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Mental Health Among Reserve Component Military Service Members and Veterans

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Since 2001, the US military has increasingly relied on National Guard and reserve component forces to meet operational demands. Differences in preparation and military engagement experiences between active component and reserve component forces have long suggested that the psychiatric consequences of military engagement differ by component. We conducted a systematic review of prevalence and new onset of psychiatric disorders among reserve component forces and a meta-analysis of prevalence estimates comparing reserve component and active component forces, and we documented stage-sequential drivers of psychiatric burden among reserve component forces. We identified 27 reports from 19 unique samples published between 1985 and 2012: 9 studies reporting on the reserve component alone and 10 reporting on both the reserve component and the active component. The pooled prevalence for alcohol use disorders of 14.5% (95% confidence interval: 12.7, 15.2) among the reserve component was higher than that of 11.7% (95% confidence interval: 10.9, 12.6) among the active component, while there were no component differences for depression or post-traumatic stress disorder. We observed substantial heterogeneity in prevalence estimates reported by the reserve component. Published studies suggest that stage-sequential risk factors throughout the deployment cycle predicted alcohol use disorders, post-traumatic stress disorder and, to a lesser degree, depression. Improved and more standardized documentation of the mental health burden, as well as study of explanatory factors within a life-course framework, is necessary to inform mitigating strategies and to reduce psychiatric burden among reserve component forces.

alcoholism; depression; mental health; military medicine; stress disorders, post-traumatic; veterans' health

Abbreviations: CI, confidence interval; DSM, *Diagnostic and Statistical Manual of Mental Disorders*; MeSH, Medical Subject Headings; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; PCL, Post-Traumatic Stress Disorder Checklist; PTSD, post-traumatic stress disorder.

INTRODUCTION

The US Armed Forces span 2 executive departments of the federal government (Department of Defense and Department of Homeland Security) and are composed of more than 2.7 million armed services members coordinating to ensure national security. The US military includes 2 components; the full-time, or active, component includes more than 1.4 million soldiers (US Army), sailors (US Navy), marines (US Marine Corp), airmen (US Air Force), and coastguardsmen (US Coast Guard), while the part-time, or reserve, component includes more than 1.2 million Army and Air National Guardsmen and members of the Army, Navy, Marine, Air Force, and Coast Guard Reserve.

During the early to mid-20th century, the active component deployed worldwide at the command of the President or Congress, while the National Guard largely supported individual states, and reserves were a trained operational force in reserve ready to augment the active component when required. Although all reserve component forces receive training and equipment similar to those of their active component counterparts, National Guard and reserve service members are citizen soldiers who generally serve 1 weekend a month and 15 days annually. Further, there are substantive administrative differences between National Guard and reserve forces. For example, although the Army, Navy, Marine, Air Force, and Coast Guard reserves are managed regionally at the federal level similarly to the active component, the Army and Air National Guard perform both federal and state operations. In summary, National Guard forces are managed by their respective state governments but can be called into federal service by the President of the United States as

needed during a time of war or crisis. In a time of war (e.g., Korean War, Vietnam War), it was expected that reserve component service members would be called upon to augment active component service members in operational roles, principally in combat support or combat service support. In the aftermath of the Vietnam War, the Total Force Policy was adopted to treat the 2 components as a single operational force. The first significant demonstration of the unified operational force created by the Total Force Policy was during Operation Enduring Freedom (OEF; October 2001–present day) and Operation Iraqi Freedom (OIF; March 2003–December 2011), which exerted substantial demand on the US Armed Forces to train and deploy combat-ready troops to multiple fronts for over 10 years of sustained conflict. As a result of the high operational tempo experienced through OEF/OIF, the military began to place a greater reliance on the reserve component to meet demands. During the height of mobilization in OIF/OEF, reserve component forces constituted approximately 40% of deployed service members in combat operations.

This reliance on the reserve component is not idiosyncratic to OEF/OIF; it is part of the Department of Defense's long-term strategic vision to increase the size, roles, and responsibilities of the reserve component moving forward (1–4). During the 21st century, the reserve component has assumed key support roles during both domestic (e.g., Hurricanes Katrina and Sandy) and international (e.g., OEF/OIF, humanitarian relief following 2010 Haiti earthquake) operations, exposing service members to a range of potentially traumatic events, including witnessing the mass casualties and destructions of national disasters (5, 6), and traumatic combat exposures comparable to active component service members' experiences when activated for deployment (7). Further, following combat deployment, reserve component service members face particular readjustment challenges that have been documented to increase their psychiatric disorder burden, relative to their active component counterparts (7). Some of the challenges they face include the vulnerability associated with deployment without one's own unit, which is associated with lower unit cohesion and reduced social support (8); unique family life and relationship difficulties (9); uncertain employment status upon return (9); and expectations of a smooth postdeployment readjustment and rapid resumption of predeployment civilian roles (9). Further, the eligibility of reserve component service members to receive active duty health services is conditional upon being called, or ordered, by the federal government to active service for more than 30 days in support of a contingency operation. During this time of activation, as well as 30 days pre- and postactivation, reserve component service members and their families may receive health services through the TRICARE system. Further, reserve component service members who incur, or aggravate, a disease or injury as a result of federally assigned active service duties may be eligible for benefits through the Veterans Administration (10).

Given the US Armed Forces' growing reliance on the reserve component (1), a better understanding of the mental health of this group is warranted. To the best of our knowledge, there has been no systematic review that has assessed whether there are differences between the reserve component and active component in terms of burden and drivers of psychiatric disorders. Similarly, there has been no review of stage-sequential risk factors for psychiatric disorders in the reserve component.

Informed by these gaps in the literature, this review aimed to do the following: 1) document the prevalence and incidence estimates of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM) psychiatric disorders in the reserve component among current service members and veterans; 2) compare the prevalence and incidence estimates between the reserve component and the active component where possible; and 3) assess which pre-, peri-, postdeployment factors are consistently associated with psychiatric burden among reserve component service members, guided by a stage-sequential framework of their engagement in military combat operations (Figure 1).

METHODS

Search strategy

In January 2014, we searched MEDLINE and PsycINFO databases with the OVID interface for original empirical

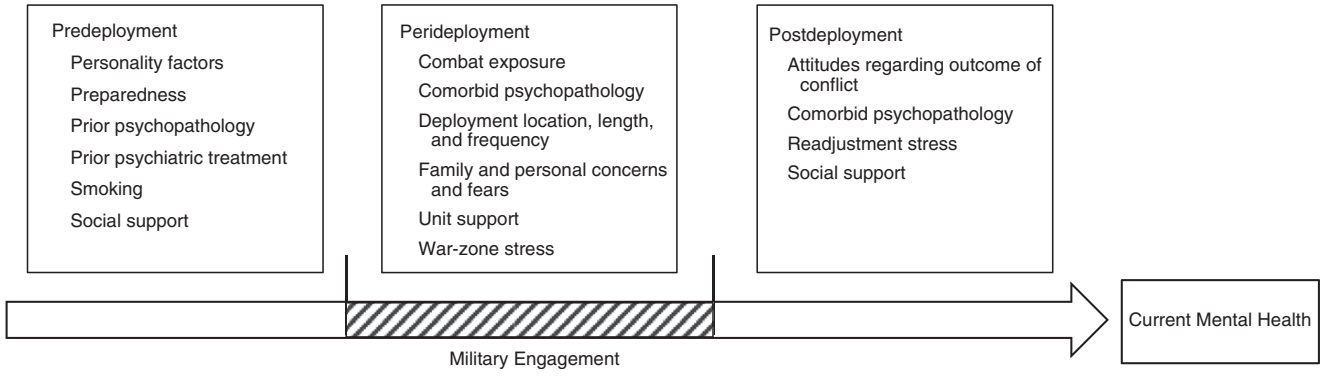

Figure 1. Schematic of predeployment, perideployment, and postdeployment influences on observed mental health in US National Guard and reserve service members, 1985–2012.

research articles estimating the prevalence and incidence of psychiatric disorders in the US National Guard and reserve component. We used Medical Subject Headings (MeSH) terms when possible to expand the breadth of our search. The primary database search was supplemented by a search of MEDLINE through PubMed restricted to the prior 6 months (from June 2013 until January 14, 2014) to capture any articles published ahead of print and not captured in the Ovid system. We searched the identified relevant review article bibliographies for additional citations. Only English language articles were considered.

Our search algorithm was as follows: ("veteran*" OR military personnel (MeSH)) AND [("psychiatry*" OR psychiatry (MeSH)) OR ("mental health*" OR mental health (MeSH)) OR ("psychology*" or psychology (MeSH)) OR ("behavioral health*" OR behavioral symptoms (MeSH) OR stress disorders (MeSH) OR "risk taking*" OR alcohol-related disorders (MeSH) OR substance-related disorders (MeSH))].

Study selection

Three of the authors (G. H. C., D. S. F., L. S.) 1) reviewed titles identified by the above search, 2) reviewed abstracts retained in the title review, and 3) reviewed full articles identified in the abstract review. Throughout this process, the authors were in close contact to resolve problems and answer questions as they arose; disagreements were resolved by the senior author (S. G.).

Studies meeting these 4 criteria were considered eligible for the systematic review: 1) They were population-based studies, representative of a clearly defined base population; 2) the sample included US National Guard and reserve component service members; 3) studies included prevalence or incidence estimates of psychiatric disorders based on the DSM; and 4) studies included samples from the Vietnam War era or later. We excluded samples from countries other than the United States because of substantial operational differences in the structure and functioning of reserve component forces across countries.

Data extraction and management

Three review authors (G. H. C., D. S. F., L. S.) extracted the following data using a standardized article assessment form developed by the authors: dates of study, study design (e.g., cross-sectional, longitudinal cohort), inclusion and exclusion criteria, response rate, number of participants, participant characteristics (e.g., gender, era of service, percentage of participants deployed), description of outcome, psychiatric diagnosis and assessment tools, effect estimates, and predictors. We tested the assessment form to ensure standardization of data collection among the authors and double checked all extracted results.

Prevalence estimates of psychiatric disorder were considered to be the number of cases divided by the sample size. Although we set out to examine incidence rates, we identified no studies that considered the number of new cases divided by the sample size at risk during a given time period, but only the number of new-onset disorders identified between 2 interview intervals that typically centered around a deployment. Therefore, we presented estimates of new-onset psychiatric disorders in lieu of incidence rates.

Stage-sequential risk factors for psychiatric disorders, identified from studies that met the inclusion criteria, were reported if they fit clearly into the pre-, peri-, and postdeployment stages, as outlined in Figure 1. These factors were identified by searching included studies for associations between stage-sequential risk factors and the outcome(s) of focus. We describe each included risk factor and the psychiatric disorder predicted.

Data analysis

Data were examined in 3 phases. First, we tabulated all extracted data from studies estimating prevalence or new onset of psychiatric disorders in the reserve component, documenting the following: study era; number of National Guard and reserve component service members in the study; specific reserve component (i.e., National Guard, reserve); whether study participants' survey responses were identified to the military (i.e., military database); length of recall in cross-sectional studies or length of investigation in cohort studies; measures assessing psychiatric disorders; sample characteristics (e.g., postdeployment, nondeployed); and prevalence estimates for alcohol use disorders (alcohol abuse or dependence), depression, and post-traumatic stress disorder (PTSD). If more than one cross-sectional report was available for the same study sample, the most comprehensive report was selected.

To accomplish our second aim, we calculated the standard error and variance for each study reporting prevalence of psychiatric disorders in both the reserve component and active component. Next, we weighted each study by sample size and performed separate analyses for each disorder. Heterogeneity of data was assessed with the Q test and I^2 statistic by using Microsoft Excel (11). Because we anticipated heterogeneity of prevalence estimates due to differences in study methodologies and measurement tools, we used random-effects models to calculate pooled prevalence estimates and 95% confidence intervals. Statistical differences in prevalence estimates by component were assessed by comparing 95% confidence intervals. The meta-analysis was performed in Microsoft Excel for Macintosh (12).

Third, using the stage-sequential framework presented in Figure 1, we identified predictors of psychiatric disorders throughout the deployment cycle documented in the published literature.

RESULTS

Search results

Figure 2 shows a flow diagram documenting the total number of reports screened, excluded on the basis of screening criteria, and final number included for this review. We identified 8,457 citations through the Ovid system and 790 potential ahead-of-print or recent-print articles through PubMed with the initial search strategy, including 619 duplicates. Of these citations, 7,283 studies were excluded by reviewing the title and abstract with the aforementioned criteria. After full

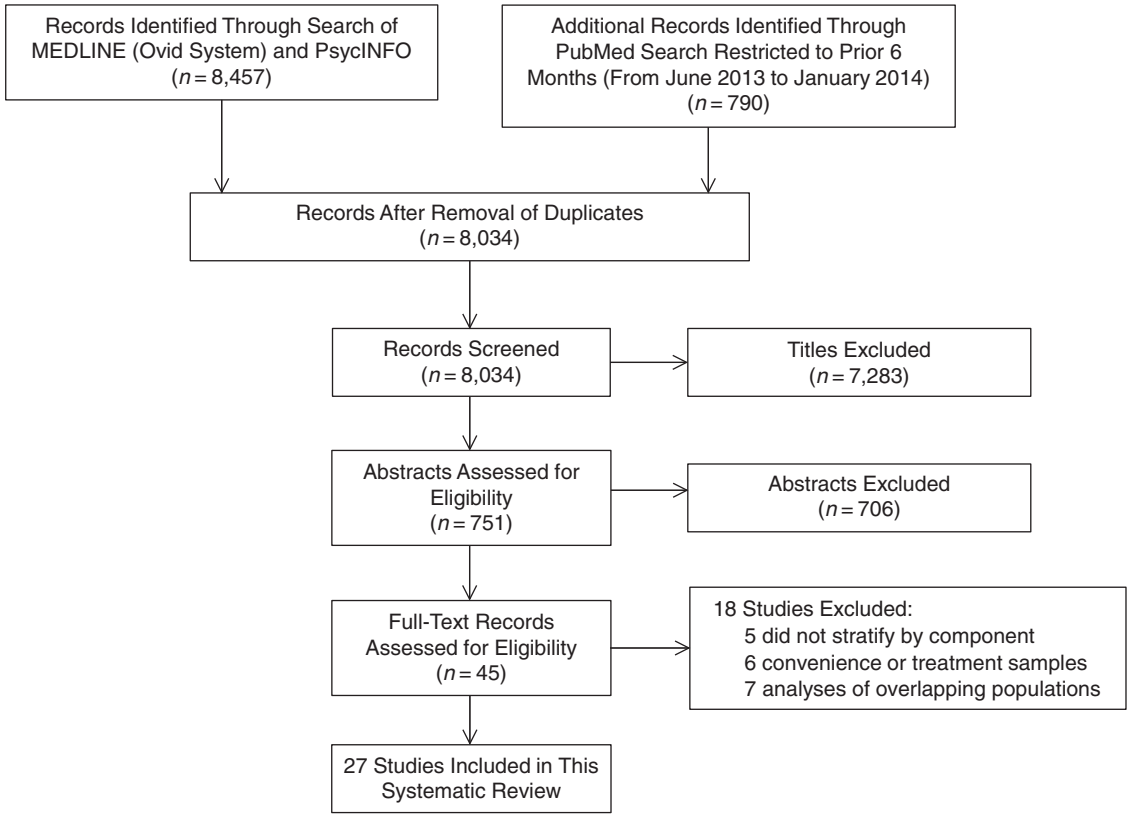

Figure 2. Flowchart of literature search for systematic review and meta-analysis of prevalence and incidence estimates of psychiatric disorders in US National Guard and reserve service members, including literature published between 1970 and 2014.

examination of the remaining 751 articles, 724 were excluded for the reasons shown in Figure 2. Finally, 27 reports met the inclusion criteria and were included in this systematic review.

Characteristics of the included studies

Among the 27 identified manuscripts, 21 documented prevalence estimates (Table 1), and 6 documented incidence estimates (Table 2). Overall, 19 unique studies produced the 27 manuscripts, with 14 of the 27 total manuscripts developed from 5 studies, including the Ohio Army National Guard Mental Health Initiative, the Readiness and Resilience in National Guard Soldiers Study, the Millennium Cohort Study, the New Jersey National Guard Study, and the Iowa Persian Gulf Study Group. Sample sizes ranged from 124 (13) to 222,183 (14). Overall, the median sample size was 2,616 participants (interquartile range, 537–35,998). The DSM outcomes observed included alcohol abuse and/or dependence; PTSD and anxiety disorders other than PTSD (i.e., generalized anxiety disorder, panic disorder); depression (i.e., major depressive disorder, other depression); and eating disorders (i.e., bulimia, anorexia). However, only alcohol use disorders, depression, and PTSD risk estimates were documented in multiple studies, enabling comparison. Therefore, we concentrated on these 3 psychiatric disorders for the review. Disorders were assessed predominantly by using self-reported scales ($n = 16$) as compared with clinician diagnosis ($n = 2$); the Readiness and Resilience in National Guard Soldiers Study used both self-reported scales and clinical interviews.

Prevalence estimates

Among the 19 unique studies reporting prevalence estimates, 9 studies reported results on the reserve component alone, and 10 studies reported results on both the reserve component and the active component (Table 1). The studies included 12 OEF/OIF era samples, 6 Persian Gulf War era (Operation Desert Shield, August 1990–February 1991) samples, and 1 Vietnam War era sample (December 1956–April 1975). Alcohol use disorder measures ranged from brief screeners (i.e., Two-Item Conjoint Screen) to the "gold-standard" Structured Clinical Interview for the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV), used in 3 and 2 studies, respectively. The prevalence of alcohol use disorders in these studies ranged from 7.2% to 19.4% among predeployment OEF/OIF National Guardsmen diagnosed by clinician interview and postdeployment Persian Gulf War National Guard and reserve members identified from the 4-item CAGE Questionnaire to diagnose

alcoholism on the basis of responses to 4 questions: cutting down, annoyance at criticism, guilty feeling, and eye-openers. Depression diagnosis was determined primarily by a combination of the 2- and 9-item versions of the Patient Health Questionnaire ($n = 6$). There was a wide spread of prevalence estimates, ranging from 2.7% to 22.0% among a sample of OEF/OIF reserve component service members using the 2-item Patient Health Questionnaire and postdeployment Persian Gulf War reserve component service members using the Beck Depression Inventory. The Post-Traumatic Stress Disorder Checklist (PCL) was the predominant tool used to assess PTSD in studies examining OEF/OIF era National Guard and reserve service members ($n = 7$). Conversely, Persian Gulf War era studies used a combination of the PCL ($n = 2$) and Mississippi Scale for Combat-Related PTSD ($n = 3$), and 1 study used both the PCL and the Mississippi Scale. PTSD prevalence had the widest range of all disorders (1.7%–24.6%). The only consistent observation across studies was that prevalence increased over time when samples were assessed twice. For example, using the primary care PTSD scale with a cutoff of 3 or higher in all reserve component service members completing postdeployment health assessments, we found that 6.6% of the sample screened positive at 3 months and 14.3% screened positive at 6 months. Similarly, in a sample of postdeployment National Guard members, 14.7% and 24.6% were diagnosed by using the PCL with DSM scoring and a score of 50 or greater at 3 and 12 months, respectively.

Figure 3 shows that the summary prevalence for alcohol use disorders in National Guard and reserve service members of 14.5% (95% confidence interval (CI): 12.7, 15.2) was higher than the summary prevalence in active duty members of 11.7% (95% CI: 10.9, 12.6), and the confidence intervals are nonoverlapping, indicating a statistically significant difference. Figure 4 shows similar prevalence estimates for depression in the reserve component of 5.6% (95% CI: 4.4, 6.8) and in the active component of 7.1% (95% CI: 5.5, 8.7). Further, 4 of the 6 studies reporting depression in both the reserve component and the active component had similar estimates, while Kim et al. (15) reported that the active component had a higher prevalence for depression of 8.1% (95% CI: 7.2, 8.9) than did the reserve component with a prevalence of 3.6% (95% CI: 2.7, 4.6), and Iowa et al. (16) reported that the reserve component service members had a higher prevalence of 10.1% (95% CI: 8.0, 12.0) than did the active component with 3.9% (95% CI: 2.7, 5.2) among Persian Gulf War veterans.

Figure 5 shows that the reserve component has PTSD prevalence estimates of 9.8% (95% CI: 5.9, 13.7) that were similar to those for the active component studies with 8.9% (95% CI: 5.7, 12.1). The heterogeneity of documented PTSD prevalence between studies resulted in wide confidence intervals for the summary estimates.

New-onset estimates

Three cohort studies (Ohio Army National Guard Mental Health Initiative, Readiness and Resilience in National Guard Soldiers Study, and Millennium Cohort Study) originated the 6 manuscripts documenting new-onset estimates, but only the Millennium Cohort Study reported both reserve component and active component new-onset estimates (Table 2). All studies examined OEF/OIF samples exclusively. New-onset alcohol use disorders ranged from 3.3% by using the Patient Health Questionnaire to assess alcohol abuse among postdeployment National Guard and reserve service members without combat exposure to 11.7% among a representative sample of the Ohio Army National Guard by using the Mini–International Neuropsychiatric Interview. The Readiness and Resilience in National Guard Soldiers Study by use of the Structured Clinical Interview for DSM documented new-onset alcohol use disorders at a prevalence of 8.0%, between the estimates reported in the other 2 studies. Although 2 studies used the 9-item Patient Health Questionnaire to measure depression, the Ohio Army National Guard Mental Health Initiative used a sensitive scoring method to determine depression diagnosis (i.e., 2 or more co-occurring items) compared with the standard method used by the Millennium Cohort Study (i.e., 5 or more symptoms including depression or anhedonia, rated as being present at least more than half the days). Although the Ohio Army National Guard used the more sensitive scoring method, the study estimated new-onset depression at 7.0% and the Millennium Cohort Study estimated it between 2.2% and 15.4% depending on gender and deployment status. Although the Millennium Cohort Study and the Readiness and Resilience in National Guard Soldiers Study used the identical scoring methods on the PCL (i.e., reported at least 1 intrusion, 3 avoidance, and 2 hyperarousal symptoms at the moderate level and a total score of at least 50), the Readiness and Resilience in National Guard Soldiers Study in a sample of postdeployment National Guardsmen documented a new-onset PTSD estimate nearly 4-fold higher (13.8%) than did the Millennium Cohort Study sample composed of both deployed and nondeployed National Guard and reserve service members (2.9%). New-onset mental health disorders between the reserve and active components could not be computed as only one study documented estimates for both components.

Psychiatric disorder risk factors around deployment cycle

Figure 1 and Table 3 summarize predeployment, peridedeployment, and postdeployment predictors of psychiatric disorders among National Guard and reserve members across the reviewed studies. Additional details about each of the risk factors identified are given in Appendix Table 1. Alcohol use disorders among deployed service members were predicted by predeployment personality factors, comorbid psychopathology, and smoking; perideployment combat exposure and deployment features; and postdeployment comorbid psychopathology and readjustment stress. PTSD was predicted by predeployment preparedness, prior psychopathology, and social support; perideployment combat exposure and deployment features, unit support, and family and personal concerns or fears; and postdeployment readjustment stress, personal attitudes regarding the conflict, and social support. Depression was predicted by perideployment combat exposure and deployment features and postdeployment readjustment stress. Overall, alcohol use disorders and

Table 1. Source, Era, Sample Size, and Methodological Aspects of the Cross-sectional Prevalence Studies Included in the Review (in Alphabetical Order of First Author by Era), 1985–2012

First Author, Year (Reference No.)	Total No.	National Guard and Reserves	Identified	Reporting Method	Length of Investigation/ Recall	Measures	Survey Timing	Prevalence Estimate, %		
								AUD	Depression	PTSD
Operation Enduring Freedom/Operation Iraqi Freedom										
Allison-Aipa, 2010 (37)	51,078	Reserves	Yes	Self-report	Current	AUD: TICS; depression: PHQ-2; PTSD: PC-PTSD	Postdeployment	14.0	14.0	16.0
Goldmann, 2012 (38)	2,616	National Guard	No	Self-report	Current	PTSD: PCL[a]	Postdeployment			9.6
Kim, 2010 (15)	1,510 (3 months), 758 (6 months)	National Guard and reserves	No	Self-report	Current	Depression: PHQ-9; PTSD: PCL[b]	Postdeployment		3.6 (3 months), 5.5 (12 months)	13.0 (3 months), 17.0 (12 months)
Milliken, 2007 (39)	31,885	National Guard and reserves	Yes	Self-report	Current	AUD: TICS; depression: PHQ-2; PTSD: PC-PTSD	Postdeployment	15.0 (6 months)	3.8 (3 months), 13.0 (6 months)	12.7 (≥2) and 6.6 (≥3) (3 months); 24.5 (≥2) and 14.3 (≥3) (6 months)
Martin, 2007 (14)	87,136	National Guard and reserves	Yes	Self-report	Current	PTSD: PC-PTSD	Postdeployment			11.7
Kline, 2010 (40)	2,543	National Guard	No	Self-report	Current	AUD: NSDUH; depression: PHQ-9; PTSD: PCL[d]	Predeployment	7.2[c]	3.4	6.7
Kline, 2011 (41)	1,665	National Guard	No	Self-report	Current	AUD: NSDUH; depression: PHQ-9; PTSD: PCL[d]	Postdeployment	12.6[c]	5.8	10.8
Pietrzak, 2009 (42)	394	National Guard	No	Self-report	Current	PTSD: PCL[d]	Postdeployment			20.1
Riddle, 2007 (43)	76,476	National Guard and reserves	No	Self-report	30-days	AUD: PHQ; depression: PHQ-9; PTSD: PCL[b]	General	14.1	2.7	2.2
Kehle, 2011 (44)	348	National Guard	No	Interview	Current	AUD: SCID; depression: SCID; PTSD: CAPS	Postdeployment	12.9	14.7	6.6
Polusny, 2011 (45)	516	National Guard	No	Self-report	Current	PTSD: PCL[e]	Predeployment			3.7
Seal, 2007 (46)	49,401	National Guard and reserves	No	VA diagnosis on file	2001–2005	PTSD: ICD-9 diagnosis	Veteran			12.9
Shea, 2010 (13)	124	National Guard and reserves	No	Interview	Current	AUD and depression: SCID; PTSD: CAPS	Postdeployment	8.9	12.1	14.5

Table continues

Table 1. Continued

First Author, Year (Reference No.)	Total No.	National Guard and Reserves	Identified	Reporting Method	Length of Investigation/ Recall	Measures	Survey Timing	Prevalence Estimate, %		
								AUD	Depression	PTSD
Thomas, 2010 (7)	1,585 (3 months), 2,684 (12 months)	National Guard	No	Self-report	Current	AUD: TICS; Depression: PHQ-9; PTSD: PCL[b]	Postdeployment	14.5 (3 months), 15.0 (12 months)	10.1 (3 months), 13.7 (12 months)	14.7 (3 months), 24.6 (12 months)
						Persian Gulf War				
Benotsch, 2000 (47)	348	National Guard and reserves	No	Self-report	Current	PTSD: PCL[a]	Postdeployment			10.9
Holmes, 1998 (48)	296	National Guard	No	Self-report	Current	PTSD: Mississippi Scale	Postdeployment			6.8
	179						Nondeployed			1.7
Iowa Persian Gulf War Study Group, 1997 (16)	911	National Guard and reserves	No	Self-report	Current	AUD: CAGE; depression: PRIME-MD; PTSD: PCL[d]	Postdeployment	19.4	10.1	2.0
	831						Nondeployed	16.8	5.3	1.1
Kang, 2003 (49)	7,174	National Guard and reserves	No	Self-report	Current	PTSD: PC-PTSD	Postdeployment			13.3
Ross, 1993 (50)	251	National Guard and reserves	No	Self-report	Current	PTSD: Mississippi Scale	General			5.0
Sutker, 1993 (51)	275	National Guard and reserves	No	Self-report	Current	Depression: BDI; PTSD: PCL and Mississippi Scale	Postdeployment		22.0	19.0 (Mississippi Scale), 16.0 (PCL)
						Vietnam War				
Stretch, 1985 (52)	925	Reserves	No	Self-report	Current	PTSD: VEVAS	Deployed veterans			10.9
							Nondeployed veterans			1.5

Abbreviations: AUD, alcohol use disorder; BDI, Beck Depression Inventory; CAGE, questionnaire with 4 items (cutting down, annoyance at criticism, guilty feeling, eye-openers) used to diagnose alcoholism; CAPS, clinician-administered PTSD scale; DSM, *Diagnostic and Statistical Manual of Mental Disorders*; ICD-9, *International Classification of Diseases, Ninth Revision*; NSDUH, National Survey on Drug Use and Health; PC-PTSD, primary care-PTSD screen; PCL, Post-Traumatic Stress Disorder Checklist; PHQ, Patient Health Questionnaire; PHQ-2 and PHQ-9, 2- and 9-item components of the longer Patient Health Questionnaire; PRIME-MD, Primary Care Evaluation of Mental Disorders; PTSD, post-traumatic stress disorder; SCID, Structured Clinical Interview for the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; TICS, Two-Item Conjoin Screen; VA, Department of Veterans Affairs; VEVAS, Vietnam-Era Veterans Adjustment Survey.

[a] PCL-DSM: reporting at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms at the moderate level on the PCL.

[b] PCL-DSM-50: reporting at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms at the moderate level and total score of at least 50 on the PCL.

[c] Alcohol dependence.

[d] PCL-50: total score of at least 50 (range, 17–85) on the PCL.

[e] PCL: total score of at least 34 (range, 17–85) on the PCL.

Table 2. Source, Sample Size, and Methodological Aspects of the New-Onset Studies Included in This Review[a] From Operation Enduring Freedom/Operation Iraqi Freedom, 2008–2012

First Author, Year, (Reference No.)	Total No.	National Guard and/or Reserves	Identified	Reporting Method	Length of Investigation or Recall, Months	Measures	Respondent's Deployment Status	Time Between Surveys	New-Onset Estimate, %		
									AUD	Depression	PTSD
Marshall, 2012 (53)	1,391	National Guard	No	Self-report	12	AUD: MINI-Depression Scale and PHQ-9; PTSD: PCL[b]	Deployed	Retrospective	11.7	10.8	8.0
Jacobson, 2008 (54)	21,868	National Guard and reserves	No	Self-report	12	AUD: PHQ	Nondeployed	3 years	3.3		
							Deployed without combat exposure	3 years	2.8		
							Deployed with combat exposure	3 years	6.0		
Wells, 2010 (29)	18,192	National Guard and reserves	No	Self-report	12	PHQ-9	Nondeployed	3 years		5.0	
							Deployed without combat exposure	3 years		2.8	
							Deployed with combat exposure	3 years		8.2	
Smith, 2008 (55)	22,531	National Guard and reserves	No	Self-report	12	PCL[c,d]	General	3 years			3.7[c], 2.9[d]
Kehle, 2012 (56)	349	National Guard	No	Interview	20	AUD: SCID	Deployed	Predeployment/ 6–12 months postdeployment	8.0		
Polusny, 2011 (45)	424	National Guard	No	Self-report	12	PCL[d]	Deployed	Predeployment/ 6–12 months postdeployment			11.3[d]

Abbreviations: AUD, alcohol use disorder; DSM-IV, *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*; MINI, Mini–International Neuropsychiatric Interview; PCL, Post-Traumatic Stress Disorder Checklist; PHQ-9, 9-item Patient Health Questionnaire; PTSD, post-traumatic stress disorder; SCID, Structured Clinical Interview for DSM-IV.

[a] In alphabetical order of study name.

[b] PCL-DSM: reporting at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms at the moderate level on the PCL.

[c] PCL-DSM-50: reporting at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms at the moderate level and total score of at least 50 on the PCL.

[d] PCL-50: total score of at least 50 (range, 17–85) on the PCL.

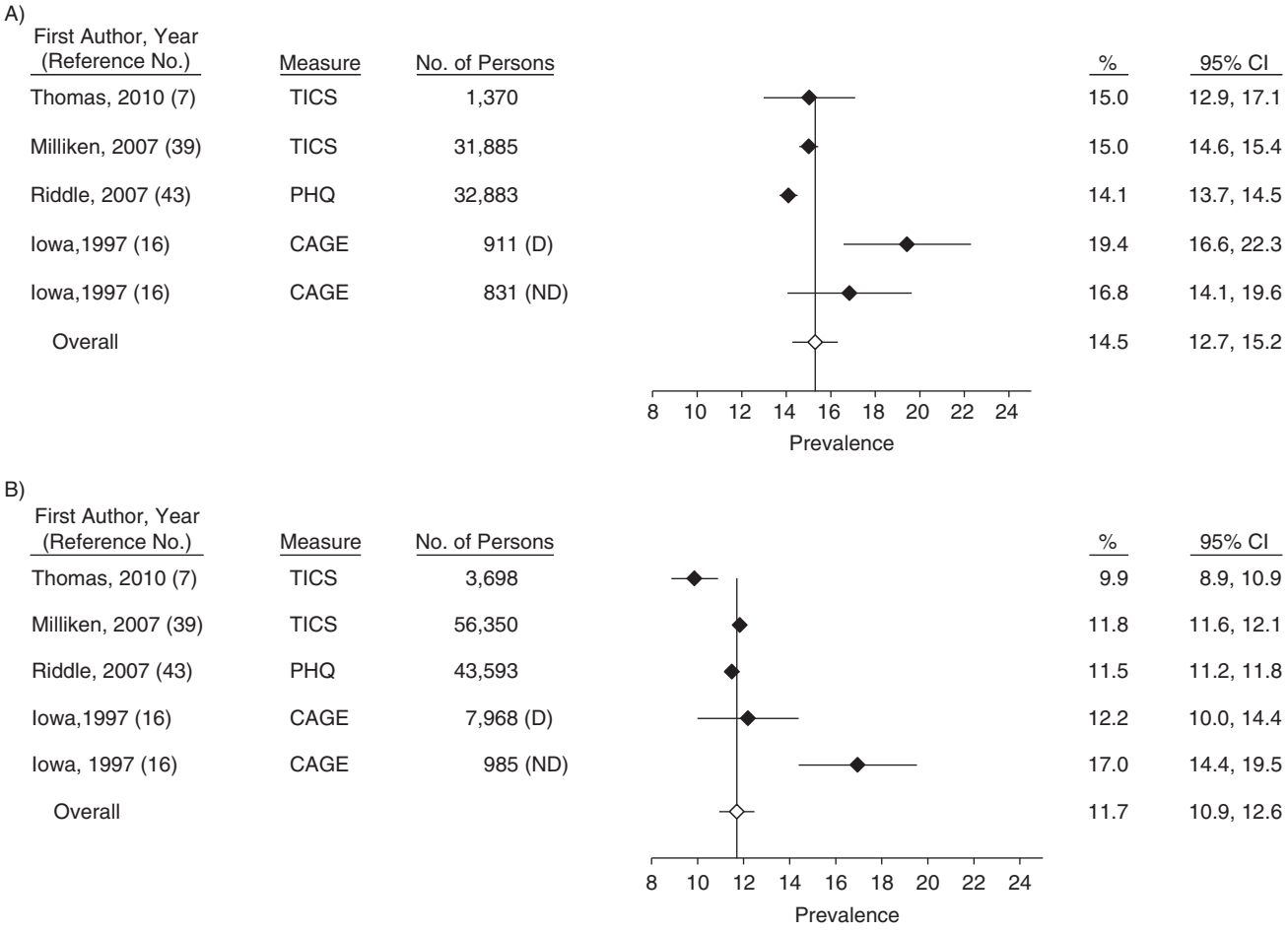

Figure 3. Prevalence meta-analysis of alcohol use disorder among National Guard and reserve service members (A) and active duty service members (B), 1997–2010. Bars, 95% confidence interval (CI). CAGE, CAGE Questionnaire; D, deployed during the Persian Gulf War; ND, served but did not deploy during the Persian Gulf War; PHQ, Patient Health Questionnaire; TICS, Two-Item Conjoint Screen.

PTSD were associated with a variety of stage-sequential risk factors, while depression was associated only with deployment factors. Additionally, co-occurring psychiatric disorders predicted alcohol misuse throughout the deployment cycle.

DISCUSSION

Through a comprehensive systematic review and meta-analysis of studies estimating the prevalence and new-onset of DSM psychiatric disorders in the reserve component, we found the following: 1) that alcohol use disorders, depression, and PTSD are the most commonly documented DSM psychiatric disorders in the reserve component and no other disorders were studied in more than one report; 2) that there is significant heterogeneity of risk estimates observed between reserve component–specific samples, likely accounted for by changing diagnostic definitions and substantially different methodology across studies; 3) that the pooled prevalence for alcohol use disorders for the reserve component of 14.5% (95% CI: 12.7, 15.2) is higher than that for the active component of 11.7% (95% CI: 10.9, 12.6), while there was no difference in depression and PTSD prevalence between the reserve component and the active component; and 4) that there were a variety of stage-sequential risk factors for postdeployment alcohol use disorders and PTSD, while postdeployment depression was predicted principally by deployment factors.

We found 27 separate papers from 19 unique studies examining the reserve component from Vietnam era samples to the present. Given the growing importance of the reserve component, this represents a paucity of population-based studies of psychiatric disorders in the National Guard and reserve component. Although we identified several additional studies documenting psychopathology in reserve component service members, a large number of these studies are based on convenience samples that limit the generalizability of inference that can be drawn from these estimates. We anticipate that some more insight will emerge from the ongoing work in the area. To our knowledge, there are 4 currently active cohort studies examining the National Guard and reserve component: the Millennium Cohort Study, the Readiness and Resilience

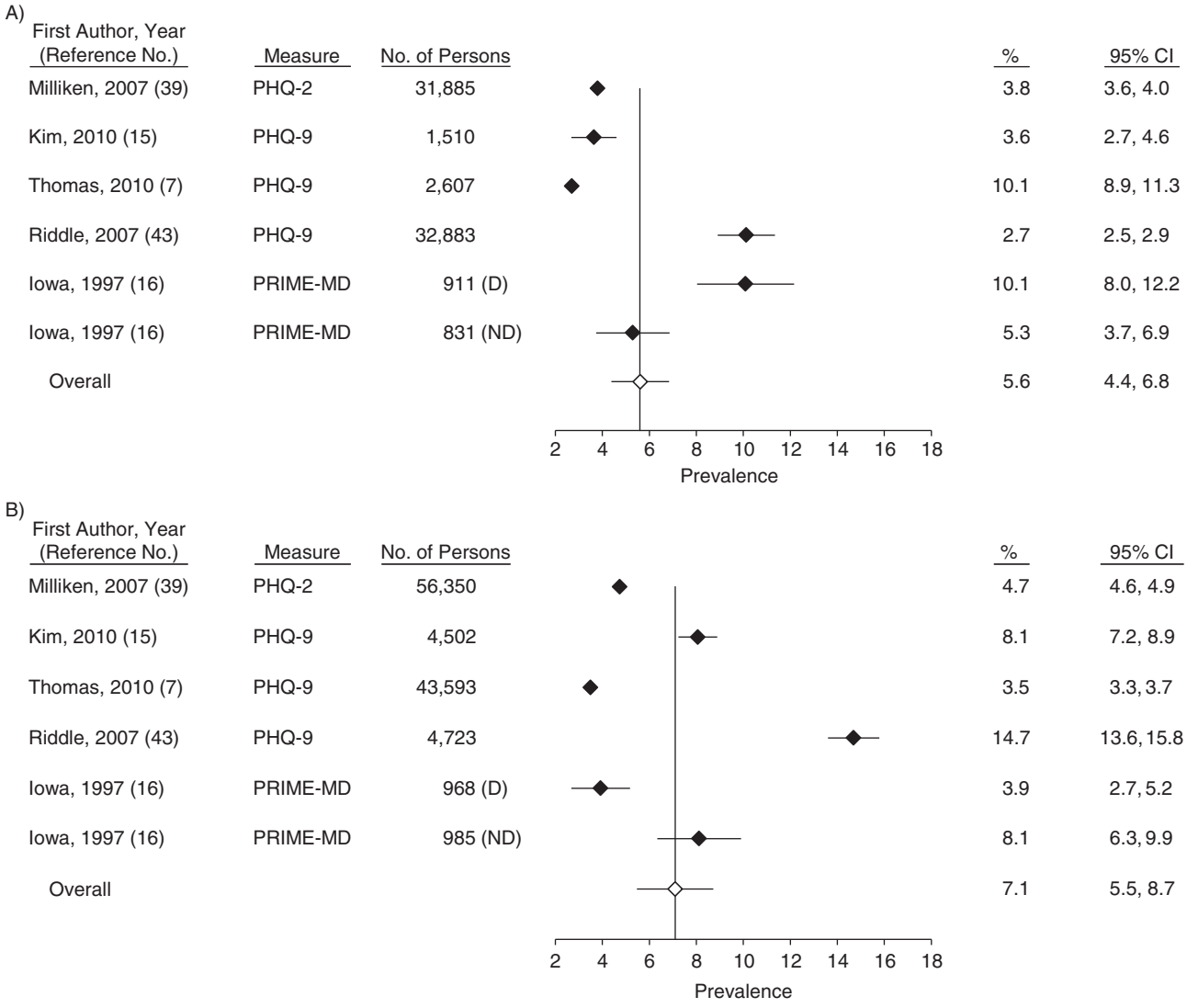

Figure 4. Prevalence meta-analysis of depression among National Guard and reserve service members (A) and active duty service members (B), 1997–2010. Bars, 95% confidence interval (CI). D, deployed during the Persian Gulf War; ND, served but did not deploy during the Persian Gulf War; PHQ-2 and PHQ-9, 2- and 9-item components of the longer Patient Health Questionnaire; PRIME-MD, Primary Care Evaluation of Mental Disorders.

in National Guard Soldiers Study, the Ohio Army National Guard Mental Health Initiative, and the Reserve National Guard Study. Unfortunately, although the All Army Study and the Historic Administrative Data Study components of the Army Study to Assess Risk and Resilience in Service members, the largest study of military mental health risk and resiliency, include some Army Reserve and National Guard members, these samples are limited to the Army National Guard and reserve component members who were mobilized at the time of data collection, effectively excluding the majority of reserve component service members from their selection pool. As the Department of Defense shifts its long-term strategic vision to increase the reserve component's operational capacity, it becomes more important than ever for future studies to include systematic samples of reservists.

The heterogeneity of prevalence and new-onset psychiatric disorder estimates observed across studies was likely driven by the 1) changing definition of psychiatric disorders over time and 2) the variety of screening methods used among studies. Although the conflict era may influence the heterogeneity of estimates (e.g., elevated prevalence of alcohol use disorders in the Persian Gulf War compared with OEF/OIF samples), we lack a sufficient number of studies from the Persian Gulf War and Vietnam conflicts to evaluate its role empirically.

First, the consequences of changing definitions and diagnostic criteria over decades can be substantial. In 1988, using Structured Clinical Interviews for the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition-Revised* (DSM-III-R), Kulka et al. (17) published findings from the National Vietnam Veterans Readjustment Survey

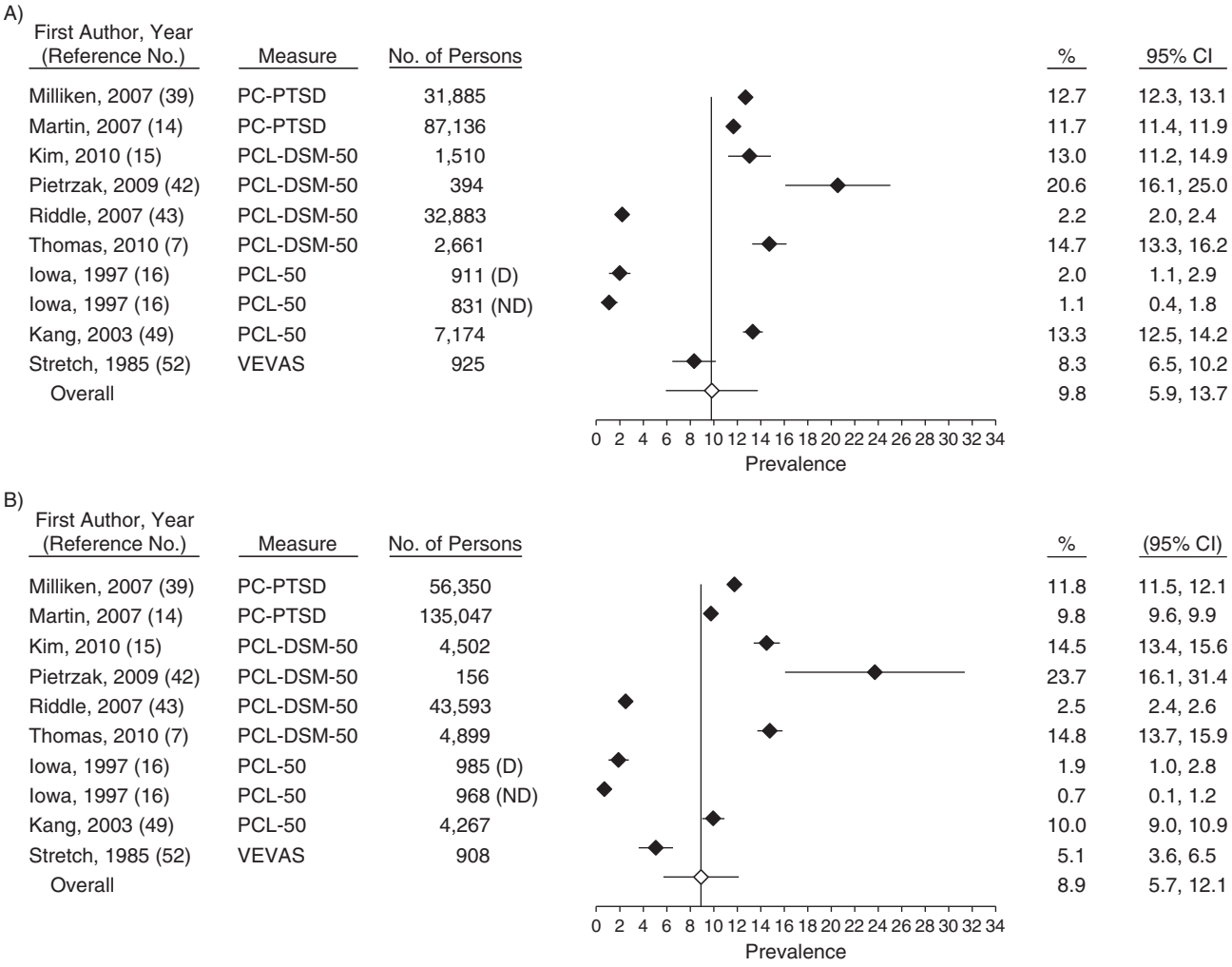

Figure 5. Prevalence meta-analysis of depression among National Guard and reserve service members (A) and active duty service members (B), 1985–2010. Bars, 95% confidence interval (CI). D, deployed during the Persian Gulf War; ND, served but did not deploy during the Persian Gulf War; PC-PTSD, primary care post-traumatic stress disorder; PCL-50, a total score of at least 50 (range, 17–85) on the Post-Traumatic Stress Disorder Checklist; PCL-DSM-50, reporting at least 1 intrusion symptom, 3 avoidance symptoms, and 2 hyperarousal symptoms at the moderate level and a total score of at least 50 (range, 17–85) on the Post-Traumatic Stress Disorder Checklist with the *Diagnostic and Statistical Manual of Mental Disorders*; VEVAS, Vietnam-Era Veterans Adjustment Survey.

data reporting that 30.9% of veterans had developed PTSD during their lifetime. Dohrenwend et al. (18) about 15 years later reanalyzed the written records and tape recordings in a subsample of 260 participants to distinguish whether 1) the PTSD was specifically war related and 2) the participants met DSM-IV's requirement for impairment by either disability in social roles or elevated psychological distress, which DSM-III did not have. The reanalysis resulted in a 13.4% and 15.2% reduction in prevalence, respectively. Overall, this reexamination of the National Vietnam Veterans Readjustment Survey data resulted in a reduction from 30.9% to 18.7% when adjusting for both impairment and documentation of a traumatic exposure. We observed that studies assessing each of the 3 primary disorders used at least 4 different diagnostic tools total and several alternative diagnostic algorithms, including 3 for the PCL alone (i.e., DSM criteria, total score of ≥50, and both DSM criteria and total score of ≥50).

Second, the investigators' choice in diagnostic tools will greatly affect risk estimates. For example, although the gold-standard Clinician-Administered PTSD Scale requires approximately 2–4 hours to administer by a trained doctoral level psychologist, the 17-item PCL provides good sensitivity of 0.78–0.94 and specificity of 0.83–0.86 in about 15 minutes (19). Although every study has to carefully weigh options based on the time available for assessment, the choices made in diagnostic instruments substantially affect risk estimates across studies. In an effort to increase comparability among studies, we believe that the field may advance substantially if future studies requiring diagnostic accuracy use

Table 3. Summary of Predeployment, Perideployment, and Postdeployment Predictors of Mental Health Problems Among Reserve Component Service Members

Predictor	Reference No.	Mental Health Problem		
		Alcohol Use Disorders	Depression	PTSD
Predeployment				
Personality factors	56	Yes		
Preparedness	38			Yes
Prior psychopathology	54	Yes		
Prior psychiatric treatment	48			Yes
Smoking	54	Yes		
Social support	45			Yes
Perideployment				
Combat exposure	45, 52, 54	Yes		Yes
Comorbid psychopathology	53, 56	Yes		
Deployment location	37, 49	Yes	Yes	Yes
Deployment length	37	Yes	Yes	Yes
Family concerns and fears	48			Yes
No. of deployments	37	Yes	Yes	Yes
Personal concerns and fears	48			Yes
Unit support	38			Yes
War-zone stress	51			Yes
Postdeployment				
Attitudes toward outcome of conflict	48			Yes
Comorbid psychopathology	53, 56	Yes		
Readjustment stress	41	Yes	Yes	Yes
Social support	38			Yes

Abbreviation: PTSD, post-traumatic stress disorder.

the gold-standard Structured Clinical Interview for DSM-IV for psychiatric disorders and the Clinician-Administered PTSD Scale for PTSD, while surveys affected by time constraints use the Alcohol Use Disorder Identification Test (total score of ≥8), 9-item Patient Health Questionnaire for depression, and PCL with DSM-IV criteria for PTSD. All of these measures are shown to be valid and reliable in military populations (19–22) and were most frequently used by the studies included in this review.

The documentation of stage-sequential risk factors for psychiatric disorders provides a measure of understanding of the drivers of mental health over the deployment cycle, as in a life-course epidemiologic approach (23) but on a more focused scale. In addition to drawing from life-course epidemiology (23, 24), the examination of stage-sequential risk factors derives in part from the substance misuse literature (25) and offers great hope for more targeted causal inference and more directed prevention and early intervention efforts. A fuller understanding of the drivers of mental health among reserve component forces awaits a more comprehensive literature in the area. The available evidence suggests few identified risk factors for depression, relative to alcohol use disorders and PTSD. This may be due to the small number of studies overall that examined stage-sequential predictors of psychiatric disorder. The associations between alcohol use disorders and comorbid psychopathology at each stage are consistent with the shared vulnerability and self-medication hypotheses (26).

In the broader literature on psychiatric disorders in the general population, depression, alcohol use disorders, and PTSD are all associated with stage-dependent or sequential risk factors (23, 27). Accordingly, it is notable that we did not find such a range of factors for depression. One potential reason for this is that the commonly measured predeployment risk factors for depression may be temporally too distant from the deployment cycle for many service members. For example, early life stress was not included in any of the studies we reviewed, but it is a key risk factor for depression onset (28). Additionally, some studies found smoking to be a stage-sequential risk factor for depression, but we could not include these findings, as one did not stratify by component (29) and the other collapsed pre- and perideployment smoking into one predictor (30). Finally, it is notable that studies including depression were more focused on risk estimation than explanation, and when predictors were evaluated they were mostly time-stable, relative to studies on alcohol use disorders and PTSD. Most studies of military personnel focus on time-stable or perideployment risk factors, and it will be important, going forward, to examine risk factors throughout the deployment cycle, especially among reservists.

In the future, longitudinal studies covering the deployment cycle should be prioritized in order to provide standardized measures of new-onset prevalence and incidence of psychiatric disorders. Additionally, the literature would benefit from more in-depth investigations of pre-, peri-, and postdeployment factors throughout the life course. Although we found a number of studies that documented a difference in prevalence of disorders between the reserve component and the active component, we found fewer that focused on why these differences might exist. Second, given the co-occurrence of alcohol misuse and psychiatric disorders, this comorbidity is worth exploring and measuring, as investigators look to understand and potentially intervene on the high prevalence of alcohol misuse disorders in this population. Related, our results point to the importance of ensuring availability of alcohol use disorders treatments for both active component and reserve component service members. Finally, the evidence for a continuum of behavioral and social health outcomes (31) suggests that future manuscripts and review articles should examine preeminent factors (e.g., alcohol misuse and abuse) that may shift persons experiencing subthreshold and developing behavioral health concerns to more serious adverse events (e.g., suicide).

This review is not without limitations. First, despite our best efforts, it is possible that we failed to identify some studies that would have met our inclusion criteria. Second, we restricted our review to DSM psychiatric disorders, which required the exclusion of studies examining non-DSM psychological concerns, such as Gulf War illness (defined as any identified excess of atypical morbidity associated with Persian Gulf War deployment (32)), and studies using general psychological distress measures (e.g., the Global Severity Index (33, 34) and the Impact of Events Scale (33)). This exclusion criterion was determined to be necessary to increase comparability among samples, and the paucity of studies using non-DSM measures obviates their inclusion. Third, we excluded studies that did not use population-based samples. Although this restricted our study pool, we suggest that the heterogeneity introduced by inclusion of samples that were not population based would make generalizable inference from a review impossible. We did include representative postdeployment samples, considering these studies representative of veteran reserve component populations. It is possible that these samples underestimate the true prevalence of psychiatric disorders in the population. For example, the "healthy warrior effect" has the potential to underestimate risk in military service members because healthier, more resilient, service members are more likely to be deployed than service members with lifetime or current disorders (35, 36). Fourth, we included only studies in the pooled analysis that provided prevalence estimates for both components to minimize differences in sampling when comparing risk estimates between components. Fifth, we restricted this review to studies of US reserve component forces. Although there are some studies of reserve component forces from other countries, the heterogeneity in training and engagement conditions of reserve component forces across countries suggest that pooled cross-national comparisons in this area are not likely to be fruitful. Sixth, we documented new-onset psychiatric disorder estimates in lieu of incidence rates because we included all studies that examined time around an event (e.g., deployment, interview cycle) and did not present findings in reference to time. Future studies should examine incidence rates (compared with new-onset estimates) to provide estimates comparable with those from other subpopulations and the general population.

In summary, through a comprehensive systematic review we documented that reserve component forces have a higher prevalence of alcohol use disorders than active component forces have. We also documented risk factors for alcohol use disorders, depression, and PTSD throughout the deployment cycle. The overall inferences drawn here are limited by the number of studies available, suggesting that substantially more work is needed to better understand the mental health burden in reserve component forces as the Department of Defense shifts its long-term strategic vision to increase the reserve component's operational capacity.

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Gregory H. Cohen and David S. Fink contributed equally to this work and should be regarded as joint first authors.

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(Appendix follows)

Appendix Table 1. Pre-, Peri-, or Postdeployment Influences on Psychiatric Disorders Among US Reserve Component Service Members, 1985–2012

	Predeployment, Perideployment, or Postdeployment	Risk Factor	Findings
Alcohol misuse	Predeployment	Personality factors	Lack of positive emotionality, as well as disconstraint (or impulsivity) as measured on the MMPI-2, was associated with incident alcohol misuse (56).
		Prior psychopathology	Depression, PTSD, comorbid depression and PTSD, and prior alcohol use disorder were associated with prevalent alcohol misuse (54).
		Smoking	Smoking and history of smoking at baseline predicted incident alcohol misuse (54).
	Perideployment	Combat exposures	Deployment with combat exposure was associated with incident alcohol misuse (54).
		Deployment location	Deployment to OIF, relative to OEF, was associated with prevalent alcohol use disorder; deployment to a conflict zone was associated with incident alcohol abuse (37).
		Deployment length	Deployments for >6 months and >12 months were each associated with prevalent alcohol use disorder (37).
		No. of deployments	Having been on multiple deployments rather than a single deployment was associated with prevalent alcohol misuse (37).
		Comorbid psychopathology	Incident PTSD and depression predicted incident alcohol misuse (53).
	Postdeployment	Readjustment stress	High levels of readjustment stress, as measured with questions on financial and family-related problems, were associated with prevalent alcohol misuse (41).
		Comorbid psychopathology	PTSD diagnosis, severity, and high symptomatology on the avoidance cluster predicted incident alcohol misuse (56). Incident PTSD and depression predicted incident alcohol misuse (53).
Depression	Perideployment	Deployment location	Deployment to OIF, relative to OEF, was associated with prevalent depression (37).
		Deployment length	Deployment lengths of >6 and >12 months were associated with prevalent depression (37).
		No. of deployments	Multiple, compared with single, deployments were associated with prevalent depression (37).
	Postdeployment	Readjustment stress	High readjustment stress was associated with prevalent depression (41).
PTSD	Predeployment	Preparedness	Low deployment preparedness was associated with incident PTSD (38).
		Prior psychiatric treatment	Prior history of any mental health treatment was associated with prevalent PTSD (48).
		Social support	Predeployment social support was protective against incident PTSD (45).
	Perideployment	Combat exposure	Exposure to combat and the aftermath of battle were associated with incident PTSD (45); high levels of combat exposure were associated with prevalent PTSD (52).
		Deployment location	Deployment to OIF, relative to OEF, was associated with prevalent PTSD (37, 49).
		Deployment length	Deployments of >6 months and >12 months were associated with prevalent PTSD (37).
		Family concerns and fears	Fear of one's family's being attacked by terrorists was associated with prevalent PTSD (48).
		No. of deployments	Multiple vs. single deployment was associated with prevalent PTSD (37).
		Personal concerns and fears	Fear of being killed from a chemical, biological, or terrorist attack was associated with prevalent PTSD (48).
		Unit support	Unit support was associated with prevalent PTSD (38).
		War zone stress	High war-zone stress was associated with prevalent PTSD (51).
	Postdeployment	Attitudes toward outcome of conflict	Negative perception of the outcome of the Persian Gulf War was associated with prevalent PTSD (48).
		Social support	Low postdeployment social support was associated with prevalent PTSD (38).
		Readjustment stress	High levels of readjustment stress, as measured with questions on financial and family-related problems, were associated with prevalent PTSD (41).

Abbreviations: MMPI-2, Minnesota Multiphasic Personality Inventory-2; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; PTSD, post-traumatic stress disorder.