships between PTSD, depression, and TBI on physical health outcomes. We structure this review in terms of the way physical health is operationalized. First, we review two seemingly “objective” measures of physical health: mortality and morbidity according to official medical diagnoses. We then turn to self-reported measures of physical health, distinguishing between reports of medical symptoms, limitations in physical functioning, and finally health-risk behaviors. Both of these types of measures (i.e., objective measures and self-reported measures) are informative. Individuals with MDD, PTSD, or TBI may naturally *perceive* their health to be worse than persons without these co-occurring disorders, thereby promoting objective measures of physical health. On the other hand, measures of self-report reflect the physical health of persons who have not accessed medical care or been treated for these condition, while measures of quality of life or physical functioning reflect the actual burden that poor physical health has on an individual. When possible, literature drawn from military populations is described, though literature from civilian populations is referenced when appropriate.

Mortality and Morbidity

Mortality

Persons with PTSD and depression face an increased risk of death relative to their similarly aged counterparts without these conditions. The relationship between depression and mortality has been the most frequently studied. In a review of studies that examined this link, Wulsin and colleagues (Wulsin, Vaillant, & Wells, 1999) concluded that these studies collectively suggest that depression increases the risk of death. For PTSD, total mortality was higher among Army veterans with PTSD who served in theater than of those who served in theater but did not have PTSD in one study conducted 30 years after service (Boscarino, 2006b).

The increased risk of death among persons with PTSD and depression appears to be driven by two primary causes: increases in the risk of death from unnatural causes (e.g., homicide, suicide, and unintentional injuries) and from cardiovascular disease. We discussed the link between depression and PTSD and suicide in a previous chapter. Evidence of an increased association between depression and cardiovascular disease includes clinical samples of persons hospitalized for myocardial infarctions (i.e., those with depressive symptoms having an increased risk of death) (Frasure-Smith, Lesperance, & Talajic, 1993, 1995) as well as prospective community-based studies (i.e., among those with and without cardiac disease, persons with depressive symptoms had an increased risk of cardiac-related mortality) (Penninx, Beekman, Honig, Deeg, Schoevers et al., 2001). For the sample of Army veterans referenced above, combat veterans with PTSD had elevated risks of cardiovascular mortality, external cause mortality, and cancer mortality relative to combat veterans without PTSD (Boscarino, 2006). However, there was no evidence of an increased risk in cancer-related mortality among persons with depression.

The cause of the link between depression or PTSD and cardiovascular mortality remains unclear. There is mounting evidence of a biologic influence, whereby depressive symptoms both stimulates and prolongs proinflammatory cytokine production, which influences cardiovascular disease (Kiecolt-Glaser & Glaser, 2002). Alternatively, mental health symptoms may influence adverse health-related behaviors, such as poor diet or smoking, which contribute to the risk of cardiovascular-caused deaths (discussed below).

The impact of TBI on mortality may be the most pronounced because these injuries can, in and of themselves, be life-threatening. There are an estimated 50,000 deaths caused by TBI in

the United States each year (Langlois, Rutland-Brown, & Wald, 2006). As mentioned previously, even during times of peace military personnel have higher rates of TBI than the general population (Ommaya, Ommaya, Dannenberg, & Salazar, 1996a), possibly due to the increased exposure of service members to opportunities for injury. Service members with TBI are also more likely to face fatal outcomes. In 1992, military personnel with a medical discharge record indicating TBI diagnoses were more likely to be discharged from the military due to death relative to the entire military discharged population without TBI. As would be expected, the likelihood of discharge due to death increased with injury severity: persons with a mild TBI were 11.6-times more likely to die while those service members with a severe TBI diagnosis were close to 150-times more likely to be discharged from death (Ommaya, Salazar, Dannenberg, Ommaya, Chervinsky et al., 1996b).

Morbidity

Diseases of the heart are the leading cause of death in the United States, and range in scope from high blood pressure and stroke to coronary heart disease (CHD) (Minino, Heron, & Smith, 2006). We discussed above how the heightened mortality risk for persons with PTSD and depression is driven by increases in fatal cardiovascular problems. It is therefore not too surprising that cardiovascular diseases, particularly CHD, which includes myocardial infarctions (MI) or heart attacks, are the most frequently studied morbidity outcome among persons with psychiatric disorders. In a meta-analysis, Rugulies (2002) found that persons who meet probable diagnostic criteria for depression were nearly 1.64 times more likely to develop both fatal and nonfatal CHD than persons without depression, concluding that depression predicts CHD. There is also research that documents a relationship between PTSD and CHD (Bankier & Littman, 2002; Boscarino & Chang, 1999; Falger, Op den Velde, Hovens, Schouten, De Groen et al., 1992; Solter, Thaller, Karlovic, & Crnkovic, 2002), though only one prospective study has been performed. In this study of men who had at one point served in the military, increasing levels of PTSD symptoms were associated with an increased risk of a combined category of all CHD outcomes (i.e., nonfatal MI, fatal CHD, and angina) and specifically for a combined category of nonfatal MI and fatal CHD (Kubzansky, Koenen, Spiro, Vokonas, & Sparrow, 2007). We found very little research that investigated cardiovascular outcomes after TBI.

Studies have also indicated a relationship between PTSD and depression with physical morbidities aside from those of the heart. For instance, in a study of combat Vietnam veterans, those with PTSD had a greater number of unspecified physician-rated medical complaints than those without PTSD (Beckham, Moore, Feldman, Hertzberg, Kirby et al., 1998). Among women in Michigan on Medicaid, those with a PTSD diagnostic code were more likely to have diagnoses codes for other chronic conditions (e.g., fibromyalgia, irritable bowel syndrome) and gynecologic conditions (e.g., dyspareunia) (Seng, Clark, McCarthy, & Ronis, 2006). There is also evidence that depression directly impacts conditions associated with aging, including osteoporosis, arthritis, Type 2 diabetes, certain cancers, periodontal disease, and frailty (Kiecolt-Glaser et al., 2002).

Finally, there is some evidence that TBI impacts other medical conditions. Often, patients with TBI endure other physical injuries as results of the trauma (polytrauma) that can include pulmonary dysfunction, cardiovascular dysfunction, gastrointestinal dysfunction, fluid and hormonal imbalances, and fractures, nerve injuries, blood clots, or infections (National Institute of Neurological Disorders and Stroke (U.S.), 2002). One study examined hospital discharge records from military hospitals in 1992 that were linked with military discharge records up to 2.7 years later (Ommaya et al., 1996a). Compared to all those discharged from the military, persons with mild TBI were more likely to be discharged for medical disability (OR=7.5); moderate TBI (OR=25.2, OR=11.8, respectively) as were severe TBI (OR=40.4.). As the severity of TBI increases, the rate and severity of physical health consequences do as well. The form of these disabilities can range, but can include problems in cognition, sensory processing, and communication (National Institute of Neurological Disorders and Stroke (U.S.), 2002). Long-term consequences related to TBI have also been documented in the literature. Individuals with TBI may also be more likely to experience Alzheimer's disease, Parkinson's disease, and other disorders more specific to the cause of trauma (i.e., repetitive blows for boxers) or its severity (i.e., brain injury that results in coma) (National Institute of Neurological Disorders and Stroke (U.S.), 2002).

Self-Reported Medical Symptoms

Somatic symptoms as reported by individuals themselves provide an alternative indication of their physical well-being. Deployed service members report high levels of somatic

complaints during deployment: in a survey of over 15,000 military personnel deployed to Iraq or Afghanistan, 77% of personnel deployed to Iraq and 54% of those deployed to Afghanistan experienced diarrhea (which is often associated with fevers and vomiting), 69% of the total sample reported a respiratory illness, and 35% non-combat injuries during the course of their deployment (Sanders, Putnam, Frankart, Frenck, Monteville et al., 2005). While treatable, having these conditions on a frequent basis can impact efficiency, mood, and work performance while on duty. In a smaller study of 56 active duty and Reserve veterans, personnel expressed an average of four physical health concerns (e.g., musculoskeletal and injury) and concerns about exposure to polluted air, depleted uranium from weapons and disease prophylaxis from vaccinations (Helmer et al., 2007).

When asked about their own health, persons with PTSD, depression, and TBI are consistently more likely to endorse many physical problems. Among service members assessed 1-year after returning from Iraq, those who meet probable diagnostic criteria for PTSD were more likely than soldiers who did not screen positive for PTSD to report being bothered by a variety of physical symptoms including stomach pain, back pain, pain in the limbs, headaches, chest pain, dizziness, fainting spells, pounding or racing heart, shortness of breath, bowel symptoms, nausea, and pain or problems during sexual intercourse (Hoge et al., 2007). Soldiers in this study screening positive for PTSD were also more likely to rate their health as poor or fair, and report making sick calls or missing work days. All of these associations were sustained even after controlling for suffering an injury during combat.

Studies among both veteran and civilian populations have shown similar results. Women vets with PTSD are more likely to self-report having the following problems: irritable syndrome, fibromyalgia, chronic pelvic pain, polycystic ovary disease, asthma, cervical cancer, and stroke compared to women vets without PTSD (Dobie, Kivlahan, Maynard, Bush, Davis et al., 2004). In a study of veterans from Vietnam, those with PTSD had a greater number of health complaints, lifetime physical conditions, current physical conditions, physician-rated medical categories, and total illnesses across categories than those without (Beckham et al., 1998). Among civilians, data from the National Comorbidity Survey indicate strong associations between PTSD symptoms and physical problems, including ulcers, problems with stomach or gallbladder, and kidney diseases (Lauterbach, Vora, & Rakow, 2005). Persons with chronic

PTSD report more medical conditions including arthritis, bronchitis, migraine, and gynecological complaints among women than persons with nonchronic PTSD (Breslau et al., 1992).

As mentioned above, in addition to co-occurring mental/physical problems, each of the disorders consist of several diagnostic symptoms that can be described as physical or medical abnormalities (i.e., weight changes, sleep difficulties, motor changes, fatigue, and inability to think or concentrate). It may therefore be a common occurrence that individuals with these disorders report physical complaints prior to having a diagnosed mental disorder. In a literature review examining the co-occurrence of depression and pain, the authors found that depressed individuals were more likely to present in primary care with somatic complaints (fatigue, insomnia, pain) than psychological complaints, which resulted in higher rates of undetected and untreated depression (Bair, Robinson, Katon, & Kroenke, 2003). This clinical presentation may place depressed individuals at risk for inappropriate treatment, symptom severity, and worse outcomes.

Quality of Life/Physical Functioning

Because PTSD is commonly associated with increased distress from symptoms such as nightmares and flashbacks, reporting a lower quality of life or dissatisfaction with their life may be very common. Research incorporating more objective data or practitioner corroboration may counter self-report bias. Indeed, physicians and patients often differ in their assessments. In a study examining the health status of 1,276 combat veterans, the rate of patient and physician agreement about physical symptoms ranged from low to moderate, but patients and physicians were more likely to agree on ratings of cardiovascular and pulmonary conditions (Beckham et al., 1998).

Many studies have investigated the relationship between PTSD, depression, and TBI and quality of life or physical functioning. These investigations are particularly useful, because although they are based on self-report, these outcomes generally reflect the degree of functional impairment regardless of its cause. Quality of life and physical functioning are both typically operationalized using scales such as the Short Form 36, the Quality of Well-being scale, the WHOQoL-Bref, and the Quality of Life Inventory.

Across studies, individuals with PTSD are also more likely to rate their quality of life and well-being as lower than those without PTSD. Higher levels of PTSD symptoms were associated

with lower levels of physical functioning in clinical samples of veterans (Magruder, Frueh, Knapp, Johnson, Vaughan et al., 2004; Schnurr, Hayes, Lunney, McFall, & Uddo, 2006) and among community-based samples of Vietnam veterans (Zatzick, Marmar, Weiss, Browner, Metzler et al., 1997). Similar findings have been found among primary care patients with untreated PTSD (Schonfeld, Verboncoeur, Fifer, Lipschutz, Lubeck et al., 1997), and among persons experiencing sudden physical injuries (Holbrook, Hoyt, Stein, & Sieber, 2001; Michaels, Michaels, Moon, Smith, Zimmerman et al., 1999; Zatzick, Jurkovich, Gentilello, Wisner, & Rivara, 2002). In a recent longitudinal analysis among persons experiencing sudden physical injuries, Ramchand and colleagues (Ramchand, Karney, Caldarone, & Osilla, in press) found a complex pattern of reciprocal relationships, whereby increased PTSD symptoms immediately following an injury was linked with decreased functioning 3-months later, and that, in turn, decreased functioning at 3-months was linked with increased PTSD symptoms nine-months later.

Similar patterns of relationships exist for depression, in which cross-sectional studies consistently reveal that high levels of depressive symptoms are associated with lower levels of functioning. For instance, in a large survey of outpatients in health care provision systems in the United States, those with current depressive disorder or depressive symptoms were more likely to report worse physical, social, and role functioning, worse perceived health, and greater bodily pain than those without chronic conditions, and comparable or worse levels of functioning as those patients with hypertension, diabetes, advanced coronary artery disease, angina, arthritis, as well as current back, lunch, or gastrointestinal problems (Wells, Stewart, Hays, Burnam, Rogers et al., 1989). Insight into the mechanism underlying cross-sectional relationships between these constructs, however, is lacking. In one of the few longitudinal studies that examined both hypothetical relationships of these constructs on each other, among older adults there was evidence that self-rated overall health has a modest effect on depressive symptoms, but that depressive symptoms had very little effect on self-related health (Kosloski, Stull, Kercher, & Van Dussen, 2005).

The study of quality of life and physical functioning after TBI is a relatively new research field. In the time immediately after an injury, it is difficult to measure quality of life, due in large part to the loss of consciousness that is likely to accompany moderate to severe head injuries. However, after three months, assessments of quality of life/physical functioning are generally recommended (Bullinger, Azouvi, Brooks, Basso, Christensen et al., 2002). Most studies of

functioning outcomes after TBI occur during or after a rehabilitation program and indicate general improvement in these outcomes as the time from the injury increases; for example, among patients with severe TBI, scores in 7 of 8 functional dimensions of the SF-36 were higher one year after the injury, signaling improvement (Lippert-Gruner, Maegele, Haverkamp, Klug, & Wedekind, 2007).

Health-Compromising Behaviors

In another chapter, we discuss relationships between PTSD, depression, TBI and substance use behaviors (i.e., alcohol and drug use), which are known to be major health compromising behaviors. The link between negative physical health outcomes and PTSD, depression, and TBI may partially be explained by increases in other types of health-risk behaviors which are known to influence health outcomes as well. Here, we focus on the literature examining tobacco use, though note that the lessons and empirical research on this topic is in many ways likely to be transferable to other health risk behaviors such as poor diet and risky sexual behaviors.

There is a clear link between most psychiatric disorders, including PTSD and depression, and smoking. For example, cross-sectional analyses using the National Comorbidity Survey reveal that persons who met criteria for depression or PTSD at any point in their lives and in the past 30 days were more likely to be lifetime and current smokers relative to persons without mental illness (Lasser, Boyd, Woolhandler, Himmelstein, McCormick et al., 2000). Samples of military veterans have found similar associations between smoking and PTSD (Buckley, Mozley, Bedard, Dewulf, & Greif, 2004; Dobie et al., 2004). The relationship between TBI and tobacco use, even in cross-sectional analyses, has not received much attention from the research community.

Studies do also indicate unique smoking-related outcomes with respect to PTSD and depression. For instance, there is evidence that exposure to trauma and the development of PTSD is likely to increase smoking frequency, though results on the impact of trauma and PTSD on smoking onset are inconsistent, as are study findings on whether smoking or nicotine dependence increase the risk of developing PTSD (Feldner, Babson, & Zvolensky, 2007). In addition, although depressive symptoms do not appear to affect rates of cessation, there is limited research

indicating that persons with PTSD have harder times quitting (Feldner et al., 2007; Kinnunen, Haukkala, Korhonen, Quiles, Spiro et al., 2006).

As mentioned above, mental health symptoms may impact other health-compromising behaviors that increase the risk for adverse health outcomes other than those caused by smoking. For instance, symptoms of depression and PTSD may impact sexual-risk taking, behaviors that increase the risk of sexually transmitted infections, including HIV (Holmes, Foa, & Sammel, 2005). In addition, epidemiologic studies reveal elevated prevalence of obesity among persons with depression (Simon, Von Korff, Saunders, Miglioretti, Crane et al., 2006) and PTSD (Vieweg, Fernandez, Julius, Satterwhite, Benesek et al., 2006; Vieweg, Julius, Benesek, Satterwhite, Fernandez et al., 2006); while longitudinal studies that document changes in dietary and eating habits in relation to these disorders is lacking, it possible that these behaviors are effected in the same ways as are smoking.

Conclusions

Returning service members are at risk for adverse physical health outcomes as the direct result of their service (i.e., injuries, traveler's diarrhea). However, these injuries and infections can often be treated in theater and immediately upon return from Iraq or Afghanistan. Mental health symptoms, which can also develop in theater but also upon return from service, also influence physical health in important ways, such as increasing the risk of death and cardiovascular disease.

7. Substance Use Disorders

Alcohol and drug use disorders, referred to as substance use disorders, along with tobacco use, is a large public health concern in the military with consequences impacting physical health, work status and performance, legal status, interpersonal relationships, and treatment outcomes. These consequences are costly to society and, for active-duty service members, the threat of injury and performance impairment are of particular concern. Zero tolerance, a policy implemented by the Department of Defense where disciplinary action is taken at the sight of any drug use, has curbed documented rates of drug use among *active-duty* military personnel over time (Ballweg & Li, 1991; Bray, Marsden, & Peterson, 1991). Rates of alcohol use, however, have continued to increase in the past 10 years among active duty members (Bray & Hourani, 2007).

This chapter reviews the available literature examining alcohol, drug, and tobacco use disorders and associated consequences for individuals with PTSD, MDD, and/or TBI. First, information about the rates and consequences of alcohol, drug, and tobacco use is provided from the available military literature. Second, the literature on consequences related to substance use and co-occurring PTSD, MDD, and TBI is described. Third, temporal relationships between alcohol use disorders and the three mental disorders are examined. When possible, literature was drawn from the military population, but literature from the civilian population is also described.

Alcohol use can be viewed on a continuum whereby individuals can drink from none to heavy amounts, and can experience none to severe problems (Institute of Medicine, 1990). At-risk drinking, defined as experiencing non-severe, but substantial problems related to drinking would be positioned in the middle of the continuum (National Institute on Alcohol Abuse and Alcoholism, 2005), while alcohol abuse and dependence would be considered more severe. Conceptualizations of drug use tend not to fall under the same continuum, as most military policies support a zero-tolerance framework. In reviewing this literature, several word choices are used. For consistency in this chapter, alcohol and drug use disorders refer to papers that combine or do not differentiate between abuse and dependence diagnoses. Alcohol misuse refers to heavy drinking where abuse and/or dependence are either not measured or participants do not meet these diagnoses.

Alcohol Use in the Military

Rates of alcohol consequences among active-duty personnel are directly impacted by the availability of alcoholic beverages. Research suggests that alcohol use and related consequences have been higher in military populations deployed within the United States compared to deployment overseas (Gutierrez, Blume, Schmaling, Stoeber, Fonseca et al., 2006). There is no research examining access to alcohol for the current military cohort when deployed, but anecdotal evidence gathered by news sources suggest that obtaining liquor or drugs is not difficult for the current military cohort; it can be easily smuggled in or purchased from Iraqi Army soldiers or civilian contractors working on American bases despite both US military policy and Islamic law that strictly prohibit alcohol and drugs (von Zielbauer, 2007). With rising rates of heavy drinking, there have been an increasing number of alcohol- and drug-related crimes committed by US troops deployed to these areas: Recent information obtained by the New York Times suggest that more than a third (240 out of 665 cases) of all Army criminal prosecutions (including murder, rape, armed robbery, and assault) of OIF/OEF soldiers involved alcohol or drugs (von Zielbauer, 2007). These results suggest that despite policies prohibiting alcohol, alcohol may be accessible in Iraq/Afghanistan and that heavy drinking and related consequences may be of growing concern. Alternatively, it may be argued that while alcohol is accessible and consumed on military bases, it is done so in a way that would not draw attention to the infringement (i.e., drinking minimal amounts rather than binge drinking). Military service members live in very close quarters overseas, and it is suggested that this lack of privacy may serve as a protective factor against substance use.

There is some evidence to suggest that alcohol misuse has increased among active-duty personnel in the past ten years. A recent study of over 150,000 active-duty personnel cross-sectionally over a 25-year period found that rates of alcohol misuse (defined as five or more drinks per occasion at least once a week) have increased from 1988 to 2005 with one in six military personnel estimated to experience alcohol misuse in 2005 (Bray et al., 2007). The rise in alcohol misuse may be of particular concern at the present time. Bray and colleagues (Bray et al., 2007) found that the rate of alcohol misuse among soldiers in the Army increased by 30 percent between 2002 and 2005. While the military population is more likely to be younger and male, factors associated with increased drinking, this study found that alcohol misuse remains higher in the military compared to the civilian population even after controlling for

sociodemographic variables. This study also found that junior service members were at highest risk of alcohol misuse compared to more senior members (Bray et al., 2007). In another study of OEF/OIF returnees, about 33% experienced alcohol misuse, which was associated with lower quality of life and lower utilization of health and support services (Erbes, Westermeyer, Engdahl, & Johnsen, 2007). Finally, in a recent study of US soldiers returning from Iraq, about 12% reported alcohol misuse (Milliken et al., 2007). Rates in the literature have been found to vary depending on the definitions and sample population used in each study, but seem to reach a consensus that alcohol misuse is increasingly prevalent among the current military cohort.

Elevated rates of alcohol misuse in the military may be directly and indirectly impacted by several factors (Bray et al., 1991). Military personnel are often stationed overseas separated from their primary support networks and may also experience stressors related to adjusting to their new living environment. Factors related to being in the military such as social norms, stress, trauma exposure, and violence may also increase the risk of heavy drinking (Bray, Fairbank, & Marsden, 1999a). The social norm of drinking in the Navy for example, is often to go to bars at port stops after months at sea (Ames, Cunradi, Moore, & Stern, 2007). Social norms have been shown to have a strong impact on drinking such that the more one perceives their peers or social network as drinkers and perceives them to drink more than him/her, the more likely the individual will drink and drink in large quantities. In research in other settings, social norms marketing that aims to correct misperceived norms that overestimate rates of drinking has been shown to correct misperception and lower rates of drinking (Mattern & Neighbors, 2004). Individuals compare themselves socially to the people they associate with to determine the appropriateness of their behavior (Festinger, 1954) so perceiving that their peers drink more than they do helps justify that their drinking is less severe than others.

In addition to social norms, other military-specific work factors may impact drinking rates. In the Navy, work factors such as ambivalent alcohol policies, work problems, stress, and length of deployment have also been shown to increase rates of alcohol abuse and heavy drinking (Ames et al., 2007). Military deployment may also impact rates of drinking. In a survey of combat infantry units, Army groups were nearly one and a half times more likely to endorse alcohol misuse after deployment to Afghanistan; Marine groups were up to three times more likely after deployment to Iraq when compared to rates prior to deployment (Hoge et al., 2004). Elevated rates of alcohol misuse may be partly attributed to factors intrinsic to the military.

Drug Use in the Military

While reports suggest that the rate of illegal drug use has decreased in the military over time and zero tolerance policies have successfully been integrated (Ballweg et al., 1991; Bray, Kroutil, & Marsden, 1995), even low levels of illegal drug use remain a significant public health concern. Drug use has been significantly linked with crime, difficulty in family relationships, job loss, and health problems. Historically, being in the military has been associated with greater risk of drug use. In Vietnam, rates of heroin soared where nearly 35% of Army enlisted men reported use of heroin while in theatre (Robins & Slobodyan, 2003). Unlike alcohol, heroin was easy to access and affordable in Vietnam (Robins et al., 2003) and provided relief of fear and tensions related to the war (Mintz, O'Brien, & Pomerantz, 1979). When military personnel returned from deployment, rates of remission were high suggesting that most individuals that used heroin in Vietnam did not continue using after returning (Robins, Helzer, & Davis, 1975). These findings may suggest that factors intrinsic to the military climate, stressors, and access to drugs outside the US impact rates of drug use.

Despite the fact that most Vietnam returnees naturally remit their heroin use with time, research suggests that short-term drug use during military service has long-term consequences. One examined the mortality of 1227 Army male returnees 25-years after returning from Vietnam (Price, Risk, Murray, Virgo, & Spitznagel, 2001). Compared to both civilian counterparts and non-drug using Vietnam returnees, veterans who continued using opiates after the Vietnam war was more likely to experience premature death (Price et al., 2001). Short-term drug use has also been associated with alcohol abuse (Boscarino, 1981; O'Brien, Nace, Mintz, Meyers, & Ream, 1980), depressive symptoms (Helzer, Robins, & Davis, 1976; Nace, Meyers, O'Brien, Ream, & Mintz, 1977), and poor social adjustment (Mintz et al., 1979). For Vietnam returnees that continued using heroin, the severity of their drug use (measured by multiple factors including more than 6-month use, experiencing withdrawal symptoms, and being known in the military as a heroin user) increased their risk of using needles to inject the heroin and injecting for the first time (Robins et al., 2003). Along with an increased severity of heroin use, they were also at higher risk of HIV and other infections. Rates of heroin, even of short-term duration have important public health implications.

As stated earlier, issues of availability may also impact rates of drug use while the current military cohort is in theatre. The United Nations' 2007 World Drug Report found that more than

90% of illegal opium, which is used to make heroin, comes from Afghanistan (United Nations Office on Drugs and Crime, 2007). Anecdotal information from news sources suggests that veterans of Operation Enduring Freedom are aware of heroin availability and use on US military bases in Afghanistan but hesitate to report the issue to authorities; one author suggests that OEF veterans returning with heroin addiction are increasingly common (McCanna, 2007). According to one study, the rate of drug use among members of the Navy increased nearly two-fold between 1998 and 2002; the rate of drug use was highest among military members in the Army, approximately 5 percent in 2002 (Bray et al., 2007). Military policies, which include frequent urinalysis screenings among active-duty cohorts may help curb rates of drug use (Vogl, Peterson, & Jewell, 1989). With little research verifying news reports suggesting that heroin is of growing concern, it is unclear how best to interpret these findings. Undoubtedly, heroin use among active military personnel in Iraq and Afghanistan may be important to monitor and address given the availability of heroin in the region and the known direct consequences of this drug.

Tobacco Use in the Military

Despite public health efforts to reduce the prevalence of tobacco use, smoking is still the leading preventable cause of morbidity and mortality in the general population (United States Department of Health and Human Services, 1990) and is a considerable problem for the US military, costing an estimated \$952 million per year (Robbins, Chao, Coil, & Fonseca, 2000). Research has shown that smoking is associated with disability, decreased productivity, increased absenteeism, and longer and more frequent work breaks among Department of Defense personnel (Helyer, Brehm, & Perino, 1998). Klesges and colleagues (Klesges, Haddock, Chang, Talcott, & Lando, 2001) found that Air Force recruits who smoke cost the US military an additional \$18 million per year in training costs; when applied to all branches of the military, the attitudes and behaviors associated with smoking status (which contribute to early discharge) cost the military an estimated \$130 million dollars per year in excess training costs (Klesges et al., 2001). The military has made attempts to curb rates of smoking through various DoD directives, such as a ban against smoking in official buildings, buses, and vans and dissemination of information about the dangers of tobacco smoking upon entry into the military (Department of Defense, 1994, 1999). Despite these efforts, the prevalence of smoking among US military members increased from 29.9% to 33.8% from 1998 to 2002; 30% of smokers in the military

began smoking after entering the military (Bray, Hourani, Rae, Dever, Brown et al., 2002). Furthermore, other research findings indicate that 51% of all recruits reported using tobacco products during the 30 days prior to enlistment (38% smoked cigarettes, 27% used cigars or pipes, 12% used smokeless tobacco) (Ames, Cunradi, & Moore, 2002). Military personnel are more likely to drink heavily and use cigarettes than civilians and factors specific to the military may impact these rates (Bray et al., 1991). The findings above suggest a need for additional and possibly earlier efforts to reduce rates of tobacco use among this population.

Consequences of Co-occurring Substance Use Disorders

The comorbidity or co-occurrence of substance use disorders with other mental disorders is common. In the general population, about half of those with substance abuse also have a mental illness and about 15-40% of people with mental illness have substance abuse (Kessler, Nelson, McGonagle, Edlund, Frank et al., 1996; Regier, Farmer, Rae, Locke, Keith et al., 1990). Alcohol use disorders are highly prevalent among individuals with PTSD, MDD, and TBI. For PTSD, a study of Vietnam combat veterans showed that up to 75% of veterans with a lifetime history of PTSD met criteria for abuse or dependence (Kulka et al., 1990). For depression, individuals in the general population with depression are 3.7 times more likely to meet alcohol dependence criteria, 1.2 times more likely to meet alcohol abuse, 2.5 times more likely to meet drug abuse and 9 times more likely to meet drug dependence (Grant, Stinson, Dawson, Chou, Dufour et al., 2004). Finally, about 79% and 37% of individuals with traumatic brain injury meet criteria for alcohol and drug use disorders, respectively (Taylor, Kreutzer, Demm, & Meade, 2003).

Individuals with substance use disorders that co-occur with other mental disorders have more severe diagnostic symptoms, require more specialized treatment, and have poorer treatment outcomes than individuals with singular disorder (Kessler et al., 1996; Watkins, Burnam, Kung, & Paddock, 2001). These rates of comorbidity are of concern because individuals with co-occurring substance use and psychiatric diagnoses (such as PTSD) tend not to seek services unless there is a perceived need (Jaycox, Marshall, & Schell, 2004) and benefit less from the same treatments as individuals with substance use disorders alone (Ritsher, McKellar, Finney, Otilingam, & Moos, 2002). Among those entering treatment, individuals with comorbid substance use disorders and psychiatric diagnoses have greater psychiatric, employment, and

family problems at treatment intake, but similar rates of retention and substance use outcomes in treatment at one-year outcome (Chi, Satre, & Weisner, 2006). Individuals with PTSD and SUD also have more physical health symptoms and poorer mental health functioning and well-being compared to individuals without PTSD (Ouimette, Goodwin, & Brown, 2006).

For individuals with comorbid depression and substance use disorders, there has been mixed literature on the associated consequences. Some authors found that MDD decreased likelihood of substance use remission, but that depression during abstinence was associated with substance use and relapse into substance dependence when compared to patients without MDD (Hasin, Liu, Nunes, McCloud, Samet et al., 2002). Similarly, current depression while hospitalized in substance use treatment has been linked to quicker rates of returning to drinking and relapse compared to men and women without current depression (Greenfield et al., 1998). Other research found that a lifetime diagnosis of major depression was associated with better drinking outcomes at 3-year follow-up (Kranzler, Del Boca, & Rounsaville, 1996) and better treatment attendance compared to non-depressed patients (McKay, Pettinati, Morrison, Feeley, Mulvaney et al., 2002). Some research suggests that the effects of depression on substance use may differ depending on the etiology of the depression, i.e., whether the depression is due to grief or some other cause. Those with comorbid depression and substance use tend to have a decreased perceived need for help seeking compared to those without depression (Mojtabai, Olfson, & Mechanic, 2002) and often higher health care (e.g., inpatient) costs than individuals without this comorbidity (Druss & Rosenheck, 1999).

Examining the Relationship between Heavy Drinking and PTSD, MDD, and TBI

There are several approaches to determining the temporal relationship between alcohol use disorders and co-occurring mental disorders; understanding the sequence allows for targeted prevention and intervention efforts. Most studies focus on whether an alcohol use disorder occurred before or after the co-occurring disorder. For example, models stating that symptoms of alcohol dependence precedes PTSD suggest that drinking may act as a risk factor towards developing PTSD (e.g., drinking may place the individual in more dangerous situations, which may place them at higher risk of experiencing trauma). A similar model suggests that individuals with alcohol dependence prior to a trauma may also be more likely to experience PTSD symptoms after a traumatic event. Models that treat alcohol dependence as a secondary diagnosis

following the development of PTSD tend to suggest that drinking is used to self-medicate or cope with symptoms related to PTSD (e.g., drinking to forget memories of the trauma).

Several studies have attempted to discern the temporal relationship between PTSD and alcohol misuse. Data on the temporal relationship between PTSD and substance use disorders have been mixed. Reviews of the literature (Jacobsen, Southwick, & Kosten, 2001b; Stewart, 1996) found that PTSD often precedes substance use disorders. For example, research employing several data analytic strategies to explore the temporal relationship between PTSD and substance use disorders found most support for the self-medication hypothesis, which suggests that PTSD increases the risk of substance use disorders and that individuals use substances to cope with their PTSD (Chilcoat & Breslau, 1998). Bremner and colleagues (Bremner, Southwick, Darnell, & Charney, 1996) found that Vietnam combat veterans reported that alcohol, heroin, benzodiazepines, and marijuana “helped” their PTSD symptoms though cocaine tended to worsen hyperarousal symptoms further, supporting the self-medication theory that substances may be used to relieve distressing PTSD symptoms. On the other hand, recent research suggests that alcohol consumption prior to trauma may influence the development of PTSD. In a study examining victims of community violence receiving inpatient trauma center care, alcohol abuse pre-trauma was a stronger predictor of subsequent PTSD than alcohol abuse following post-trauma (Schell, Marshall, Stewart, & Jaycox, 2007).

In general, alcohol and PTSD symptoms tend to increase in severity at similar rates such that, as PTSD symptoms worsen, substance use also worsens (Bremner et al., 1996). Yet the converse does not seem to be true: improvement in PTSD symptoms does not necessarily predict improvements in substance use. In a literature review (Ouimette et al., 1998), individuals with PTSD and substance use disorders had poorer substance use treatment outcomes and experienced distinct treatment barriers when compared with individuals with either disorder alone. These findings are consistent with other research suggesting that individuals with these disorders have more severe symptoms and are more refractory to treatment than individuals with one of these disorders (Jacobsen, Southwick, & Kosten, 2001a).

Examining the Relationship between Tobacco Use and PTSD/MDD

As stated above, tobacco use among military members has both physical health and financial consequences for the United States military. Recent research has indicated that tobacco

use may also be associated with mental health behaviors and outcomes. For example, Shalev and colleagues found that Vietnam veterans with PTSD had a greater incidence of smoking than those without PTSD (Shalev, Bleich, & Ursano, 1990). Another study found similar rates of smoking among those with and without PTSD but found a higher prevalence of *heavy* smoking among those with PTSD compared to those without (Beckham, Kirby, Feldman, Hertzberg, Moore et al., 1997). McClernon and colleagues (McClernon, Beckham, Mozley, Feldman, Vrana et al., 2005) found that smokers with PTSD had higher puff volumes than smokers without PTSD. One study of civilians in Southeast Michigan found a significantly increased risk of nicotine dependence in individuals exposed to trauma without presence of PTSD; the risk was even greater among those with exposure to trauma and presence of PTSD (Breslau, Davis, & Schultz, 2003). While the above studies do not provide causal evidence that PTSD leads to unhealthy smoking behaviors, they do suggest an association between the two.

Several studies have suggested that tobacco use may alleviate symptoms of mental disorders such as PTSD and depression. McFall and colleagues (McFall, Mackay, & Donovan, 1992) suggested that the association between PTSD and smoking may indicate the utilization of nicotine to alleviate PTSD symptoms of arousal, numbness, or detachment. Indeed, Beckham et al. (Beckham et al., 1997) found that heavy smoking status was associated with hyperarousal and avoidance symptoms, as well as general PTSD symptoms (Beckham et al., 1997). Thorndike and colleagues found that severity of nicotine dependence was positively correlated with total PTSD symptoms, hyperarousal symptoms, and avoidance symptoms; this correlation remained after controlling for depression vulnerability (Thorndike, Wernicke, Pearlman, & Haaga, 2006). Similar hypotheses have been generated with regards to major depression: in a prospective study, Breslau et al. (Breslau, Peterson, Schultz, Chilcoat, & Andreski, 1998b) found that those with history of major depression were more likely to become daily smokers, suggesting possible self-medication of depressive symptoms. The researchers also found that a history of daily smoking at baseline increased the risk for major depression (Breslau et al., 1998b).

Models examining TBI stress the importance of pre-injury alcohol/drug use levels

The literature examining the relationship between alcohol/drug use and TBI among civilians have stressed the impact of alcohol and drug use prior to the injury, stating that pre-injury rates of substance abuse are high and impact the consequences associated with TBI over

time. Corrigan (Corrigan, 1995) found that nearly two thirds of TBI patients had a history of substance abuse and that nearly half of patients admitted to hospitalization were intoxicated at the time of injury. Rates of pre-injury drinking are less prevalent in another review study (37-51%), but rates of intoxication at the time of injury are similar (Parry-Jones, Vaughan, & Cox, 2006). Rates of pre-injury drinking and related problems have been associated with continued at-risk drinking after injury (Jorge et al., 2005). There is also evidence to suggest that pre-injury drinking was predictive of heavy drinking one-year after the injury but that drinking patterns were not associated with TBI severity (Horner, Ferguson, Selassie, Labbate, Kniele et al., 2005). These results suggest that adequate identification, assessment, and treatment of heavy drinking and related problems may be an important step toward identifying individuals vulnerable to experiencing TBI. It is important to keep in mind, however, that these studies of civilians may not generalize to military service members, as service members are more likely to experience TBI resulting from combat rather than injuries.

Substance use and TBI comorbidity has also been associated with military discharge. Compared to all those discharged from the military, persons with mild TBI were over two times more likely to be discharged for alcohol/drugs or criminal convictions, and persons with moderate TBI were about five times more likely to be discharged for alcohol/drug problems (Ommaya et al., 1996a). Additional consequences associated with TBI and substance use included lower likelihood of returning to work, military discharge, decreased life satisfaction, greater risk of continued abuse post-injury, and that continued drinking post-injury perpetuated these consequences (Taylor et al., 2003). Together these findings suggest that heavy drinking and drug use has a direct impact on the rates of TBI.

Models examining depression and alcoholism do not support a self-medication hypothesis and suggest that depression is often a consequence of alcoholism

The co-occurrence between depression and substance use is high. Heavy drinking comorbid with depression is of particular concern because at-risk alcohol use affects both the diagnosis and treatment of depression (Graham & Schmidt, 1999; Thase, Salloum, & Cornelius, 2001). Even small amounts of alcohol use are associated with an increased prevalence of depression and poorer treatment outcomes, as well as increased morbidity, mortality, and disability (Rehm, Room, Graham, Monteiro, Gmel et al., 2003; Stinson, 1998; Sullivan, Fiellin, & O'Connor, 2005; Worthington, Fava, Agustin, & Alpert, 1996). Research in a representative

U.S. sample of over 43,000 respondents showed that alcohol dependence increases one's risk for experiencing major depression by nearly four times, and drug dependence increases risk even more (Grant et al., 2004).

Models examining the relationship between substance use and depression show more support for alcohol and substance use disorders preceding depression, suggesting that depression and negative affect are a consequence of substance use (Swendsen & Merikangas, 2000). This model is in contrast to a self-medication hypothesis where substance use is used to cope after the onset of depression symptoms. Direct consequences and increased vulnerability to stress related to substance use such as relationship and work problems may increase the likelihood of developing depression consistent with the stress-diathesis model.

Factors that May Impact the Relationship between Co-occurring Diagnoses

Men and women may experience stressors differently and may experience different vulnerabilities to substance use and co-occurring PTSD, MDD, and TBI. Military stressors are high among men and women and have been reported to be higher than stressors related to their family or personal lives; men tend to report stress related to work and family, stresses that have been directly associated with substance use; women report stress from their experiences of discrimination within the military, a stress that has been directly associated with drug and cigarette use (Bray, Fairbank, & Marsden, 1999b). While men with PTSD are more likely to have alcohol abuse and dependence, women may be at greater risk for comorbid depression rather than alcohol abuse dependence (Jacobsen et al., 2001b). Additionally, the association between nicotine dependence and PTSD symptoms is stronger among men than women (Thorndike et al., 2006). Rates of substance abuse among women veterans with PTSD, however, remain common and of concern (Dobie et al., 2004).

Other factors may also impact rates of substance use. Alcohol use is greater and the consequences of alcohol use are more severe among soldiers with less education, ethnic minority groups, males, those not in an intimate relationship, enlisted members, and those deployed in the US (Gutierrez et al., 2006).

Summary and Implications

Rates of co-occurring substance use disorders with PTSD, MDD, and TBI are common and are often associated with more severe diagnostic symptoms and poorer treatment outcomes.

These findings suggest that individuals with substance abuse comorbidity may be more difficult to treat and may present with more challenging and unique sequelae in treatment (Ouimette et al., 1998). More challenging clinical presentations often lead to more money spent on healthcare (Druss et al., 1999). It appears that substance use often results from PTSD and often precedes depression, and that this temporal understanding can help shape treatment programs to identify the risk factors associated with each of those conditions. Also knowing that pre-injury substance use precedes TBI in most cases also may have implications on heavy alcohol and drug use screening in the military. Efforts aimed at curbing alcohol and drug use may directly reduce rates of TBI. It is likely to be the case that treatment for comorbid substance use and TBI may be challenging such that pre-injury substance use needs to be identified and integrated within treatment goals. Research on integrated treatment efforts to treat both substance use and concurrent mental health problems has provided preliminary evidence that outcomes are improved in integrated versus distinct mental health and substance use programs (Watkins et al., 2001). Therefore, understanding the complexities of the conditions soldiers are returning with would allow more likelihood of successful amelioration of symptoms.

8. Labor-Market Outcomes: Employment and Productivity

The impact of mental health on employment outcomes in the military population requires an understanding of the structure of the military itself and of service members' experiences in both the military and civilian labor force. We outline this labor market flow in Figure 8.1 below. U.S. service members can be generally categorized as members of the active component (AC) or the reserve component (RC). As per the U.S. Code, active duty service members perform full-time duty in the active service of a uniformed service. Members of the reserve component, on the other hand, perform a minimum of 39 days of service per year and augment the active duty military. Prior to deployment, military service is the full time job of the active component, though some may hold part-time jobs to supplement their incomes. On the other hand, members of the reserve component are either employed within the civilian labor force or are unemployed. There are active duty Reserve component service members who work full time for their Service Reserve component, yet who are considered reservists. However, these make up a small percent of the total Reserve force.

Employment outcomes upon returning from deployment are based upon the service requirements that are unique to each individual service member. With this in mind, upon redeployment from service, members of both the active component and reserve component may return to the same employment status they held prior to deployment. Alternatively, they may switch, i.e. members of the reserve component may transfer to the active component or vice versa, where their civilian labor force participation will fall under one of the pre-deployment categories above (list again?). However, upon returning from deployment, troops may also separate from military service. If they separate, they may pursue employment opportunities in the civilian labor market or may be unemployed.

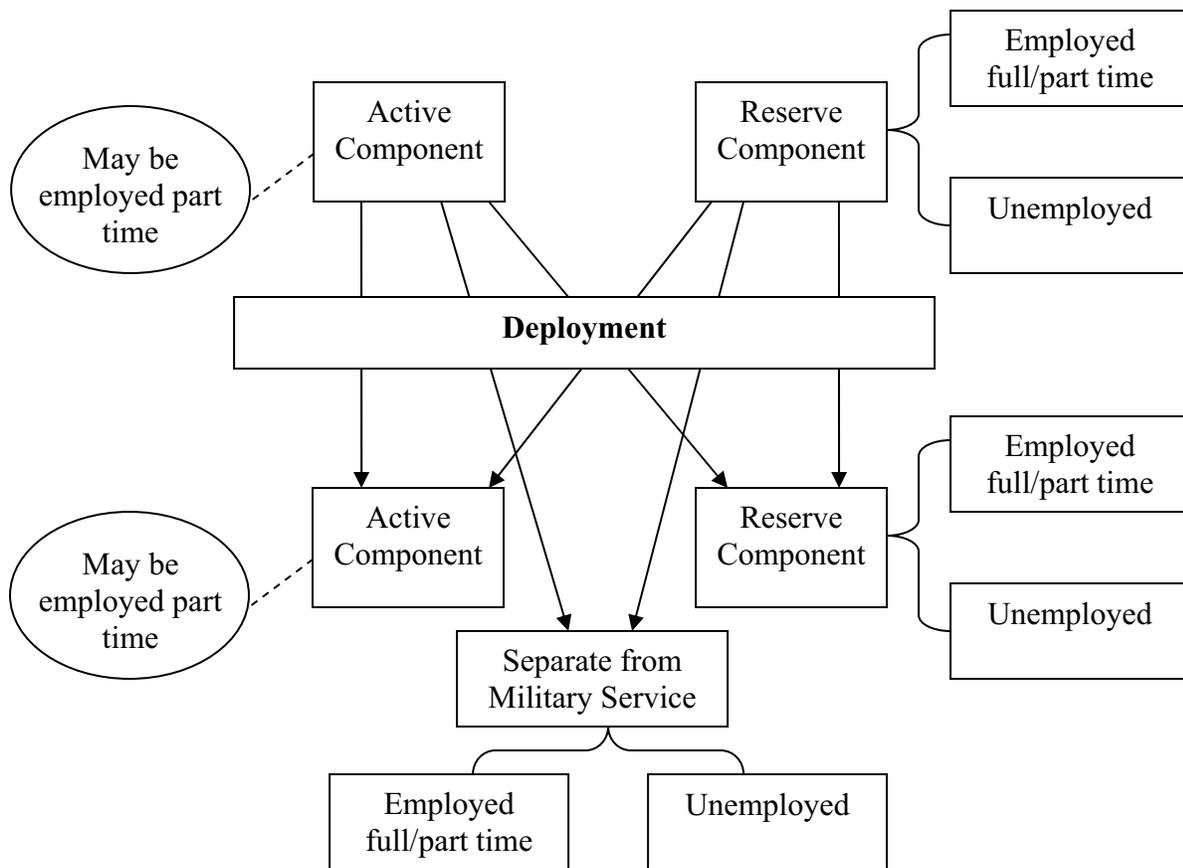


Figure 8.1 Patterns of Labor Force Participation for Deployed Service Members.

It is important to keep these options in mind as we review studies of the impact of mental health problems on labor market outcomes, particularly as they may pertain to service members returning from deployment. We found only one study on the impact of mental health problems on performance in the military among active duty personnel, which focused on productivity among service members redeployed from OIF or OEF (Hoge et al., 2007). On the other hand, there is information on civilian labor market experiences of veterans, particularly those from Vietnam, and the influence of psychiatric disorders on these outcomes relative to veterans without psychiatric disorders. Additionally, there is literature documenting the impact of psychiatric disorders on the employment outcomes of civilians in the civilian labor force relative to other civilians without these disorders. We draw from all of these sources in this chapter to

assess the impact of mental disorders on rates of employment, absenteeism and presenteeism (i.e., reduced productivity at work), wages and income, and educational outcomes.

Employment

Studies on the impact of PTSD on current employment status have been conducted primarily on Vietnam veterans. Such studies come from a variety of sources, including the National Survey of the Vietnam Generation (Savoca & Rosenheck, 2000), National Vietnam Veterans Readjustment Study (Zatzick et al., 1997), the Vietnam Era Twin Registry (McCarren, Janes, Goldberg, Eisen, True et al., 1995) or in clinical trials of veterans with severe PTSD (Smith, Schnurr, & Rosenheck, 2005). Collectively, these studies indicate that veterans with PTSD are less likely to be currently employed than veterans without the disorder. For example, Zatzick and colleagues (Zatzick et al., 1997) found that veterans with a current probable PTSD diagnosis were over three-times more likely to report currently not working relative to veterans without PTSD, even after adjustment for demographics characteristics and comorbid conditions. Smith and colleagues (Smith et al., 2005) extended these findings by showing that among a sample of veterans receiving treatment for PTSD symptoms, as severity of these symptoms increased, the likelihood of both full-time and part-time work decreased.

Savoca et al. (2000) studied the impact of depression on employment among veterans, finding that a lifetime diagnosis of major depression was inversely associated with the probability of current employment. Similar findings have been shown in nationally representative studies of the civilian population. For instance, in data from the National Comorbidity Survey, a nationally representative survey of the civilian population, models stratified by sex indicated that both men and women with current depression were less likely to be employed than their civilians without the disorder (for men, 87% of those with major depression were employed versus 93.3% of those without depression; for women, the prevalence of employment was 74% among those with depression and 82% for those without) (Ettner, Frank, & Kessler, 1997).

While studies of employment outcomes for persons with PTSD and depression have generally relied on population-based samples, research on such outcomes after TBI have relied primarily on clinical samples of persons with brain injuries who may receive neurotrauma services and rehabilitation. A brain injury usually occurs in the context of an accident or injury at

a discrete point in time, and research has thus generally investigated the proportion of employed persons who *return to work* after their injury. Data from one national database provides general estimates of return to work after persons with TBI complete a rehabilitation program. The RSA 911, compiled by the U.S. Department of Education's Rehabilitation Services Administration, collects data on rehabilitation outcomes for anyone who applied or received services under the Rehabilitation Act. This data indicates that close to 60% of individuals with TBI are successfully rehabilitated and that of those, approximately 90% went on to be employed in the competitive labor market (Wehman, Targett, West, & Kregel, 2005). Among one sample of military personnel entering an 8-week clinical rehabilitation trial for moderate to severe closed head injury, over 90% were employed 1 year post-injury, and roughly three-quarters were deemed fit for duty (Salazar, Warden, Schwab, Spector, Braverman et al., 2000).

Studies have also examined those characteristics that might influence successful return to work among persons with TBI. Perhaps most importantly, the probability of employment increases as the time since the injury increases. Additional factors that are associated with the likelihood of return to work are characteristics of the injury itself, with findings indicating that less severe injuries, shorter coma times, and shorter periods of rehabilitation are all linked with an increased likelihood of return to work (Wehman et al., 2005). In addition, the degree of impairment caused by the injury, premorbid employment factors (including educational level, occupational category, and job satisfaction), social and familial supports, as well as sociodemographic characteristics have all been associated with return to work outcomes (Wehman et al., 2005).

Productive Work: Absenteeism and Presenteeism

Poor mental health is associated with individuals' likelihood of employment, but may also impact the performance of individuals who are or remain employed. There are various measures of productive work, most of which broadly fall under two categories. Absenteeism reflects the number of loss work days, and has been measured by the number of sick days, missed work days, or hours worked per week. Presenteeism generally refers to lost productivity at work, and can be measured by individuals' reports of their task focus and productivity or performance while at work. Studies have investigated both absentee and presentee outcomes in relation to mental illnesses.

Absenteeism

Studies of absenteeism among persons with PTSD and TBI are scant, though we can glean some information from studies of military personnel. For PTSD, studies have generally asked respondents to self-report on past sick days with inconsistent findings. For instance, in a sample of active duty troops one-year after returning from deployment to Iraq as part of OIF, those with PTSD were significantly more likely to report missing 2 or more work days in the past month relative to redeployed soldiers without PTSD (Hoge et al., 2007). However, when asked to recall their work hours, working Vietnam veterans with anxiety disorders did not report significantly reduced work hours relative to veterans without a disorder (Savoca et al., 2000). We were unable to find many studies focused on absenteeism among persons with TBI. Perhaps the most informative of those that we did locate, Ommaya and colleagues (Ommaya et al., 1996b) examined one year of military hospital discharge data linked with military service discharge data and found that increases in the severity of head injuries corresponded with increases in total sick days (defined as time to hospital admission to return to duty).

Studies of absenteeism in relation to depression overwhelm those for PTSD and TBI. Like those studies for PTSD, studies that have asked workers to recall the hours that they work generally have not found do not find strong evidence of reduced work hours among those with depression compared to workers without these disorders in either civilian or veteran populations (Ettner et al., 1997; Savoca et al., 2000) However, evidence of increased levels of absenteeism among individuals with depression exists in those studies that have used administrative data which is more objective? And less subject to recall bias. For instance, civilian workers with a medical diagnosis of depression in one major U.S. manufacturing company had, on average, more reported sick days than individuals with diabetes, heart disease, hypertension, or back problems (Druss, Rosenheck, & Sledge, 2000). A separate study indicated that depressed workers in the civilian population had more short-term work-disability days than non-depressed workers (Kessler, Barber, Birnbaum, Frank, Greenberg et al., 1999a). In another nationally representative sample (the American Productivity Audit/Depressive Disorders Study), workers with depression reported, on average, missing 1 hour per week due to absenteeism versus an expected loss of 0.4 hours per week in the absence of depression.

Presenteeism

Studies of presenteeism, or reduced productivity while at work, are rare; those that do exist tend to focus on depression. In perhaps the most novel of studies that have examined depression, Wang et al. (Wang, Beck, Berglund, McKenas, Pronk et al., 2004) sampled a group of airline reservation agents and telephone customer service representatives and paged these individuals during their work shifts. When paged, the respondents were asked to make an entry in a diary by answering questions about their task focus (e.g., daydreaming, concentration) and productivity (quality, speed, and efficiency) at the moment they were paged. Using this approach, the researchers found that major depression was significantly associated with lower levels of both task focus and productivity. In a study that asked respondents to recall their work performance in the past 2 weeks across 6 work-related dimensions, those with depression lost on average 4.6 hours per week for presenteeism, which was significantly higher than the expected loss of 1.5 hours per week (Stewart, Ricci, Chee, Hahn, & Morganstein, 2003). Although we found no observational studies relating PTSD or TBI to levels of work productivity, there is evidence to suggest that both PTSD and TBI are linked with lower levels of productivity. For instance, under experimental conditions, veterans with PTSD and patients with moderate to severe TBI are less attentive to common work tasks, particularly in the absence of distractions (Chemtob, Roitblat, Hamada, Muraoka, Carlson et al., 1999; Whyte, Schuster, Polansky, Adams, & Coslett, 2000). On the other hand, under experimental conditions there was no indication that police recruits with PTSD performed worse during stressful situations than control recruits without PTSD (Leblanc, Regehr, Jelley, & Barath, 2007). Thus, although evidence suggests that PTSD and TBI may impact work-related performance, it remains to be determined the degree to which deficits in functioning are clinically relevant.

Wages and Income

There is some evidence linking psychiatric disorders with decreased wages. For instance, among Vietnam veterans, depression and PTSD both had negative effects on hourly wages. More specifically, veterans suffering from PTSD have 16% lower hourly wages than veterans who do not, while those with depression have 45% lower hourly wages than veterans who do not (Savoca et al., 2000). Wages are even lower for veterans with depression and a comorbid substance use disorder (Savoca et al., 2000). However, a clinical study of veterans receiving

treatment for PTSD found no evidence that severity of PTSD was related to monthly earnings (Smith et al., 2005). Results from the National Comorbidity Survey indicate that there may be a significant reduction in the earnings of men and women with any disorder, though not specifically for depression (Ettner et al., 1997). Among one sample of TBI rehabilitation patients, average mean income declined 48% per month one-year after incurring the injury (Johnstone, Mount, & Schopp, 2003). Finally, using data from the American Community Survey, Gamboa and colleagues (Gamboa, Holland, Tierney, & Gibson, 2006) estimated full economic consequences of having a cognitive disability lasting six months or more¹ and found that those with such a disability earned, on average, \$10,000 less than persons without such disability. These differences, however, varied by highest level of education, with larger differences among those with higher levels of educational attainment.

Education

Although there are education requirements for entering U.S. military service, many service members may desire to continue their education by pursuing post-secondary schooling or graduate school. Previous studies indicate that achieving these educational outcomes has significant effects on a variety of outcomes, including occupational achievement, financial security, and health (Kessler, Foster, Saunders, & Stang, 1995a). Having PTSD, depression, or TBI is likely to impact how successful service members will be at obtaining these future educational goals. Accounting only for mental disorders that occurred before terminating their schooling, beginning in high school, persons in the National Comorbidity Survey with one or more mental disorders were consistently more likely to terminate their education than those without a disorder. However, among persons who completed eighth grade, persons with mood disorders (which include depression) and anxiety disorders (which include PTSD) were more likely to fail to complete high school; they were also more likely to fail to enter college among high school graduates and fail to complete college among college entrants (Kessler et al., 1995a).

Conclusions

It is likely that PTSD, depression, and TBI all influence labor market outcomes. Specifically, there is compelling evidence indicating that these conditions will impact returning

¹ The authors write that such impairment is typically considered mild TBI.

service members return to employment, their productivity at work, and their future job prospects as indicated by impeded educational attainment. However, these findings should be interpreted cautiously. The majority of those studies referenced above are cross-sectional; it is not yet clear that these mental conditions are underlying causes of the labor market outcomes observed. In fact, working has many benefits in and of itself, ranging from enhancing social interactions to promoting self-esteem and expanding economic self-sufficiency (Wehman et al., 2005). Thus, poor performance in the workplace can influence the development of mental health symptoms or enhance symptoms that may already exist.

9. Homelessness

Rates of homelessness are relatively high in the veteran population (Perl, 2007) and are over four times higher in the veteran than non-veteran general population (Rosenheck, Frisman, & Chung, 1994). While veterans represent about 11 percent of the civilian population, recent reports suggest that 26 percent of the homeless population consists of veterans (National Alliance to End Homelessness, 2007). The Veterans Affairs department has identified over 1000 veterans coming back from Iraq and Afghanistan as at risk for homelessness and has served about 300 in their homelessness programs (Perl, 2007).

Historically, homelessness was most common among veterans in the post-Vietnam all-volunteer forces where those who enlisted were more likely to be younger, non-White, have increased separation from relationships, less work experience, greater drug and mental health problems, and less financial support from friends and family, relative to those who did not enlist (Tessler, 2003). These individuals were also more likely to have longer duration of homelessness compared to their older counterparts. Among those veterans that sought VA homeless services, about 50% experienced at least one severe psychiatric symptom and two-thirds had reported being hospitalized at least once for a psychiatric or substance abuse problem (Rosenheck et al., 1989).

Homeless Veterans versus Homeless Non-veterans

Evidence suggests that veteran and non-veteran homeless populations are more similar than different. Studies comparing veterans with and without war-related traumatic experiences have shown that psychiatric symptoms and substance use were stronger risk factors in predicting homelessness than combat-exposure or any other military factor (Rosenheck & Fontana, 1994) and were also described as the primary risk factors among veterans (Rosenheck, Leda, Frishman, Lam, & Chung, 1996). This conclusion has been supported by other veteran and civilian studies as well (Robertson, 1987; Roth, 1992). Research from the National Vietnam Veterans Readjustment Study (NVVRS) shows that those who experienced stress in war-zone had more readjustment problems, and those related diagnoses lead to homelessness rather than the war-zone exposure itself (Kulka et al., 1990). Effects of PTSD including substance abuse, other problems, interpersonal difficulties and unemployment were associated with veteran

homelessness (Rosenheck, Leda, & Gallup, 1992). Similar to non-veteran populations, extreme poverty and social isolation have also been risk factors to homelessness (Rosenheck, Kaspro, & Seibyl, 2004).

Homelessness, PTSD, MDD, and TBI

Little data have examined the rates of homelessness among individuals with PTSD, MDD, or TBI. Instead, the literature on homelessness has tended to focus on the reverse relationship, i.e., examining the prevalence of mental illness among homeless populations. Only the former rate allows for within group comparisons (e.g., what aspects of depression may predispose an individual to homelessness). One study that has examined this relationship to some degree found that about 15% of individuals seeking mental health services in San Diego over a year period were homeless, with severe mental illness and poorer functioning being the greatest risk factors (Folsom, Hawthorne, Lindamer, Gilmer, Bailey et al., 2005). In a smaller New York study, rates of homelessness among a mental health treatment population were about 19% within three-months of admission, 25% within three-years, and 28% in their lifetime (Susser, Lin, & Conover, 1991). Further research examining homelessness in mentally ill populations may help provide additional insights into the role mental illness might play in predicting homelessness.

In general, homeless people have increased rates of mental illness, including substance use (Breakey, 2004), and traumatic brain injury (Gonzalez, Dieter, Natale, & Tanner, 2001) than non-homeless people. Homeless persons are more likely to experience severe mental illness such as schizophrenia, chronic depression, and bipolar depression compared to non-homeless persons in the general population (Susser, Valencia, Conover, Felix, Tsai et al., 1997). Most research suggests that mental illness (Muñoz, Vázquez, Koegel, Sanz, & Burnam, 1998) and cognitive impairments and dysfunction (Backer & Howard, 2007) are risk factors to homelessness. While causality and the mechanisms to homelessness is unclear, homelessness may be a consequence of multiple components including mental illness and cognitive dysfunction. In one study, about 70.7% of homeless individuals with depression experienced their depression prior to becoming homeless, and of those that were homeless and depressed, nearly 60% of those with depression were most likely to occur either immediately following homelessness or within five years preceding homeless (Koegel & Burnham, 1992). In another study, about 75% of individuals with PTSD developed the diagnosis prior to becoming homelessness (North & Smith, 1992). These

findings suggest that the relationship between mental illness and homelessness may be closely tied together, with mental illness often being a precursor.

Between 20-25% of homeless individuals have experienced a severe and often extremely debilitating mental illness, nearly half of homeless individuals have an alcohol use disorder, and about a third have experienced a drug use disorder (Koegel, Brunam, & Baumohl, 1996). In fact the risk of homelessness has been documented to be 10-20 times higher among individuals with severe mental illness than in the general population (Susser et al., 1997). These results suggest that mental illness and substance use disorders are prevalent among homeless people, but represent just a fraction of the overall homeless population.

Overestimates of the prevalence of mental health problems among homeless people may be the consequence of studies relying on poor sampling methods, or research guided by the assumption that homelessness is caused by personal faults (e.g., mental health, inability to care for themselves) (Koegel et al., 1996). In fact, an integrated perspective on homelessness highlights a mixture of personal limitations (mental health, lack of support) and structural factors (low availability of low-cost housing, decreased resources for the vulnerably poor) that may enhance the likelihood of homelessness (Koegel, 2004; Koegel et al., 1996).

Risk Factors to Homelessness

Risk factors that contribute to homelessness include poverty, disaffiliation, and personal vulnerability – each of which is overrepresented among persons with severe mental illness (Breakey, 2004). Homeless people with substance use and mental illness concerns tend to have extreme poverty, lower utilization of support programs, less social support, greater encounters with the legal system, and poorer general health (Fischer & Breakey, 1991). On the flip side, homelessness has also been shown to perpetuate mental health problems (Breakey, 2004) and has been described as a source of psychological trauma (Goodman, Saxe, & Harvey, 1991). Homeless persons have been shown to have higher cognitive dysfunction making it more difficult for them to make the decisions and find the resources to reintegrate back into society (Spence, Stevens, & Parks, 2004). Homeless individuals with mental illness are also more likely to experience affective disorders such as chronic depression and bipolar disorder compared to schizophrenia (Sullivan, Burnam, & Koegel, 2000).

Overall, homeless people with mental illness have worse physical health, difficulty with subsistence needs such as finding shelter, food, and clothing, victimization, and quality of life (Sullivan, Burnam, Koegel, & Hollenberg, 2000). Homeless vets with depression are more than two times more likely to report fair/poor health than homeless vets without depression (Nyamathi, Sands, Pattatucci-Aragão, Berg, Leake et al., 2004). Homeless men and women with depression or schizophrenia are at the greatest risk of victimization (physical and sexual assault); symptoms related to these disorders may decrease vigilance of danger or place them at greater observable risk to the community (Wenzel, Koegel, & Gelberg, 2000). Rates of victimization, while a problem among homeless men and women (Piening & Bassuk, 2004), are more prevalent among homeless women compared to non-homeless women and homeless men (Wenzel et al., 2000). Homeless women that have greater personal vulnerability and increased exposure to crime (e.g., panhandling, stealing) have been shown to be at greater risk (Wenzel et al., 2000). Victimization is also associated with increased risk of traumatic brain injury among homeless compared to non-homeless populations due to assaults and increased risk taking (Silver & Felix, 1999). Rates of mental illness and victimization appear to be higher among homeless individuals and may be more prevalent among homeless women.

Methodological Considerations

Several methodological problems have contributed to overestimates of homelessness prevalence and the inability of much of this research to distinguish psychiatric symptoms that predict homelessness from those that arise as a consequences of homelessness (Koegel et al., 1992). For example, determining paths of causal influence among risk factors and homelessness requires large samples and longitudinal studies, and these are difficult to obtain with homeless populations. It is recommended that research on homelessness incorporate representative and unbiased sampling to fully capture the homeless population, and that more rigorous instruments are used that delineate consequences related to mental health and not overlapping symptoms related to homelessness. Also, because research on homelessness has focused on the rates of disorder among these populations compared to rates of homelessness among disordered populations, it remains unclear whether homelessness is a common outcome of having a mental illness. While risk factors to homelessness include mental illness, the integrative theory of

homelessness suggests that there are multiple determinants rather than a single determinant (Koegel et al., 1996; Koegel et al., 1992).

Conclusions

Several conclusions can be made comparing the homelessness veteran population to the general population and the associated consequences related to homelessness and mental illness. First, the prevalence of homelessness is higher among veteran than non-veteran populations, but this may be due to the higher prevalence of risk factors for homelessness among service members, rather than the effects of military service itself. In addition, rates of severe mental illness range from 20-25%, which only represents about a quarter of the homeless population. Second, mental illness and cognitive dysfunction are prevalent among homeless people, and those with mental illness experience greater consequences (e.g., physical health, decreased utilization of services, difficulty reintegrating into society). While it is unclear the degree to which our current military cohort will experience homelessness, increasing rates of PTSD, MDD, and TBI may act as a precursor to homelessness if the proper financial, emotional, and structural supports are not in place. Consistent with the structural theory of homelessness, which states that one of the causes of homelessness is due to the lack of societal resources (Koegel et al., 1996), a preventative measure for decreasing rates of homeless may be to apply more structural supports and interventions among those screened to be at highest risk.

10. Marriage, Parenting, and Child Outcomes

The effects of post-combat mental disorders inevitably extend beyond the afflicted service member. As service members go through life, their impairments cannot fail to impact those they interact with, and those closest to the service member are likely to be the most severely affected (Galovski & Lyons, 2004). Indeed, a broad empirical literature has documented the range of negative consequences that post-combat mental disorders have had on the families of service members returning from prior conflicts. The great majority of this research has focused on PTSD, and the best of it has looked at the impact of this specific disorder on family outcomes after the war in Vietnam.

In general, and consistent with the broad framework described in Chapter 3, research on the consequences of mental disorders for families has identified direct and indirect routes through which these consequences come about. In the direct route, the specific interpersonal deficits suffered by service members have immediate effects on their loved ones and family members, e.g., difficulties with emotion regulation predicting greater risk of physical violence in the home. In the indirect route, the other direct consequences of a service member's disorder (e.g., the inability to sustain employment) themselves have negative consequences for the service member's family (e.g., financial hardship, deprivation).

In this section, we review research that has examined the impact of a service member's mental disorders, and PTSD in particular, on the quality of relationships between spouses, the emotional and physical health of the non-military spouse, incidence of domestic and intimate partner violence (IPV), parenting, and child outcomes. The emphasis throughout this section is on research that has examined military populations directly, but where that research is unavailable we have reviewed the relevant research on civilian populations.

Consequences for Emotional Intimacy and Relationship Satisfaction

The cognitive and emotional deficits associated with PTSD, depression, and TBI inhibit activities crucial to maintaining intimacy in a relationship (Carroll, Rueger, Foy, & Donahoe, 1985). Successful intimacy requires that partners are capable of experiencing and expressing emotion, understanding and providing for each other's needs, and recognizing (and at times restraining) their own impulses. Mental disorders, whether psychological or neurological,

interfere with all of these behaviors, leading to serious and negative consequences for intimate relationships.

PTSD. Within military populations, these sorts of effects have been documented most thoroughly with respect to PTSD. For example, MacDonald et al. (1999), in a study of Vietnam veterans living in New Zealand, asked 756 individuals about their combat experience, symptoms of PTSD, and their intimate and family relationships. Those with higher levels of PTSD symptoms reported greater interpersonal problems (i.e., difficulties expressing intimacy, lack of sociability), and poorer marital and family relationships as well. Moreover, interpersonal problems were found to mediate the associations between PTSD and the quality of family relationships. That is, PTSD symptoms were directly associated with specific interpersonal deficits in these veterans, and those deficits appeared to account for the links between PTSD and family relationships. In a smaller-scale study of 50 male Vietnam veterans assessed when they were around 50 years old, Riggs et al. (1998) asked those suffering from PTSD to describe their specific symptoms via a 17-item checklist and then asked them and their partners to rate their satisfaction with their relationship. When these veterans were experiencing higher levels of emotional numbing (i.e., emotional restriction, detachment from others, loss of interest in pleasurable activities), both partners reported greater problems in the relationship. Perhaps as a consequence, 70% of the couples in which the male partner was diagnosed with PTSD described their relationships as distressed, compared to 30% of the non-PTSD couples. Studies such as these join an extensive literature that has linked PTSD with difficulties maintaining emotional intimacy (Jordan, Marmar, Fairbank, Schlenger, Kulka et al., 1992), and with greatly elevated risk of divorce (Kulka et al., 1990). The same links have been established within the National Comorbidity Study: in the general population, individuals who have experienced PTSD for any reason have a 60% higher divorce rate than those without PTSD (Kessler, Walters, & Forthofer, 1998).

Depression. The effects of depression on emotional intimacy and relationship satisfaction have not been studied as extensively in military populations per se. However, the interplay between depression and marital relationships is one of the most thoroughly studied topics in marital research on civilian populations. Coyne (1976) was among the first to highlight the impact of depression on social functioning, suggesting that the behaviors of depressed individuals make it likely that others will reject them, reinforcing and exacerbating the

depression. Indeed, extensive research over the past three decades has supported this hypothesis within civilian populations. Among other findings, this research has revealed that, compared to non-depressed individuals, depressed individuals are poorer at resolving marital conflicts (Du Rocher Schudlich, Papp, & Cummings, 2004; Hautzinger, Linden, & Hoffman, 1982), poorer at soliciting for and providing their partners with social support (Davila, Bradbury, Cohan, & Tochluk, 1997), more likely to blame their partners for negative behaviors (Fincham, Beach, & Bradbury, 1989), and more likely to seek excessive reassurance of their worth (Joiner & Metalsky, 1995). Perhaps as a consequence, after interacting with their depressed partners, intimates and spouses of these individuals are likely to experience negative emotions like anger and sadness (Kahn, Coyne, & Margolin, 1985). It is not surprising, then, that major depression and depressive symptoms are strongly linked to lower levels of marital satisfaction and higher rates of marital distress, both cross-sectionally (Whisman, 2001) and longitudinally (Davila, Karney, Hall, & Bradbury, 2003), and higher risk for divorce as well (Kessler et al., 1998). Although the effects of depression on intimate relationships and marriage have not been studied within military populations directly, there is no reason to believe that the processes through which depression damages these relationships should differ between military and civilian couples.

TBI. The impact of TBI on the quality of intimate relationships has also yet to be studied within military populations. Research on TBI in civilian populations, however, paints a similar picture, suggesting that the deficits associated with TBI interfere with activities that maintain intimacy. For example, a study of 65 couples in which just over half of the husbands had experienced a brain injury found that, relative to men without a brain injury, the injured reported more difficulties resolving conflict in their marriages (Kravetz, Gross, Weiler, Ben-Yakar, Tadir et al., 1995). To date, TBI has not been found to be associated with risk for divorce (Kreutzer, Marwitz, Hsu, Williams, & Riddick, 2007), but the question has yet to be addressed in a large sample of civilians, let alone the military, leaving this link and open question for now.

Consequences for the Well-being of Spouses and Partners

In addition to the direct impact of PTSD, depression, and TBI on emotional intimacy, these impairments also represent a substantial, and usually unexpected, caregiving burden. Most often, it is the intimate partner or spouse who bears this burden. Figley (1993), writing

specifically about the wives of Vietnam veterans with PTSD, suggested that the stress of caring for a loved one with a mental disorder can result in secondary traumatization, i.e., a situation where the intimate partners of trauma survivors themselves begin to experience symptoms of trauma. Figley initially applied this term restrictively, referring only to spouses who develop stress reactions (i.e., nightmares, intrusive thoughts, etc.) to specific events that their partners had experienced. Later writers (Galovski et al., 2004) expanded the use of this term to refer more broadly to any distress experienced by those close to a traumatized individual.

PTSD. With respect to PTSD, there is extensive evidence that secondary traumatization, at least in its broader sense, occurs and has serious negative consequences for the emotional and psychological well-being of the spouses of veterans with PTSD (Dirkzwager, Bramsen, Adèr, & van der Ploeg, 2005; Verbosky & Ryan, 1988). A recent qualitative study (Dekel, Goldblatt, Keidar, Solomon, & Polliack, 2005) reported on interviews with nine wives of veterans with PTSD who described the strains of caring for their afflicted husbands. Their stories echoed earlier research that directly examined the level of husbands' PTSD symptoms, the degree of wives' caregiving burden, and wives' psychological well-being (Beckham, Lytle, & Feldman, 1996). These analyses confirmed that the more symptoms of PTSD reported by the veteran, the greater the caregiving burden reported by their wives, the more likely that their wives also experienced anxiety and dysphoria, and the more their wives' symptoms became more severe over the subsequent eight months. An extensive program of research on the wives of Israeli soldiers traumatized during that country's 1982 war with Lebanon reached the same conclusions (Solomon, Waysman, Belkin, Levy, Mikulincer et al., 1992a; Solomon, Waysman, Levy, Fried, Mikulincer et al., 1992b). For example, Solomon, Waysman, Levy et al. (1992b) examined psychiatric symptoms in the wives of Israeli soldiers suffering from varying degrees of PTSD and Combat Stress Reaction (CSR), a response to acute stress that can be a precursor to PTSD. Compared to wives of soldiers without either diagnosis, wives of soldiers with one or both diagnosis were significantly more likely to experience a range of psychiatric symptoms, including depression, anxiety, and somatization. It is worth noting that other family members are not equally at risk for secondary traumatization. A study of the wives and parents of Dutch peacekeepers found that higher levels of PTSD symptoms in peacekeepers were associated with higher levels of psychological symptoms in their wives, but had no relationship to symptoms in their parents (Dirkzwager et al., 2005). Thus, the brunt of the impact of service members with

PTSD appears to fall on the people who are most intimate with those individuals, i.e., their wives and children.

Depression. In the previous section, we reviewed research on civilians showing that depression in one partner predicts declines in relationship quality and increased risk for divorce among married couples. The same literature has also shown that depression in one partner can lead to depressive moods in the other partner, increasing the risk of a depressive episode in that partner (Joiner & Coyne, 1999).

TBI. To the extent that one of the engines driving secondary traumatization is the unexpected need to care for an impaired spouse, it could be predicted that the wives of veterans with TBI, similarly burdened, would be at similar risk for psychological symptoms. Indeed, interviews with wives of civilians with TBI reveal these wives to struggle with the tension between their seemingly incompatible roles of wives and caretakers (Gosling & Oddy, 1999). We are aware of only one study that has examined the consequences of this tension within a military population. Ben Arzi, Solomon, and Dekel (2000) compared psychological symptoms in wives of veterans with post-concussion syndrome (similar to TBI), wives of veterans with PTSD, and wives of veterans without a diagnosis. Compared to the wives of the healthy veterans, wives of veterans with either of the disorders experienced significantly higher levels of distress and psychiatric symptoms. Thus, whether a service member experiences a trauma that is psychological or neurological, its negative affects appear to spread to their intimate partners.

Implications for Intimate Partner Violence

In addition to their problems expressing positive emotions and experiencing intimacy, returning service members suffering from mental disorders report problems restraining negative emotions, especially anger and aggression. After the Vietnam war, for example, veterans residing at the Northport Veterans Administration Medical Center described managing anger as one of their most challenging issues (Blum, Kelly, Meyer, Carlson, & Hodson, 1984).

PTSD. Chemtob et al. (1997) have suggested that deficits in regulating anger should be especially prevalent among veterans with PTSD. According to their conceptual framework, in veterans with PTSD the experience of traumatic events during combat leads to a chronic and excessive sensitivity to threats even after returning from combat, and to a corresponding tendency to respond to perceived threats with hostility. Indeed, qualitative interviews with

Vietnam veterans with PTSD and their wives suggest that anger and the threat of violence is a substantial part of their experience (Chemtob et al., 1997; Frederikson, Chamberlain, & Long, 1996). Survey research on veterans with PTSD confirms that veterans with PTSD experience higher levels of anger than non-veterans with PTSD, or veterans with other psychiatric diagnoses (Chemtob, Hamada, Roitblat, & Muraoka, 1994).

Given that links between PTSD and difficulties managing anger were recognized soon after Vietnam, practitioners working with veterans and their families have long been concerned about the implications of PTSD for intimate partner violence. Among veterans who have sought treatment for PTSD, rates of violence and abuse within their marriages are distressingly high. For example, Williams (1980) found that 50% of veteran couples seeking treatment reported physical aggression with their households. Studies that have compared veterans with PTSD to veterans seeking treatment for other reasons have further found that those with PTSD report higher rates of domestic violence than those with other diagnoses (Carroll et al., 1985). Although these studies have drawn from veterans seeking treatment, i.e., the most severe PTSD cases, a more representative survey of 1200 male Vietnam veterans reached similar conclusions: those with higher levels of PTSD symptoms were more likely than other groups to engage in violent behavior within the home (Jordan et al., 1992). More recent research points specifically to the role of anger in accounting for the links between PTSD and intimate partner violence among veteran couples. In a study of 60 veterans who experienced combat in Vietnam (Taft, Street, Marshall, Dowdall, & Riggs, 2007), those reporting symptoms of PTSD also reported higher levels of anger and more hostile reactions when presented with trauma cues. These associations, which were not observed in veterans suffering from other disorders, in turn accounted for the higher rates of intimate partner violence in veterans with PTSD compared to other veterans.

Although the results of research on the links between PTSD and intimate partner violence in veterans has been remarkably consistent, it bears noting that this research has also been limited in a number of important ways. First, some of the most cited research on this issue has drawn entirely from samples of veterans seeking treatment. Because the decision to seek treatment may be especially likely to occur after a violent outburst against a spouse or family member, rates of intimate partner violence within the treatment-seeking population may overestimate the rates within the broader population of veterans suffering from PTSD. Second,

some of these studies have drawn from interviews with very small samples of volunteer couples, or from samples of convenience. Data from such samples illuminate the experience of PTSD for some families, but generalizations to the broader population of those with PTSD are not warranted. Yet, despite these limitations, there is enough data on this topic, and enough large-scale research (e.g., Jordan et al., 1992), to support the idea that intimate partner violence is a significant concern for the spouses of service members returning from combat with PTSD.

Depression. The literature on the implications of depression for intimate partner violence resembles the literature on PTSD and violence in its form and its content. That is, much of this research has addressed samples of couples seeking treatment, either for depression or for marital discord. For example, Boyle and Vivian (1996) examined nonviolent, moderately violent, and severely violent men seeking marital therapy with their wives, and compared them to community males who were not seeking therapy. Controlling for other related factors, levels of depressive symptoms were positively associated with degree of violent behavior toward the female partner, such that the most severely violent husbands reported the highest levels of depression. A similar study of civilian couples seeking treatment (Feldbau-Kohn, Heyman, & O'Leary, 1998) replicated this association, but suggested that, as seems to be the case with PTSD, anger plays a central role in this relationship. In this study, the association between depressive symptoms and violent behavior toward the spouse was eliminated after husbands' self-reports of anger were controlled. The most prominent study of depression and intimate partner violence within military populations is a large survey of 11,870 white males randomly sampled from Army bases between 1989 and 1992 (Pan, Neidig, & O'Leary, 1994). Controlling for demographic variables such as age and income, depressive symptoms were associated with rates of aggression against a female partner. The size of this association was substantial: each 20% increase in depressive symptoms was associated with a 74% increase in the likelihood of being physically aggressive.

The limitations of the research linking depression to intimate partner violence resemble the limitations of the parallel literature on PTSD. Specifically, the fact that this research has drawn almost exclusively from cross-sectional surveys leaves the causal relationship between depression and violent behavior an open question. To the extent that both depression and aggression are measured via self-reports, it remains possible that, in the studies described above, depression was a consequence of aggression, rather than its cause. That is, males who have behaved aggressively towards their female partners, especially those seeking treatment, may

have become depressed in remorse for their own behavior. Longitudinal research will be required to rule out this alternative hypothesis. In advance of such research, confidence that intimate partner violence is a consequence of depression is strengthened by the results highlighting the role of anger, and by a review by Schumacher, Feldbau-Kohn, Slep, & Heyman (2001) which found depressive symptoms to be a consistent risk factor for intimate partner violence across multiple studies.

TBI. Everything known about the implications of TBI for intimate partner violence comes from research on civilian populations. Within that population, a loss of impulse control and an increase in aggressive behavior are known to be direct consequences of the neurological damage associated with TBI (Kim, 2002). Direct comparisons between individuals with TBI and individuals with other injuries (i.e., spinal cord injuries) finds that those with TBI are indeed more verbally aggressive and angry, as rated by themselves and by their peers, but this work finds no differences in rates of physical aggression (Dyer, Bell, McCann, & Rauch, 2006). The research that has linked TBI specifically to intimate partner violence and abuse has tended to sample from men receiving treatment for abusing their partners, among whom rates of TBI are higher than in the general population (Marsh & Martinovich, 2006).

Implications for Effective Parenting

As the ripple effects of service members' post-combat mental disorders spread horizontally to affect their spouses, so too do they spread vertically to affect their children. In both directions, the mechanisms of the effects appear to be similar: the deficits that inhibit behaviors associated with effective intimacy also directly inhibit behaviors associated with effective parenting.

PTSD. The largest survey that has addressed associations between parenting behavior and PTSD in veterans is the National Survey of the Vietnam Generation (NSVG), the survey component of the National Vietnam Veterans Readjustment Study (NVVRS). One analysis of those data that focused specifically on the implications of post-combat PTSD for family outcomes examined responses from 1200 male veterans (Jordan et al., 1992). Among the instruments included in the survey were four items assessing parenting (e.g., do their children create problems, do they enjoy parenting, satisfaction with parenting, and satisfaction with child outcomes). Analyses revealed that men with PTSD reported significantly more problems and

less satisfaction with parenting than did other veterans. Specifically, over 50% of those with PTSD reported the highest level of parenting problems on the scale, compared to less than 20% of those without PTSD.

How does PTSD interfere with effective parenting? The few studies that have addressed this question highlight the fact that the heightened reactivity of veterans with PTSD can lead them to avoid intensely emotional experiences of any kind. The result of this coping strategy is emotional numbing, withdrawal, and disengagement from family members. For example, in a study of the children of Vietnam veterans living in Australia, researchers compared 30 children of male veterans with PTSD to 20 children of non-PTSD veterans and 33 children of civilian controls (Davidson & Mellor, 2001). The children of veterans with PTSD were more likely than the other children to rate their fathers as having difficulty solving problems within the family and expressing emotion appropriately. Ruscio et al. (2002) directly examined the role of different clusters of PTSD symptoms in a study that conducted clinical interviews with 66 male Vietnam veterans associated with the Boston VA Medical Center. Hierarchical regression modeling revealed that the emotional numbing and avoidance aspects of PTSD were associated with poorer parent-child relationships, even after controlling for a wide range of possible covariates, including substance abuse and degree of combat exposure. In contrast, other symptoms of PTSD (e.g., reexperiencing and hyperarousal) had no unique associations with parenting. The authors suggested that it is specifically “the disinterest, detachment, and emotional unavailability that characterize emotional numbing [that] may diminish a father’s ability and willingness to seek out, engage in, and enjoy interactions with his children, leading to poor relationship quality” (Ruscio et al., 2002, p. 355).

Depression. We could locate no research that has examined the implications of depression for parenting practices within military populations. Nevertheless, an extensive literature has examined the impact of depression on parenting in civilian populations, and reviews of this literature reach consistent conclusions. For example, in an early review of this area, Downey and Coyne (1990) identified 15 studies that had observed depressed mothers interacting with their children in a controlled setting (i.e., semi-structured interactions, often observed in the home, ranging from 5 to 90 minutes long). In general, these studies found that depressed mothers’ interactions with their children are characterized by reduced positive affect and energy, but at the same time increased levels of hostility and irritability, relative to non-

depressed mothers. A later meta-analysis of this literature confirmed these conclusions, and further revealed that the effects were not unique to mothers currently experiencing depression (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). That is, even mothers who had recovered from depression still displayed impaired parenting behaviors, relative to mothers who had never been depressed.

Subsequent studies have found that depressed parents have particular difficulty with child management and discipline, vacillating between inconsistent and ineffective discipline on one hand, and rigid and controlling behavior on the other (Cummings & Davies, 1999; Oyserman, Mowbray, Meares, & Firminger, 2000). Thus, for example, a study of 290 families with adolescent sons found that parents suffering from stress-related depression felt less successful at disciplining their children, who in turn experienced more behavioral problems (Conger, Patterson, & Ge, 1995). A recent study of depression in a sample of Romanian parents reached similar conclusions: relative to non-depressed parents, depressed parents reported more controlling and more externalizing behavior toward their children (Robila & Krishnakumar, 2006). Especially relevant for the current context, Banyard, Williams, and Siegel (2003) find evidence that depression can be a route through which parental trauma affects children. In their sample of 152 young mothers, those who had experienced childhood traumas were more likely than mothers who had not experienced trauma to rely on physical punishments and to have been reported to child protective services. The mothers' depression partly accounted for these associations.

How well can the results of studies of civilians be used to predict the impact of depression within military populations? The consistency of the findings in this literature across several decades and multiple reviews offers some degree of confidence that depression in a parent is likely to be associated with less effective parenting. However, this literature has also been limited in two ways that directly affect its potential application to military populations. First, research on depression in civilian parents focuses almost exclusively on depressed mothers. Among civilians, women are more likely to be diagnosed with depression than men (Kessler, McGonagle, Swartz, Blazer, & et al., 1993; Weissman, Bland, Canino, Faravelli, Greenwald et al., 1996), so the focus on depressed mother is not unreasonable. Given that military personnel are disproportionately male, however, it is not clear whether the same effects will be observed. Second, as many observers have noted (e.g., Beach, 2001), among civilians parental depression

is strongly associated with marital discord, so much so that in some families marital discord is likely to account for maternal depression and ineffective parenting. In the military, however, post-combat depression may be independent of the relationship between parents, and so may have different effects. In sum, although the existing literature suggests that depression in post-combat veterans will impede effective parenting, the lack of direct evidence of this within military populations suggests that this conclusion be held with caution.

TBI. Given that TBI is a relatively recent concern for the military, there have been no studies that have examined the impact of TBI on parenting in military populations. We were able to locate two studies that have examined the implications of TBI for parenting in civilian populations. The earliest of these located 24 families in which one parent had experienced a brain injury some time after the birth of a first child (Pessar, Coad, Linn, & Willer, 1993). Reports from the uninjured parent described negative changes in the parenting of the injured partner. A second study compared 16 families in which one parent had experienced a TBI to 16 families in which no parent was injured (Uysal, Hibbard, Robillard, Pappadopulos, & Jaffe, 1998). Interviews with family members indicated that, relative to uninjured parents, injured parents were less engaged, less encouraging, less consistent regarding discipline, and less emotionally expressive. Both of these studies addressed small, highly selected samples, and so their results can not be taken as representative of the broader civilian population, let alone the military. Nevertheless, to the extent that parenting deficits continue to be observed in civilians with TBI, it is reasonable to expect similar deficits will be observed among injured service members as well.

Implications for Child Outcomes

To the extent that service members' post-combat mental disorders damage their intimate relationships, their spouses and partners, and their parenting practices, these disorders are likely to have long-term effects on the development of their children (e.g., Wamboldt & Reiss, 2006). Unlike many of the other effects described in this chapter, the effects of post-combat disorders on children's outcomes are likely to be indirect rather than direct consequences of service members' symptoms. A relevant model making this point was developed by Cummings et al. (2001). Although specifically designed to address the effects of paternal depression on child outcomes, their model applies equally well to all three of the mental disorders discussed here.

According to their model, parents' mental disorders directly affect four crucial elements of a child's environment: 1) parents' own symptomatology, 2) parenting practices, 3) parent-child relationships, 4) conflict and distress between parents. To the extent that each of these elements suffers as a result of a disorder, children's own characteristics will be affected and so too their subsequent development. In this chapter, we have already reviewed evidence that PTSD, depression, and TBI do affect the intermediate elements highlighted by this model. In this section, we review the evidence that, through these mechanisms, these disorders may have negative consequences for child outcomes.

PTSD. In the NSVG survey described earlier, 376 spouses and romantic partners of Vietnam veterans were also interviewed extensively about their family experiences, including detailed assessments of child behavior problems (Jordan et al., 1992). Compared to the spouses of veterans without PTSD, the spouses of veterans with PTSD reported significantly greater and more severe behavior problems in their children. A separate analysis of survey responses from 40 male Vietnam veterans examined PTSD symptoms and levels of combat exposure as predictors of child behavior problems (Caselli & Motta, 1995). Results indicated that PTSD and combat exposure accounted for a third of the variance in reported child behavior problems, and that PTSD alone accounted for most of this effect. Expanding the focus beyond behavior problems, Davidson, Smith, and Kudler (1989) asked 108 veterans of World War II, Korea, and Vietnam with PTSD to describe their own and their children's psychiatric experiences. Among the children of the PTSD veterans, rates of academic problems were higher, and 23% had received psychiatric treatment, relative to the children of the non-PTSD controls, of whom none had received psychiatric treatment. Not surprisingly, outcomes for the children of abusive veterans are especially negative (Rosenheck & Fontana, 1998).

Depression. The implications of a parent's depression on children's outcomes has not been studied directly within military populations, but it has been studied extensively in civilian populations. The results of this research have been clear and consistent across numerous studies: the children of depressed parents are at several times greater risk for behavioral problems, psychiatric diagnoses, and academic disruptions than children of non-depressed parents (Beardslee, Bemporad, Keller, & Klerman, 1983; Beardslee, Versage, & Gladstone, 1998; Cummings et al., 1999). A typical study of 220 children of depressed and non-depressed parents found that having a depressed parent was more strongly associated with a child's risk of

receiving a psychiatric diagnosis than other family risk factors such as parents' marital adjustment and family cohesion (Fendrich, Warner, & Weissman, 1990). The involvement of a non-depressed father has been shown to protect children from some of these effects (Mezulis, Hyde, & Clark, 2004).

Although the negative associations between parental depression and children's well-being are beyond dispute, the explanations for these associations remain a topic of ongoing debate. At issue is the extent to which parental depression can be viewed as a cause of behavioral, emotional, and academic problems in children, or merely a symptom of other factors that cause both depression in parents and maladjustment in children. To the extent that a parent's depression stems from biological influences, for example, children may also be at risk due to their genetic inheritance, regardless of the behaviors of the parent. Indeed, studies of twins reveals a moderate genetic influence on children's depression, i.e., inheritance accounts for some of the association between parents' and children's depression, but not all (Rende & Plomin, 1993; Rende, Plomin, Reiss, & Hetherington, 1993). The model described by Cummings et al. (2001) articulates the ways family processes combine to affect children's development, through the direct effects of a parent's depression on a child's emotional security. Within military populations, both of these sources of influence on children may be observed. Future research may reveal that genetically vulnerable service members are the ones most likely to experience post-combat depression, and that processes in military families help to transmit problems to children.

TBI. The model described in Chapter 3 and the more specific model described in this section strongly suggests that a TBI in a parent will have negative implications for child development. To date, however, the cross-generational effects of TBI have yet to be studied.

Evidence for Moderators of Effects on Family Outcomes

Although PTSD, depression, and TBI appear to have negative effects on families on average, the magnitude of these effects is not the same for all families. Faced with a family member afflicted with a mental disorder, some families are more resilient than others. In general, research on these issues has not paid much attention to sources of resilience or vulnerability that may moderate the effects of mental disorders on family outcomes. Instead, the great majority of the research reviewed here focuses on simply establishing the average

associations. Nonetheless, potentially important moderators have been identified in individual studies.

Preexisting vulnerabilities. The model described in Chapter 3 suggests that the consequences of a post-combat mental disorder will be worse for service members who were vulnerable in other ways prior to their service, i.e., those with less education, less supportive extended families, or a history of adjustment problems. Two studies have demonstrated these sorts of effects empirically. One study asked 57 Vietnam veterans to describe how they were treated by their parents in childhood, their levels of combat exposure, and their degree of PTSD symptoms (McCranie, Hyer, Boudewyns, & Woods, 1992). Analyses of their responses showed that veterans who recalled worse relationships with their fathers demonstrated higher levels of PTSD symptoms at lower levels of combat exposure, compared to veterans who recalled more positive relationships with their fathers as children. Gimbel and Booth (1994), in one of the strongest studies of these issues to date, examined associations between combat exposure and marital outcomes in 2101 Vietnam veterans that varied in their levels of vulnerability prior to serving in that conflict. To assess vulnerability, these researchers asked the veterans about their experience of emotional problems and about academic problems they may have experienced in childhood. Results indicated that combat exposure predicted more anti-social behavior for veterans who had experienced more school problems in childhood, and combat predicted more symptoms of PTSD for veterans who had experienced more emotional problems in childhood. In general, these researchers concluded, “for those who come into combat with problems, the outcomes of combat are likely to be more negative than if they did not have a history of problems” (Gimbel et al., 1994, p. 701).

Marital quality. The way a marriage responds to one spouse’s post-combat mental disorder may depend on the quality of the marriage prior to the onset of the disorder. In a classic study that made this point, McCubbin et al. (1975) interviewed the families of 48 service members who had been POWs during the Vietnam war. The reintegration of the service member was a challenge in every case, but couples who had been married longer prior to the husband’s imprisonment fared better than couples who had been married less time. The couple’s shared history appeared to serve as a source of resilience that more recent marriages lacked. Research on the wives of Israeli soldiers suffering from combat stress reactions reports a similar finding (Mikulincer, Florian, & Solomon, 1995). Although on average the wives of injured soldiers

fared worse than the wives of uninjured soldiers, greater intimacy between the spouses offered a measure of protection. In general, the way family relationships respond to post-combat mental disorders may be analogous to the way buildings respond to earthquakes: the stronger the structure initially, the greater its ability to weather a shock.

Conclusions

Although PTSD, depression, and TBI have been repeatedly associated with negative outcomes for families and children, the causal role of these mental disorders in giving rise to these outcomes remains an open question. To address this question, it will be crucial for future research to follow service members over time to determine whether those experiencing one of these disorders also experience an increased risk of family problems, controlling for their family problems prior to their injuries.

Even in the absence of such studies, however, the current research supports the more modest conclusion that populations suffering relatively high rates of PTSD, depression, or TBI are likely to demonstrate relatively high rates of family difficulties as well. Each of these disorders has been linked independently to difficulties maintaining intimate relationships, and these deficits account for greatly increased risk of distressed relationships, intimate partner violence, and divorce among those afflicted. The impact of these consequences is hard to overstate, given the centrality of healthy intimate relationships for well-being in a broad range of domains. For example, individuals who are satisfied with their intimate relationships live longer (House, Landis, & Umberson, 1988), and are physically healthier (Kiecolt-Glaser & Newton, 2001), more productive at work (Forthofer, Markman, Cox, Stanley, & Kessler, 1996), and better parents (Grych & Fincham, 1990) than people who are less satisfied with their relationships. Moreover, satisfaction in a relationship is a better predictor of general life satisfaction than financial security, job satisfaction, or physical health (Glenn & Weaver, 1981). Thus, to the extent that mental disorders among returning veterans impact the quality of their intimate relationships, we can expect them and their partners to suffer impairments in these other domains as well. In addition, the interpersonal deficits that interfere with emotional intimacy in the romantic relationships of service members with these disorders appear likely to interfere with their interactions with their children as well. Thus, the impact of post-combat mental disorders

may extend beyond the lifespan of the afflicted service member to stretch across generations. It may take decades to count the costs of these afflictions, and decades more to heal from them.

11. Conclusions and Recommendations

Justification and Summary

Nearly 1.5 million service members have been deployed to Afghanistan or Iraq since 2002. As these individuals return to their homes, some will return intact, whereas some will return bearing the scars of combat. The physical scars are likely to be treated, both on the battlefield and at home. Yet the mental scars – the emotional and cognitive impairments that can be the consequence of experiencing war – may be overlooked. Preliminary studies reviewed in this report indicate that from 5 to 15% of returning service members may be returning with PTSD and from 2 to 10% with depression, and unknown additional numbers may be suffering from traumatic brain injuries. The goal of this report was to review the existing research on the implications of these disorders within military and civilian populations and in so doing to describe the potential consequences of these invisible wounds if left untreated.

In general, the existing literature suggests that each of these three disorders have implications that are wide-ranging and negative for those afflicted. Although the three disorders are defined by distinct patterns of symptoms, in terms of their implications and consequences the similarities between the disorders are more notable than the differences. For example, the presence of any one of these disorders predicts a greater likelihood that an individual will experience other psychiatric diagnoses as well. All three disorders increase an individual's risk for attempting suicide. All three have been associated with higher rates of unhealthy behaviors (e.g., smoking, overeating, unsafe sex), higher rates of physical health problems, and higher rates of mortality. In addition to the direct implications of these disorders for the afflicted individual, each of these disorders appears to affect the way that afflicted individuals interact with their social environments. Thus, individuals experiencing any one of these disorders, especially PTSD and depression, tend to miss more days of work, report being less productive while at work, and are more likely to be unemployed. Psychiatric illnesses appear to predict homelessness as well, although this literature suffers from serious methodological limitations. Finally, all three disorders have profound implications for interpersonal relationships, disrupting marriages, interfering with parenting, and ultimately giving rise to problems in children that extend the costs of combat experiences across generations. Thus, the effects of a post-combat

mental illness can be compared to ripples spreading outward on a pond, but whereas ripples fade over time, the consequences of mental disorders may grow more severe, especially if left untreated.

Together, the studies reviewed here offer consistent support for the integrative framework proposed in Chapter 3. That framework, drawing upon existing theoretical perspectives on mental illness and lifespan development, describes the consequences of mental disorders as a cascade of accumulating challenges and negative outcomes that, if allowed to continue, may expand to affect more and more domains in the life of an individual. Indeed, prior research on military and civilian populations indicates that these cascades can and do occur. The direct results of a mental disorder (i.e., impaired cognitive and emotional functioning) can have immediate consequences for the individual (e.g., additional psychiatric problems, poor health maintenance behaviors) which themselves accumulate and contribute to additional problems (e.g., with physical health, work performance, interpersonal relationships, etc.). The model further suggests that, given the experience of a disorder, the likelihood of experiencing a negative cascade is greater to the extent that: a) the initial symptoms of the disorder are more severe, and b) the afflicted individual has other sources of vulnerability (e.g., unstable family relationships, low SES, prior history of psychopathology). Indeed, the research reviewed here consistently shows that individuals afflicted with one of these disorders experience worse consequences when they must simultaneously confront other sources of stress, whereas other sources of strength (e.g., supportive family relationships, high SES, high education) may serve as buffers even for those whose symptoms are relatively severe.

Given the estimated prevalence of PTSD, depression, and TBI in service members returning from OEF and OIF, the picture that emerges from this review may appear bleak, but the accumulated results should be kept in perspective. Each of the studies reviewed here indicates only that service members who return from their deployments with one of these disorders are at increased risk for these negative outcomes. Most service members, however, are returning from combat free from any of these disorders. Moreover, even those afflicted with post-combat mental disorders may remit spontaneously, and may, with adequate treatment and support, avoid concomitant negative outcomes altogether. In other words, this research emphasizes probabilities, but should not be used to promote deterministic conclusions.

Recommendations for Future Research

Although the research reviewed in this report varies widely in methods and perspectives, a number of specific methodological limitations appeared to be common across most studies. A worthwhile preliminary aim of future research on the consequences of post-combat mental disorders would be to address these limitations directly.

Determining causal relationships. The model proposed in Chapter 3 suggests that the experience of a post-combat mental disorder is a cause of negative outcomes for service members, in that they account for the experience of negative outcomes that the service member would not have experienced in the absence of the disorder. The research reviewed in this report is consistent with this position, but it is important to note that the vast majority of the research reviewed here has not been capable of ruling out alternative interpretations. Most of this research has relied on cross-sectional and retrospective designs, i.e., research participants have been contacted on a single occasion and asked to report on their experience of psychiatric symptoms and their functioning in other life domains. To the extent that symptoms are found to be associated with functioning in such studies, the association may arise in several ways. First, the disorder may indeed determine subsequent outcomes for afflicted individuals, as the framework proposed here suggests. Second, preexisting characteristics of individuals may give rise to both the experience of the disorder and the negative outcomes, even if the disorder has no independent influence on the outcome. As an example of the latter case, it is possible that service members in relatively poor health prior to combat are also those most likely to experience PTSD post-combat. Such an association would lead to post-combat associations between PTSD and poor health, even if one of these variables did not cause the other.

A common technique for supporting causal statements about the impact of mental illness is to conduct longitudinal research, i.e., studies that assess individuals on multiple occasions to determine the temporal ordering of symptoms and outcomes. The best of the research reviewed here adopts this approach, but even these studies are limited in several ways. First, they often connect with service members only after they report symptoms, meaning that researchers have no ability to determine whether symptoms or outcomes came first. Second, longitudinal research on individuals with mental disorders is often challenged by high rates of attrition, such that the most vulnerable individuals fail to provide data at all assessments, restricting samples (and conclusions) to only the least vulnerable individuals (Corrigan, Bogner, Mysiw, Clinchot, &

Fugate, 1997; Corrigan, Harrison-Felix, Bogner, Dijkers, Terrill et al., 2003). Third, even the longitudinal studies described here typically follow service members only for a few years, and intervals are typically chosen based on convenience rather than a model of how long it may take the consequences of mental disorders to emerge. Longitudinal research that successfully follows service members from pre-deployment, through post-deployment, and into post-service would provide crucial insights into the etiology and consequences of combat-related mental illness. In the absence of such data, the existing research supports conclusions about how mental disorders are associated with subsequent negative outcomes for service members, but not about whether the disorders may be considered causes of those outcomes.

Assessment and diagnosis. Although research on the prevalence of PTSD, depression, and TBI after service in OEF and OIF has relied on only a small number of assessment tools (as noted in Chapter 2), research on the consequences of these disorders has used a vast array of instruments and strategies. Some research has examined diagnosable instances of each disorder, whereas others have addressed levels of self-reported symptoms. More significantly, some research has examined associations between each disorder and outcomes shortly after combat, whereas other research, especially research on veterans of Vietnam, have examined these associations years or even decades after the veterans had their combat experiences. Understanding how mental disorders affect the lives of afflicted service members will require greater attention to how and when these disorders are assessed. The longer the interval between the onset of symptoms and the time they are assessed, the more time those symptoms have to impact the functioning of the individual, and the greater the likelihood that a particular study will observe a negative consequence. To determine the course of these disorders across the lives of afflicted service members, and so to determine the optimal windows for interventions, the best research will assess service members before and immediately after deployment to a combat zone, and then at regular intervals subsequent to combat and post-service.

Generalizing across services and components. Research on the implications of mental disorders in veterans of Vietnam rarely specifies the component of the military (i.e., active duty or Reserves) or the service within which the veteran served. Because different segments of the military are likely to have different experiences and have access to different sources of support, careful attention to service and component will be important in future research to understand the mental health implications of OEF and OIF. In these conflicts, the Army and Marines have had

more exposure to combat than the other services, suggesting that the prevalence of combat-related mental disorders (and accordingly the need for post-combat support) should be greater in these services than in the other services. There may also be differences in prevalence rates between active duty and Reservists: although the majority of the forces in OEF and OIF come from the active component, Reservists have been deployed at higher rates in these conflicts than in the recent past. To the extent that combat for Reservists is more unexpected, and to the extent that Reservists have less access to support services after deployment because they are less likely to live near a base, then mental disorders may be more prevalent and have more severe consequences for Reservists. To examine this possibility, and to inform the future allocation of resources between Reservists and active duty members, research that directly compares the prevalence and consequences of mental disorders across the services and across the components is needed.

Gathering population data. Virtually all of the data on the implications of post-combat mental disorders come from treatment, clinical, and help-seeking samples. Because those who seek treatment are likely to differ from those who do not, these samples form an inadequate basis from which to draw conclusions about the military as a whole. Systematic assessments of the entire military population will provide a more accurate sense of the distribution of post-combat mental disorders and their consequences, and thus a more accurate view of the true costs of the current conflicts.

Recommendations for Policy and Intervention

Throughout this report, we have endeavored to emphasize the limitations in the existing literature, the need for additional research, and the inability of the majority of the studies reviewed here to support causal statements. Notwithstanding these caveats, the pattern of findings paints a broadly consistent picture that may serve as a basis for specific, immediate recommendations for policies and interventions to promote the well-being of service members afflicted with mental disorders post-combat.

Facilitate service members seeking and receiving treatment. The most powerful message of the accumulated research on the lives of individuals afflicted with PTSD, depression, or TBI is that, on average, these disorders are associated with great suffering and impaired functioning across multiple domains. To the extent that effective treatments for these disorders can be found,

any efforts that connect afflicted service members with those treatments therefore has the potential to promote the well-being of afflicted service members substantially. One step toward that goal is to eliminate any stigma associated with service members asking for and receiving assistance for mental disorders. One possibility in this regard would be to provide concrete incentives for seeking treatment, upholding treatment for mental disorders as something that military not only accepts but rewards. A second step is to ensure that treatments are accessible to all service members suffering from mental disorders. Achieving this goal will require attending to the different ways that service members in the active duty and Reserves currently access mental health services.

Early interventions are likely to pay long-term dividends. The model described in Chapter 3 of this report emphasizes the accumulation of negative outcomes over time, suggesting that the immediate consequences of mental disorders, if left untreated, themselves can give rise to long-term consequences. To the extent that the research reviewed here supports this cascade, then it is crucial that programs and policies directed toward afflicted service members intervene early, to prevent the cascade of negative consequences from occurring. Frequent assessments of service members' mental health and early detection of problems be central to this effort. Waiting for service members themselves to seek treatment may be too late, as service members may be motivated to seek treatment only after their impairments have resulted in negative consequences.

Policies that promote resilience may be as effective as programs that target the symptoms of mental disorders directly. A second implication of the model described in Chapter 3 is that the consequences of a mental disorder are affected as much by the circumstances of the afflicted individual as by the severity of the individual's symptoms. The support for this idea throughout the research reviewed in this report suggests that policies aimed at alleviating the suffering of afflicted service members expand their focus beyond simply treating the disorders. To the extent that financial security is a source of protection, then improved financial service for veterans may play an important role in mitigating the negative consequences of post-combat mental disorders. To the extent that close relationships with family members serve as a source of social support for afflicted service members, then treatment programs that address these relationships directly may be warranted. To the extent that officers' behaviors can exacerbate or buffer the effects of stress on the troops under their command (Britt, Davison, Bliese, & Castro, 2004), then officers and other military leaders might be instructed in methods for creating working environments in

which troops may manage stress optimally. Overall, the connections among the various symptoms and consequences of each of these disorders points toward an integrated approach to treatment. Programs that account for multiple aspects of service members' lives may be more effective than programs that attempt to address specific domains independently.

Conclusions

The three mental disorders most prevalent in service members returning from combat in OEF and OIF – PTSD, depression, and TBI – are not new. All three have been recognized for decades or more and all three have been studied extensively for their associations with functioning in various domains of life. Although not without its limitations, this literature is nevertheless extensive and the results are consistent, providing a firm basis from which to project the likely consequences of these disorders for service members returning from the current conflicts. In general, the review described in this report reveals those consequences to be severe, negative, and wide-ranging, affecting not only multiple domains of life for afflicted service members, but their spouses, partners, and children as well. The predictions are not optimistic, but negative outcomes may be preventable with early and careful interventions. The research results assembled and summarized here may therefore serve as a call to action.

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