

Prevalence of Mental Health Disorders in Elderly U.S. Military Veterans: A Meta-Analysis and Systematic Review

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Objective: Older veterans may be vulnerable to mental health problems. Meta-analytic and systematic review methods sought to determine the prevalence rate of mental health disorders in older military veterans (≥ 65 years). **Methods:** Eleven studies were eligible, and meta-analyses of veteran depression, substance abuse, post-traumatic stress disorder (PTSD), anxiety, dementia, bipolar disorder, and schizophrenia were conducted. **Results:** Although conducted exclusively with U.S. veterans, high prevalence rates of substance (5.7%) and alcohol use disorders (5.4%) in older veterans were found. However, the prevalence of other mental health disorders, including PTSD and depression, in older veterans was not markedly high. **Conclusion:** The rates of disorder prevalence observed indicates a need for continued awareness of mental health difficulties, particularly substance and alcohol use disorders, in older veterans. In the future studies with non-U.S. military samples using a longitudinal design are required to further understand the prevalence of mental health disorders in geriatric veterans. (Am J Geriatr Psychiatry 2017; ■■■:■■■-■■■)

Key Words: Veteran, geriatric, military, mental health, meta-analysis, systematic review

Highlights

- These results further our understanding of the prevalence of mental health problems in older veterans.
- High prevalence rates of substance and alcohol use disorders in older veterans were found.
- Future studies with non-U.S. military samples using longitudinal design are needed to further understand the prevalence of mental health disorders in geriatric veterans.

INTRODUCTION

As life expectancy grows, the military veteran population is becoming increasingly elderly, with almost

2.2 million veterans in the United States aged 80 and older,¹ with similar numbers of older veterans reported in the United Kingdom.² Older veterans may be at an increased risk of mental health disorders compared with similarly aged nonveterans. First,

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a significant proportion of older veterans will have been exposed to combat and may experience long-term adjustment difficulties as a result, including post-traumatic stress disorder (PTSD).³ Second, research has found high levels of social isolation and depression in the elderly because of factors including transport and communication difficulties or poor health,³⁻⁵ and geriatric veterans can be vulnerable to isolation and loneliness.^{4,6} Finally, as the cohort of U.S. veterans who served in Vietnam ages, substance abuse disorders (SUDs) may be a growing concern given the greater lifetime prevalence of SUDs in this group.⁷ Consistent with this, several studies have reported older veterans (≥ 65 years) to experience a variety of mental health problems, including SUDs and depression.⁸⁻¹¹ Taken together, mental health disorders in elderly veterans represent a growing public health problem given the significant impact on veteran quality of life and increased healthcare costs.^{12,13}

Purpose of the Current Review

Older veterans appear to be at risk for several mental health disorders; however, research has yielded mixed findings, and the prevalence rates of mental health problems in older veterans remain unclear. To address this we present a systematic and meta-analytic review of studies examining the prevalence rate of mental health disorders in older veterans (≥ 65 years), including depression, substance abuse, PTSD, anxiety, dementia, bipolar disorder, and schizophrenia, to allow conclusions derived from the evidence base.

METHODS

Search Strategy

A computer-based search of electronic databases, including EMBASE, PubMed, PsycINFO, PILOTS, and Web of Science, was conducted between November and January 2017. The search terms were “mental health,” “geriatric,” and “veteran” ([Supplementary Table S1](#)). We also searched reference lists of included articles and relevant review articles,^{14,15} Google Scholar, issues of journals, and contacted key authors in the field to find additional studies.

Eligibility Criteria

Articles had to meet the following inclusion criteria: study group of veterans, defined as any individual who served in the Armed Forces; a sample ($N \geq 450$) with a mean age of ≥ 65 years; and report of current, period, or lifetime estimates of mental health disorder prevalence. Studies had to have a sample size of 450 or greater to ensure stable prevalence estimates, consistent with previous reviews.¹⁶⁻¹⁸

Articles were excluded if they were single-case studies; if the study sample was selected because participants were a targeted group (e.g., racial group) or had a specific comorbid primary physiologic or psychiatric disorder (e.g., Parkinson disease, dementia, etc.) as this may limit the generalizability of findings; if study participant mental health was assessed by self-report; if the article was a review or only presented qualitative findings; if they were conference abstracts and Ph.D. dissertations where further information or published versions could not be obtained; or if studies were not written in English.

Two authors (VW and SAMS) independently screened articles and extracted data. A flow chart ([Figure 1](#)) shows the number of articles retrieved. The final sample consisted of 11 studies that met the inclusion criteria.

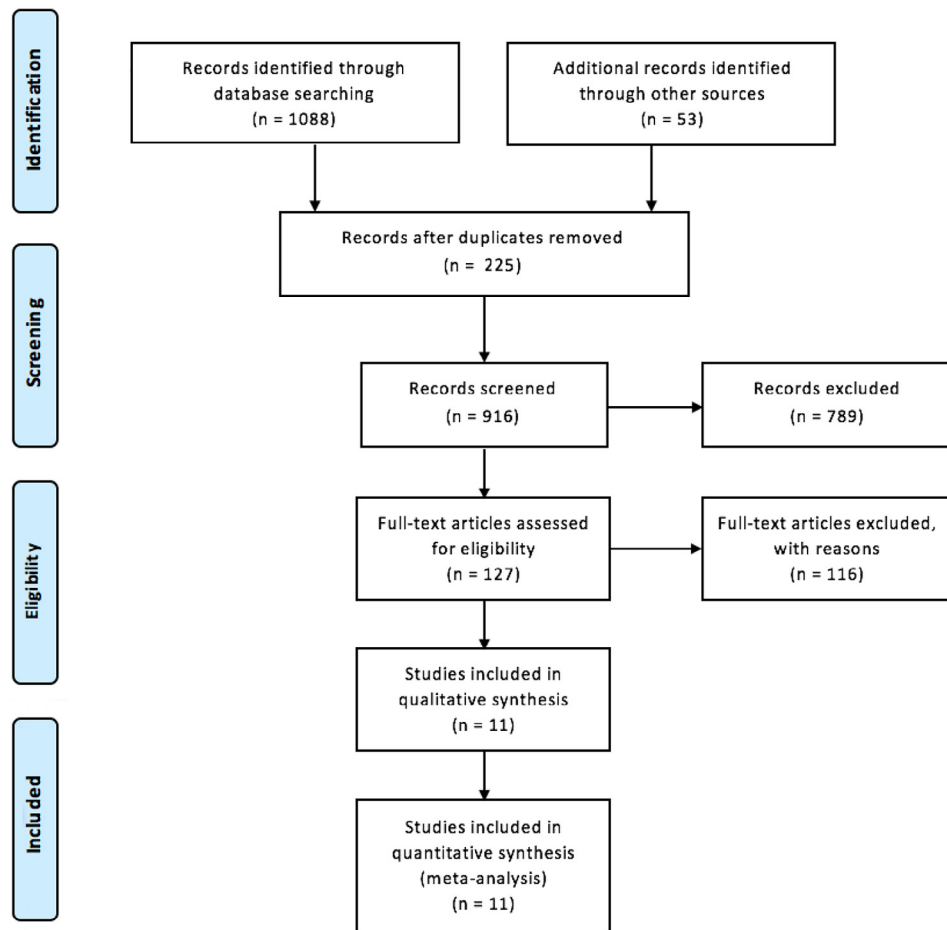
Data Extraction

The following data were extracted from each study: author name, publication year, study location, study design, participant ethnicity, participant socioeconomic status (SES), era of deployment (e.g., Korean war, Vietnam war, etc.), gender distribution, participant age, assessment time points, mental health disorder prevalence rate and type, instruments/diagnostic criteria used, sample size, and any sources of bias or ethical issues. Data were extracted and assessed by two authors (VW and SAMS) with any disagreements resolved after discussion and consensus.

Quality Rating

Two authors (VW and SAMS) independently assessed the methodologic quality of the included studies using a 14-item study design specific checklist.¹⁹ Checklist items were an assessment of whether the study objective was clearly stated; the outcome measures were

FIGURE 1. Flow chart.



clearly defined, reliable, and used consistently; and key potential confounding variables were measured and controlled for. Studies were scored depending on whether they met the specific criteria (no = 0, yes = 1). Studies had to meet criteria for at least scale items 3, 11, and 14 to receive a quality score of “good.” A study that met criteria on two of three items received a quality rating score of “fair,” whereas a study that met one or none of these items received a score of “poor.” There was strong agreement between reviewers, and disagreements were resolved through consensus.

Statistical Analysis

Because eight disorders were analyzed in this review, separate meta-analyses were conducted for each disorder. Few studies included measures of disorders

such as affective disorder, adjustment disorder, and psychosis ($\kappa = 3$). Meaningful prevalence rates of these disorders could therefore not be calculated and are not included in this analysis. Prevalence rates were coded into proportional effect sizes (by dividing the number of cases by the sample size). A random-effects model was chosen a priori to calculate the pooled prevalence of mental disorders and 95% confidence intervals (CIs). Statistical analyses were conducted using MetaXL (www.epigear.com). We used a double arcsine transformation to avoid unduly large weight being applied to studies with small or large prevalence.²⁰ Cochran’s Q and I^2 statistic were used to assess heterogeneity. Where possible, we descriptively compared study disorder prevalence estimates by demographic and study population characteristics and quality rating.

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Publication bias of each disorder prevalence analyses was examined by creating funnel plots to provide a visual representation of the data. Rank correlation tests²¹ and regression tests²² were conducted to determine if there was any evidence of publication bias.

RESULTS

Study Sample

The 11 included studies dated from 2000 to 2016 and involved 1,612,073 participants. Participants had an average age range of 68.6–84.3 years, although in four cases participant age could not be calculated from the information provided.^{9,23–25} Most study participants were male. Seven studies reported participant marital status, with the percentage of married participants ranging from 43%²⁵ to 67.3%.²⁴ Veteran combat exposure type was largely unreported, with only one study reporting that participants had served in Vietnam and/or Korea.²⁴ Ethnic composition of the sample was reported in seven studies and consisted of mostly white participants, although a substantial proportion of ethnicity data were missing in three studies.^{9,23,26}

Mental health diagnosis was determined by the clinician diagnosis given in the veteran's treatment file in eight studies and by diagnostic interview in three studies (Table 1). Studies that used diagnostic codes from treatment files did not supply information regarding the time frame of diagnosis (e.g., diagnosed in the last 2 weeks, last month, lifetime, etc.), except for DiNapoli et al.,²⁶ who examined mental health problems newly diagnosed in the last year. Of the studies that used diagnostic interviews, Mohamed et al.²⁴ assessed veteran mental health over the last week using the Brief Symptom Index,²⁸ whereas substance use was measured over the last 30 days using the Addiction Severity Index.²⁷ Wray et al.³⁴ assessed depressive symptoms over the last 2 weeks using the Patient Health Questionnaire³² and PTSD symptoms over the last month using PTSD Patient Checklist.³³ Study characteristics and prevalence rates are reported in Tables 1 and 2.

Depression

Veteran depression prevalence was reported in nine studies (Table 2). The pooled prevalence of depression was 13.4% (95% CI: 2.04%–30.70%; $Q(8) = 429,751.74$; $p < 0.0001$; $I^2 = 99.99$). Most estimates were

between 3% and 19% of the population (Supplementary Figure S1). Two studies reported considerably higher prevalence estimates of 61.3% and 62.7%.^{26,34} although patients in these studies had often recently been diagnosed with a mental health disorder. The five studies reporting lower prevalence of depression largely recruited participants after nonmental health treatment (Table 1). Moreover, studies reporting lower prevalence estimates determined participant diagnosis from their treatment file. Conversely, participants were identified as meeting diagnostic criteria by Wray et al.³⁴ after an assessment of patient behavioral health problems. No other marked differences in participant demographic characteristics (e.g., marital status, ethnicity, SES, education attainment, etc.) were observed between high and low prevalence reporting studies.

Post-Traumatic Stress Disorder

Eight studies reported data on older veteran PTSD prevalence. The pooled prevalence of PTSD was 8.4% (95% CI: 2.04%–17.88%; $Q(7) = 146,663.26$; $p < 0.0001$; $I^2 = 99.99$). Most PTSD estimates were between 1.0% and 22.0% (Supplementary Figure S2). Three studies reported high PTSD prevalence^{23,26,34} and five lower PTSD prevalence (range, 1.0%–8.8%).^{8,9,24,35,36} No marked difference was observed between high and low PTSD prevalence studies in terms of study or demographic characteristics. However, Wray et al.,³⁴ who reported one of the highest prevalence estimates (21.9%), assessed PTSD symptoms over the last month, which may have had an impact on the findings.

Insufficient information was reported regarding veteran ethnic composition and education attainment to determine whether these factors influenced the results. However, studies reporting lower PTSD prevalence often had a greater number of female participants than the studies that found a higher rate of PTSD prevalence (Table 1), which may have moderated the findings. Moreover, two of three studies reporting higher PTSD prevalence rates did not measure exposure(s) of interest continuously or assess multiple categories of exposure,^{26,34} which contributed negatively toward study quality ratings.

Substance Abuse

The pooled prevalence of veteran SUDs was 5.7% (95% CI: 2.83%–9.34%; $Q(8) = 38,321.64$; $p < 0.0001$;

TABLE 1. Included Studies, Sample Characteristics, Methods of Assessment, and Quality Ratings

Study	No. of Patients Aged > 65	Mean Age (yr)	Males (%)	Mental Health Measured	Instrument	Marital Status (%)	Design	Quality Score Rating Received	Data Collection
Byers et al., 2012 ²⁶	281,540	69.7	96.0	Clinician diagnosis	ICD-9-CM	N/A	RCH	Good	Electronic records of inpatient/outpatient at VA healthcare facilities
Cho et al., 2016 ⁸	721,588	84.3	98.0	Clinician diagnosis	ICD-9-CM	66.9	RCH	Good	VA electronic records of patients with psychiatric disorders
DiNapoli et al., 2016 ²⁶	47,765	75.4	97.3	Clinician diagnosis	ICD-9-CM	66.3	RCH	Fair	Electronic records of patients receiving mental and non-mental healthcare at VA clinics ^a
Edgell et al., 2000 ²⁵	565	72.0	100	Interview	MMSE	43.0	RCH	Fair	VA geropsychiatric inpatient unit ^b
Kerfoot et al., 2011 ²³	181,935	N/A	97.4	Clinician diagnosis	ICD-9-CM	59.5	RCH	Fair	Patients enrolled in specialist VA mental health program
McCarthy et al., 2004 ⁶⁹	9,619	73.6	96.3	Clinician diagnosis	PAI	N/A	Cross-sectional	Fair	VA nursing home ^c
Miller and Rosenheck, 2007 ⁹	41,513	N/A	95.8	Clinician diagnosis	ICD-9-CM	51.0	RCH	Fair	Electronic records of inpatient/outpatient at VA healthcare facilities
Mohamed et al. 2009 ²⁴	535	N/A	94.2	Interview	BPRS, BSI, ASI	67.3	RCH	Fair	Enrolled in MHICM
Prigerson et al., 2001 ³⁵	17,766	N/A	97.4	Clinician diagnosis	ICD-9-CM	N/A	RCH	Good	Electronic records of patients accessing VA mental health clinics, occupying VA mental health bed, or accessing VA healthcare facilities as an inpatient/outpatient
Wray et al., 2012 ³⁴	4325	68.6	97.4	Interview	MINI, PHQ-9, PCL	52.1	Cross-sectional	Fair	Electronic records of outpatients at VA healthcare facilities; patients assessed at BHL
Yaffe et al., 2010 ⁷⁰	181,093	69.9	96.0	Clinician diagnosis	ICD-9-CM	N/A	RCH	Fair	Electronic records of inpatient/outpatient at VA healthcare facilities

Notes: ASI: Addiction Severity Index;²⁷ BHL: Behavioral Health Laboratory (screens for issues such as PTSD, depression, substance misuse, and anxiety; patients are referred to the BHL by VA healthcare providers based on mental health disorder screening or if the patient has been newly prescribed antidepressants); BSI: Brief Symptom Index;²⁸ BPRS: Brief Psychiatric Rating Scale;²⁹ ICD-9-CM: *International Classification of Diseases, Ninth Revision, Clinical Modification*; MHICM: Mental Health Intensive Case Management (national VA program that uses the assertive community treatment model; admission criteria for MHICM include diagnosis of severe and persistent mental illness with severe functional impairments poorly addressed by standard outpatient treatment); MINI: MINI International Neuropsychiatric Interview;³⁰ N/A: information not available; PAI: Patient Assessment Instrument;³¹ PHQ-9: Patient Health Questionnaire;³² PCL, PTSD Patient Checklist;³³ RCH: retrospective cohort study.

^aVeterans with a newly recognized diagnosis of mental health disorder in the fiscal year 2009 without a similar diagnosis appearing within 6 months before date of diagnosis.

^bEstablished diagnosis using inpatient records of the VA geropsychiatric unit between October 1993 to May 1995 and March 1996 to November 1997.

^cDiagnosis established from assessment of VA nursing home patients on April 1, 2001.

TABLE 2. Study Mental Health Disorder Prevalence Estimates

Study	Depression	PTSD	SUD	AUD	Schizophrenia	Bipolar Disorder	Anxiety	Dementia
Byers et al., 2012 ³⁶	9.8 (9.7-9.9)	1.0 (0.9-1.1)	10.4 (10.3-10.5)	2.9 (2.8-3.0)	0.32 (0.30-0.33)	0.55 (0.52-0.58)	3.8 (3.7-3.9)	
Cho et al., 2016 ⁸	0.61 (0.59-0.63)	1.7 (1.7-1.8)	2.1 (2.0-2.1)			0.22 (0.21-0.23)	2.4 (2.3-2.4)	
DiNapoli et al., 2016 ³⁶	62.7 (62.5-63.0)	16.6 (16.4-16.8)					27.8 (27.6-28.1)	
Edgell et al., 2000 ²⁵			4.3 (2.7-6.1)	2.5 (1.3-3.9)				
Kerfoot et al., 2011 ²⁵	19.4 (19.2-19.6)	27.7 (27.5-27.9)	3.3 (3.2-3.4)	8.2 (8.1-8.4)	6.6 (6.5-6.8)	6.2 (6.1-6.3)	24.4 (24.2-24.6)	10.4 (10.2-10.5)
McCarthy et al., 2004 ⁶⁹	3.4 (2.9-3.6)		11.4 (10.7-11.9)		12.2 (11.6-12.9)	2.9 (2.6-3.3)		19.6 (18.8-20.4)
Miller and Rosenheck, 2007 ⁹	6.3 (6.0-6.5)	6.1 (5.9-6.3)	2.6 (2.5-2.8)	5.1 (4.9-5.3)	4.3 (4.1-4.5)	2.3 (2.1-2.4)	7.2 (7.0-7.5)	5.7 (5.5-6.0)
Mohamed et al., 2009 ²⁴		4.5 (2.9-6.4)	0.58 (0.07-1.4)	8.8 (6.5-11.3)	43.4 (39.2-47.6)	20.9 (17.6-24.5)	6.0 (4.1-8.2)	14.4 (11.5-17.5)
Prigerson et al., 2001 ³⁵	7.1 (6.8-7.4)	8.8 (8.6-9.1)		9.7 (9.3-10.0)	24.9 (24.4-25.4)	7.1 (6.8-7.4)		7.5 (7.2-7.9)
Wray et al., 2012 ³⁴	61.3 (60.0-62.8)	21.9 (20.7-23.1)	15.1 (14.1-16.2)					
Yaffe et al., 2010 ⁷⁰	3.3 (3.2-3.4)		11.6 (11.4-11.8)	5.4 (3.4-7.9)				6.6 (6.5-6.7)

Notes: Values are percents with 95% CIs in parentheses.

$I^2 = 99.98$). Estimates ranged from 0.6%²⁴ to 15.0%²⁸ (Supplementary Figure S3). Most estimates were between 0.6% and 4.0% of the population, and most studies whose participants had received mental health care from the Department of Veteran Affairs (VA) gave estimates between these two levels. The four studies that gave higher estimates of substance abuse prevalence (range, 10.0%–15.0%) comprised samples that received general inpatient/outpatient VA treatment rather than treatment specifically for mental health difficulties (Table 1). Mohamed et al.²⁴ reported a particularly low estimate of substance abuse prevalence (0.58%), and this may reflect the fact that substance use was assessed over the last 30 days in this study. Demographic variables were not related to disorder prevalence. Notably, many studies that reported the prevalence of SUDs received lower quality ratings as key potential confounding variables (e.g., medication, education attainment, etc.) were unaccounted for; Byers et al.³⁶ and Cho et al.⁸ are exceptions.

Alcohol Use Disorders

One study identified individuals with alcohol use disorders (AUDs) via diagnosis using the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised* and *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*,³⁷ and six studies used *International Classification of Diseases, Ninth Revision*³⁸ (ICD-9) codes (Table 1). AUD was defined by studies using the diagnostic codes for AUD; for example, the *International Classification of Diseases, Ninth Revision* definition includes a pathologic pattern of alcohol consumption that causes serious functional impairment, characterized by impaired control over consumption and physical dependence.³⁸ The pooled prevalence of veteran AUDs was 5.4% (95% CI: 3.42%–7.85%; $Q(6) = 7,506.33$; $p < 0.0001$; $I^2 = 99.92$). Prevalence rates of AUDs ranged from 2.4% to 8.8% (Supplementary Figure S4). Two studies reported slightly higher prevalence rates of AUDs,^{23,24} and it is worth noting that the participants in these studies were recruited after mental health treatment, whereas participants from the studies reporting lower prevalence rates of AUDs had received general medical treatment (Table 1). No other differences in participant demographic characteristics or measurement tool used were observed between groups.

Schizophrenia

Six studies examined schizophrenia in elderly veterans. The pooled prevalence of schizophrenia was 11.2% (95% CI: 3.69%–21.69%; $Q(5) = 50,053.31$; $p < 0.0001$; $I^2 = 99.99$). Most estimates were between 0.3% and 12.2% (Supplementary Figure S5). Two studies reported considerably higher schizophrenia prevalence of 24.9% and 43.4%,^{24,35} and, again, this is likely to reflect the fact that participating veterans in these studies were receiving VA mental health treatment, often because of chronic and significant mental health conditions requiring inpatient treatment.

Bipolar Disorder

The pooled prevalence of veteran bipolar disorder was 3.9% (95% CI: 1.40%–7.33%; $Q(6) = 29,711.34$; $p < 0.0001$; $I^2 = 99.98$). Prevalence estimates often ranged between 0.20% and 2.9% (Supplementary Figure S6), with studies whose participants had received nonmental healthcare from the VA reporting estimates between these two levels. Three studies reported higher prevalence rates of bipolar disorder,^{23,24,35} and these studies specifically recruited participants after mental health treatment. Furthermore, neither Mohamed et al.²⁴ nor Kerfoot et al.²³ received a quality rating of good because neither controlled for potential confounding variables, unlike studies reporting lower prevalence rates,^{8,34,36} which must be considered when interpreting the reported bipolar disorder prevalence.

Anxiety Disorders

The prevalence rate of veteran non-PTSD anxiety disorders was 9.1% (95% CI: 1.53%–20.97%; $Q(6) = 144,071.42$; $p < 0.0001$; $I^2 = 99.99$). Most prevalence estimates ranged between 2.4% and 7.2% (Supplementary Figure S7). Two studies reported higher prevalence rates of 24.4% and 27.8%, respectively,^{23,26} with participants recruited after both mental health and nonmental health VA treatment. DiNapoli et al.²⁶ reported a particularly high anxiety disorder prevalence (27.8%), which could reflect the fact that patients were newly diagnosed in the last year. Studies reporting higher anxiety prevalence rates provided insufficient data regarding participant ethnicity, education attainment, and participant age for these variables to be examined as

moderators.^{23,26} Studies reporting lower rates of anxiety disorder prevalence did not differ from studies reporting higher prevalence in terms of marital status, percentage of male participants, or SES.

Dementia

Dementia prevalence was reported in six studies, with a pooled prevalence rate of 10.1% (95% CI: 7.59%–12.84%; $Q(5) = 2,971.30$; $p < 0.0001$; $I^2 = 99.83$). Prevalence estimates ranged between 5.7% and 19.6% (Supplementary Figure S8). Two studies examined the prevalence of dementia by participant age,^{23,24} with a greater incidence of dementia found in older participants. Miller and Rosenheck⁹ reported the lowest prevalence rate of dementia at 5.7% (Table 1), and this may reflect the fact that the other three studies sampled veteran participants from nursing homes and those receiving mental healthcare. Miller and Rosenheck⁹ also reported moderately higher participant SES, with 3.7% of participants receiving a VA pension and only 26.5% of participants reporting a low income.

Publication Bias

No evidence of publication bias was found for the PTSD, schizophrenia, depression, anxiety (non-PTSD), bipolar disorder, dementia, or AUD/SUD analyses. For all analyses visual inspection, nonsignificant Egger's tests (smallest $p = 0.11$), and rank correlation indicated nonasymmetric funnel plots (data not shown).

DISCUSSION

The aim of this review was to examine the prevalence of mental health disorders in older veterans using meta-analytic and systematic review methods.

Depression

The prevalence of depression was 13.4%, with most estimates ranging between 3.0% and 19.0%. This is consistent with previous reviews that found global geriatric depression to range between 0.9% and 42.0%.³⁹ Higher estimates were reported in two studies^{26,34} where patients had often received a new diagnosis of a mental health disorder. Geriatric mental healthcare training in nonmental health contexts, such as primary care, can

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be limited and result in decreased detection and increased misdiagnosis of depression in older patients.⁴⁰ This may explain the lower prevalence rates reported in the five studies that largely recruited participants after nonmental health treatment. Wray et al.³⁴ also highlighted that veterans meeting criteria for depression were significantly more likely to meet criteria for possible dementia. This is consistent with DiNapoli et al.,²⁶ who found older veterans were more likely to have a diagnosis of depression and higher Charlson comorbidity index scores, indicative of greater burden of comorbid conditions including dementia. This may suggest that greater depression prevalence could be associated with comorbid dementia, consistent with previous reviews.⁴¹

Post-Traumatic Stress Disorder

The pooled prevalence rate of PTSD in elderly veterans was 8.4%. This is not inconsistent with PTSD prevalence found in U.S., European, and Australian geriatric community samples (range, 1.76%–10.0%).^{42–44} The included studies that reported smaller prevalence rates of PTSD often had a smaller proportion of male participants, consistent with prior studies showing that female gender is a risk factor for PTSD.⁴⁵ Methodologic and demographic factors did not appear to influence PTSD prevalence. Notably, few studies included in this review reported veteran trauma exposure, specifically whether veterans had been exposed to war-related trauma in early life or if trauma exposure was recent and noncombat related (e.g., medical emergencies, accidents, etc.). Böttche et al.⁴⁶ found that older veterans exposed to war-related trauma in early life have higher rates of PTSD than veterans traumatized more recently; therefore, the inclusion of veteran trauma exposure type and timing in future studies is needed.

SUD and AUD

The prevalence rates of SUD and AUD in elderly veterans were 5.7% and 5.4%, respectively. Prevalence rates of AUD in the U.S. elderly general population have been estimated at 2.4%,⁴⁷ indicating that the prevalence of AUDs may be elevated in older veterans. Similarly, prevalence rates of SUDs in community geriatric populations have been reported at 2.2%.^{7,48} Our findings indicate that the prevalence of SUD/AUDs may be higher in older veterans than civilians,

consistent with previous research.⁴⁹ These results highlight the potential utility of AUD/SUD screening and treatment in elderly individuals, particularly for veterans. However, these results are based exclusively on U.S. geriatric veterans and may not be generalizable to other contexts given the greater lifetime prevalence of AUD/SUDs found in U.S. Vietnam veterans.⁷ It is also possible that clinicians may screen for and thus detect SUDs/AUDs in veterans more frequently than civilians, which warrants additional investigation.

Bipolar Disorder

The prevalence estimate of bipolar disorder was 3.9%. Studies that recruited participants after nonmental healthcare reported bipolar disorder estimates between 0.2% and 2.9%, consistent with U.S. nonveteran, geriatric prevalence rates.⁵⁰ Mohamed et al.²⁴ reported the highest prevalence rate of bipolar disorder at 20.9%, and this rate likely reflects the study's clinical population because geriatric bipolar disorder is more common in clinical settings.⁵¹ Notably, studies did not provide information regarding bipolar disorder age at onset. Geriatric individuals with bipolar disorder are generally categorized as either those experiencing a late-life manic episode but whose bipolar disorder began in young adulthood or those who did not experience a manic episode before late life.⁵² Because elderly individuals with late-onset bipolar disorder present with more affective episodes per year with increased episode duration and chronicity,^{52,53} future research should include age at disorder onset to ensure a more complete understanding of the prevalence and presentation of bipolar disorder in older veterans.

Schizophrenia

The pooled prevalence of schizophrenia was 11.2%. This is higher than rates found in similarly aged U.S. community samples,^{54,55} although some studies report that schizophrenia may be present in 13% of all U.S. nursing home residents.⁵⁶ Considerably greater prevalence rates of schizophrenia were reported in two studies,^{24,35} where participants were recruited after VA mental health treatment often for severe and persistent mental illness. Therefore, these estimates are likely to reflect the clinical nature of sample.

Dementia

The prevalence of dementia in older veterans was 10.7%. This is consistent with previous U.S. geriatric community studies.⁵⁷ The potential moderating effect of SES was also observed, and studies with lower participant income reported higher dementia prevalence, consistent with past research that has found low SES to be a risk factor for dementia.⁵⁸

Anxiety

Non-PTSD anxiety disorder pooled prevalence rate was 9.1%, consistent with similarly aged U.S. community prevalence rates.⁴⁴ The lower prevalence rate of veteran anxiety compared with depression found in the present review is in line with research that older age is a protective factor for anxiety but a risk factor for depression.⁴¹ Two studies reported higher veteran anxiety prevalence rates;^{23,26} however, many potential moderators could not be examined because insufficient data regarding participant demographic characteristics were reported. It should be noted that anxiety disorder prevalence in older veterans may be higher than 9.1% given the under-recognition of anxiety in older patients by practitioners⁵⁹ and the tendency for geriatric patients to under-report or somatize anxiety symptoms.⁴¹

Clinical Implications

These results tentatively suggest that the prevalence rate of AUDs/SUDs is higher in older veterans than the similarly aged civilian population. This highlights the need for continued investment in identifying older veterans with SUDs/AUDs and ensuring that effective treatment programs and services for this group are available. Sundin et al.⁶⁰ found higher rates of alcohol consumption in the U.K. military than in the U.S. military; therefore, additional research is needed to determine whether increased SUD prevalence is also present in elderly non-U.S. veterans. From a U.K. perspective, the results of this review, albeit of considerable interest, should be regarded as tentative because information from a variety of other publications^{61–63} suggests substantial differences between U.S. and U.K. veterans in terms of the national attitudes toward the military and veteran healthcare provision.

Strengths and Limitations

This review was limited by several factors. First, only published studies were included in this review, which may have caused less precise prevalence estimates.^{64,65} However, no evidence of publication bias was found.

Second, most included studies had a high proportion of male participants but did not typically report the incidence of mental health conditions by gender, despite substantial statistical evidence of gender as a risk factor for psychiatric disorders,⁶⁶ which should be considered in future studies. Moreover, few included studies reported complete participant trauma (e.g., nature, type, time since trauma, deployment location) and demographic information, such as age, education attainment, and marital status, all of which are risk factors for mental health disorders.⁶⁷ Because armed conflicts can vary in terms of the social, political, and cultural climate; warfare techniques; and the nature of combat exposure, with subsequent implications for veteran psychological adjustment, this should be considered when interpreting the findings, and we recommend this information is included in future studies.

Third, a degree of caution is needed when interpreting the prevalence rates of mental health disorders found in this study. Most studies did not provide adequate information regarding disorder prevalence time frames (e.g., whether mental health disorder prevalence related to the last month, last 12 months, etc.), which may have impacted the findings. Furthermore, comparisons between the mental health disorder prevalence rates found in the present study and the general population are tentative because some community studies could potentially have included veteran participants.

Fourth, studies included in this review examined mental health difficulties in veterans enrolled in VA services. Because older U.S. veterans and civilians have been found to underutilize mental health services due to perceptions of stigma and negative appraisals of mental healthcare,^{11,36,68} the prevalence of mental health disorders in U.S. veterans may potentially be higher than estimated.

Finally, high heterogeneity was found across all analysis. This heterogeneity may reflect clinical differences between studies (e.g., veterans recruited after nonmental health treatment versus veterans recruited after mental healthcare versus veterans in nursing homes) as well as methodologic differences. We allowed for heterogeneity by using a random-effects

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model and described the variation between studies to account for the presence of heterogeneity.

Conclusions

This study presents the first comprehensive review and meta-analysis of the prevalence of eight mental health disorders in older veterans (≥ 65 years). Somewhat higher prevalence rates of SUDs/AUDs in older veterans were observed compared with geriatric community populations. However, the prevalence of other mental health disorders in older veterans did not differ substantially from community estimates. Given the small number of high-quality studies and high levels of heterogeneity found, only tentative conclusions regarding the prevalence of mental health disorders in

geriatric veterans can be made. Nonetheless, the findings suggest a need for additional research into mental health difficulties and treatment for older veterans. Future research including longitudinal studies and investigations with geriatric non-U.S. military samples are needed to better understand the prevalence of mental health conditions in older veterans.

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APPENDIX: SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at [doi:10.1016/j.jagp.2017.11.001](https://doi.org/10.1016/j.jagp.2017.11.001).

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