We conducted a systematic literature review on substance misuse, abuse, and dependence in women veterans, including National Guard/reserve members. We identified 837 articles published between 1980 and 2013. Of 56 included studies, 32 reported rates of alcohol misuse, binge drinking, or other unhealthy alcohol use not meeting diagnostic criteria for abuse or dependence, and 33 reported rates of drug misuse or diagnosed alcohol or drug use disorders. Rates ranged from 4% to 37% for alcohol misuse and from 7% to 25% for binge drinking; among Veterans Health Administration (VA) health-care system outpatients, rates ranged from 3% to 16% for substance use disorder. Studies comparing women veterans and civilians reported no clear differences in binge or heavy drinking. Substance misuse rates were generally lower among women veterans than men veterans. Substance misuse was associated with higher rates of trauma, psychiatric and medical conditions, and increased mortality and suicide rates. Most studies included only VA patients, and many used only VA medical record data; therefore, the reported substance misuse rates likely do not reflect true prevalence. Rates also varied by assessment method, source of data, and the subgroups studied. Further efforts to develop epidemiologically valid prevalence estimates are needed to capture the true health burden of substance misuse in women veterans, particularly those not using VA care.

**Alcohol and Drug Misuse, Abuse, and Dependence in Women Veterans**

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Abbreviations: AUDIT, Alcohol Use Disorders Identification Test; AUDIT-C, Alcohol Use Disorders Identification Test-Consumption; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; PTSD, post-traumatic stress disorder; VA, Veterans Health Administration.

**INTRODUCTION**

Substance misuse, ranging in severity from drinking alcohol in excess of recommended limits to a diagnosis of alcohol or drug use disorder, is a health concern for women. About 4.9% of women in the United States meet the diagnostic criteria for alcohol use disorder (alcohol abuse or dependence) (1), with 19.5% for lifetime alcohol use disorder (2), 1% for current drug use disorder (nonalcohol drug abuse or dependence), and 7.1% for lifetime drug use disorder (3). Approximately 23,000 deaths among women annually are associated with excessive alcohol use (4), and women’s body composition puts them at increased risk for alcohol-related health problems (5–7). Substance misuse among women is associated with increased occurrence of homelessness, injuries, intimate partner violence, and sexual assault (5), and it co-occurs with depression (8, 9), post-traumatic stress disorder (PTSD) (10, 11), and suicidal behavior (12).

Substance misuse has received limited attention in reviews of women veterans’ health research (13, 14), although it has been identified as an important health concern for veterans generally (15). US women veterans currently number over 2.2 million and are about 10% of the veteran population. Women are the fastest growing segment of eligible users of the Veterans Health Administration (VA) health-care system (16). Providing high-quality health care for women veterans is a VA priority (17–19); however, only about a quarter of women veterans use VA services (20). The number of women veterans seeking care in community settings is expected to increase under the Affordable Care Act of 2010, which broadens the scope of available health-care services, thereby increasing access to care (21). For both VA providers, who are generally more familiar with the presentation of substance misuse in veteran men, and community providers, who are more familiar with women civilians than veterans, delivering high-quality care to women veterans requires an understanding of their
specific patterns of substance misuse and co-occurring conditions.

To date, there has been no systematic review of the literature on the prevalence and correlates of substance misuse in women veterans, although there have been one narrative review of substance misuse in women veterans (22) and another focused on screening (23). These reviews highlight several issues in the literature on substance misuse in women veterans that the present review seeks to address. First, both reviews stated that women veterans have higher rates of substance misuse than women in the general population (mostly civilians). A difference in substance misuse between women veterans and civilians is plausible: Studies have reported that women veterans and civilians differ on sociodemographic characteristics correlated with substance misuse (24, 25), and women veterans have a higher prevalence of risk factors for substance misuse including childhood abuse (26, 27), intimate partner violence (24), lifetime history of sexual assault (28, 29), and adverse mental health conditions (25). However, no studies cited in these reviews made direct comparisons between women veterans and civilians, and thus inferences about differences between the 2 groups may lack empirical support. Second, both reviews stated that women veterans generally have lower rates of substance misuse than men veterans do, although exceptions were noted. These statements align with research in the general population: Although most studies report higher substance misuse rates among men than women (1–3), some suggest that the gender gap may be

Figure 1. Selection process for research articles on alcohol and drug misuse, abuse, and dependence in US women veterans, 1980–2013. “Nonrepresentative sample” indicates studies of special populations, such as veterans with specific medical conditions. EBSCO, Elton B. Stephens Co., Ipswich, Massachusetts; SUD, substance use disorder (alcohol or drug abuse or dependence).
narrowing (30) with younger women more closely approximating men in both the onset and course of these disorders (31–34). Third, both reviews summarized studies of VA patients based on VA medical record data and studies of veterans in the general population that used other measures of substance misuse; however, the reviews did not describe how the patterns of prevalence or comorbidity differed depending on the subgroup studied, source of data, or method of assessment. Again, it is plausible that the rates of substance misuse and comorbidity would differ between VA patients and other women veterans. Health-care–seeking populations have higher rates of substance misuse in some studies (35), and VA patients have higher rates of mental health conditions that are often correlated with substance misuse (14, 36–40).

The current systematic review of the literature addresses these issues by summarizing published estimates of the rates of substance misuse and co-occurring conditions in US women veterans. In particular, we sought to answer the following questions: 1) What are the published rates of substance misuse among women veterans? 2) How do rates of substance misuse among women veterans compare with rates in civilian women and veteran men? 3) What types of trauma exposures and psychiatric and medical comorbidities distinguish women veterans with and without substance misuse? 4) How do published prevalence and comorbidity estimates vary depending on the subgroup studied, source of data, and method of assessment?

METHODS

Eligibility criteria

We conducted a systematic search for English-language, peer-reviewed publications reporting on non-tobacco alcohol or drug misuse, abuse, or dependence in US women veterans. We limited our search to articles published since 1980 when the Diagnostic and Statistical Manual of Mental Disorders, Third Edition (41), was published with standards for diagnosing substance use disorders separately from personality disorders (42). The Diagnostic and Statistical Manual of Mental Disorders, Third Edition, and subsequent diagnostic standards (43–45) generally have high concordance for substance use disorders (46, 47); we report the standards and coding system (e.g., International Classification of Diseases, Ninth Revision, Clinical Modification (48)) in the tables. We excluded studies of women in substance use disorder treatment because results from these highly select subgroups may not represent patterns among women veterans more generally. We excluded clinical trials, studies with nonrepresentative samples (e.g., disease-specific populations), case studies, abstracts, reviews, and commentaries. We also excluded studies that involved only deceased subjects or examined other addictive disorders (e.g., gambling). Details on study exclusions are reported per Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines in Figure 1 (49).

To focus on the most relevant studies about substance misuse in women veterans, we excluded results for women in active duty military service but included results for members of the reserve forces (National Guard and reserve members) as a distinct population. Veteran and active duty women differ in ways that likely impact reported rates of substance misuse (e.g., active duty women tend to be younger than veteran women), and many active duty personnel are deployed to locations where alcohol use and drug use are constrained. Moreover, some studies have reported veterans to have poorer health and unique health concerns compared with active duty personnel (30, 31), and therefore, patterns of substance misuse and related comorbidities in active duty and women veterans may differ. Studies that included National Guard and reserve members or individuals on active duty at the time of enrollment were retained if the authors described their findings as applying to veterans (“deactivated” National Guard and reserve members could qualify for VA care and would in that key way be comparable with other veterans or VA patients).

Search protocol

We restricted the search to articles published from January 1, 1980, to December 31, 2013 (4 articles with 2014 publication dates were available online in 2013). Table 1 lists database search terms, including Medical Subject Headings for PubMed and MEDLINE (Ovid) that were adapted for PsycINFO (Ovid and EBSCOhost). We identified 4 additional citations from reference lists of review articles and 6 additional relevant articles known to our study team. A total of 837 unique citations were initially screened for inclusion by at least 2 coauthors, and another coauthor verified the screening decisions per our eligibility criteria; 212 articles were retained for full-text review. Ambiguous articles were decided upon by team consensus.

<table>
<thead>
<tr>
<th>Table 1. Database Search Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed and MEDLINE MeSH Terms</td>
</tr>
<tr>
<td>“Women” OR “female”</td>
</tr>
<tr>
<td>AND</td>
</tr>
<tr>
<td>“Veterans” OR “veterans”</td>
</tr>
<tr>
<td>AND</td>
</tr>
<tr>
<td>“Substance-related disorders” OR “United States Substance Abuse and Mental Health Services Administration”</td>
</tr>
</tbody>
</table>

Abbreviation: MeSH, Medical Subject Headings.
Data collection

Four reviewers conducted data extraction on 56 final articles. At least 2 coauthors abstracted information on rates of substance misuse (n = 55 articles) and rates of trauma exposure and co-occurring conditions among women veterans with substance misuse (n = 22 articles). Most studies reported rate estimates directly, and others presented data that allowed us to calculate the proportion with substance misuse (n = 19) or the proportion with a given comorbidity (n = 7).

Reporting

We grouped findings on rates of substance misuse by type of substance misuse to address Question 1, starting with less severe types of unhealthy alcohol use and then proceeding to diagnosed alcohol, drug, or substance use disorder and other types of nonalcohol drug misuse (Web Tables 1 and 2 available at http://aje.oxfordjournals.org/). Studies reporting multiple types of substance misuse are listed under each type for which estimates were available. To address Question 2, we summarized results for veteran women versus civilian women or veteran men when direct comparisons were made. To address Question 3 on the relation between substance misuse and trauma exposure or comorbidities, we presented detailed findings in Web Table 3 and provided a narrative summary. To address Question 4, we described the subgroups studied, the types of data sources used including the timeframes over which studies used specific data sources, and the method of assessment (Tables 2 and 3; Web Tables 1 and 2). In the description below, we distinguish studies using data collected prior to the start of the Operation Enduring Freedom (OEF)/Operation Iraqi Freedom (OIF) military era in 2001. Unless stated otherwise, the reported findings are for women.

RESULTS

Rates of substance misuse in women veterans

Alcohol misuse. VA annual alcohol screening uses the 3-item Alcohol Use Disorders Identification Test (AUDIT)-consumption items (AUDIT-C) (23, 52), scored on a scale from 0 to 12 (53) and validated for identification of alcohol misuse in women veterans (53). Ten studies reported AUDIT-C scores for women veterans (54–63) (Web Table 1). For 9 of these, which focused exclusively on VA patients, we extracted information on the proportion with scores of 3 or greater, which is often used to identify alcohol misuse in veterans (53), and 5 or greater, which in VA settings triggers a clinical reminder for brief intervention for patients currently drinking above recommended limits (52). One additional study using a threshold of 4 is included for completeness (57).

Considering AUDIT-C scores of 3 or greater, the proportion of VA patients with alcohol misuse ranged from 12% to 37%. Two studies using overlapping VA chart review data on clinically administered AUDIT-C screens reported rates of 12% among patients from any military era (63) and 19.3% among younger OEF/OIF patients (59). Two studies reported

Table 2. Definitions of Data Sources Used in Studies of Alcohol and Drug Misuse, Abuse, and Dependence in Women Veterans

<table>
<thead>
<tr>
<th>Data Source (Acronym)</th>
<th>Description</th>
<th>Review Nomenclature</th>
</tr>
</thead>
<tbody>
<tr>
<td>VA Puget Sound studies</td>
<td>Annual surveys mailed to women veterans receiving care in the VA Puget Sound system. Demographic data extracted from VA administrative databases. A subset of the women was also interviewed in person.</td>
<td>Project-specific survey and/or interview data</td>
</tr>
<tr>
<td>Various independently collected</td>
<td>Data sets collected by various investigators.</td>
<td>Project-specific survey and/or interview data</td>
</tr>
<tr>
<td>data sets</td>
<td></td>
<td>Project-specific survey and/or interview data</td>
</tr>
<tr>
<td>VA Postdeployment Data Repository</td>
<td>Mental health diagnostic interview and survey data for postdeployment active duty service members, National Guard and reserve, and veterans who served after September 11, 2001. Participants were recruited from 4 Veterans Affairs medical centers.</td>
<td>Project-specific survey and/or interview data</td>
</tr>
<tr>
<td>Survey of Health-Care Experiences of</td>
<td>Stratified random samples of veterans who received VA care in the preceding month are asked to provide data about themselves and their recent VA care experience. These surveys are ongoing, and the data are updated regularly.</td>
<td>VA survey data</td>
</tr>
<tr>
<td>Patients (SHEP)</td>
<td></td>
<td>Project-specific survey and/or interview data</td>
</tr>
<tr>
<td>External Peer Review Program (EPRP)</td>
<td>Third-party reviewers do monthly audits of a random sample of electronic and paper medical records at each VA facility.</td>
<td>VA chart review data</td>
</tr>
<tr>
<td>VA administrative data</td>
<td>VA electronic health record data reflect what clinicians enter into the Veterans Health Information Systems and Technology Architecture known as “Vista,” which uses standard coding for most diagnostic data. Data from Vista are transmitted to the National Patient Care Database, which currently includes data for both inpatient and outpatient encounters.</td>
<td>VA administrative data</td>
</tr>
<tr>
<td>National Health and Nutrition Examination</td>
<td>A nationally representative sample of about 5,000 persons surveyed each year who are located in counties across the country, 15 of which are visited annually. Both interviews and physical examinations are done.</td>
<td>National survey data</td>
</tr>
<tr>
<td>Survey (NHANES)</td>
<td></td>
<td>Project-specific survey and/or interview data</td>
</tr>
<tr>
<td>Behavioral Risk Factor Surveillance System</td>
<td>Cross-sectional telephone survey conducted in all US states by individual state health departments.</td>
<td>Project-specific survey and/or interview data</td>
</tr>
</tbody>
</table>

Abbreviation: VA, Veterans Health Administration.
higher rates: one using VA survey data for OEF/OIF patients (37%) (55) and another using pre-2001 project-specific survey data with a modified AUDIT-C including a binge-drinking question tailored to women (24.1%) (56). Considering AUDIT-C scores of 5 or greater, the proportion of women veterans with alcohol misuse ranged from 4% to 17%. Three studies using overlapping VA chart review data reported rates of 4% for outpatients from any military era (63), 4.8% for non-OEF/OIF outpatients aged 55 years or younger (62), and 7.0% (59) or 8.6% (62) for OEF/OIF outpatients aged 55 years or younger. Three studies of patients from any military era using overlapping VA survey data reported rates of 5% (54) and 6% (60, 61), respectively. The pre-2001 study using a tailored binge-drinking question reported a rate of 8.9% (56), and the highest rate of 17.0% was reported in a project-specific survey of OEF/OIF veterans that oversampled National Guard and reserve members (58). In studies comparing women and men using a common threshold, the rates of alcohol misuse were higher for men (58, 60).

Hazardous or harmful drinking. Six studies used the full 10-item AUDIT (scored from 0 to 40) in a project-specific survey or interview to assess past-year hazardous or harmful drinking among women veterans (64–69) (Web Table 1). An AUDIT-based positive screen for hazardous or harmful drinking reflects unhealthy levels of alcohol consumption, negative alcohol-related consequences, and symptoms of dependence (70). AUDIT scores range from 0 to 40, and thresholds of 7 for women and 8 for men are recommended to detect likely unhealthy drinking (70). However, the studies we identified generally used an AUDIT threshold of 8 for both sexes, with a single study reporting the proportion with AUDIT scores of 3 or greater (68). The 5 studies with a threshold of 8 or greater reported rates of 4.1% among former reservists (66), 8.8% in a combined group of OEF/OIF VA patients and active duty personnel (67), 16.3% among OEF/OIF and Operation New Dawn VA patients (69), 17.0% among OEF/OIF veterans or National Guard and reserve members (65), and 23% among the National Guard demobilized after OEF/OIF (64).

Binge drinking. The National Institute on Alcohol Abuse and Alcoholism defines binge drinking as consumption of 4 or more drinks on a single occasion among women and 5 or more drinks among men (71). However, the operational definition of binge drinking varied across the 9 studies of women veterans (51, 55, 72–78) (Web Table 1). At a threshold of 4 or more drinks on an occasion, 2 studies using the same project-specific survey data reported a past-year binge drinking rate of 25% for VA patients (72, 77). Among respondents 19–30 years of age to a 2010 national survey, past-month binge drinking rates were 22.9% for women veterans and 18.2% for women civilians (difference not statistically significant; level of significance not specified) (75). At a threshold of 5 or more drinks on an occasion, past-month binge drinking rates among the 2010 national survey respondents of all ages were similar for veterans (9.7%), civilians (9.5%), and National Guard and reserve members (11.9%)(P > 0.05) (51). In a survey of reservists, past-month binge drinking rates ranged from 24% for women with no recent deployments to 37% for those with multiple deployments (74). Past-year binge drinking rates among respondents to national surveys from 1999 to 2010 were 17.09% and 22.35% for women veterans and civilians, respectively (P = 0.12) (78). At a threshold of 6 or more drinks at least monthly (the threshold used on the AUDIT-C), past-year binge drinking rates were 7.2% among women OEF/OIF veterans (mainly VA patients) responding to a project-specific survey (73) and 13% for OEF/OIF patients based on VA survey data (55). The Millennium Cohort Study defined binge drinking in women National Guard and reserve members as 4 or more drinks on at least 1 day per week or as 5 or more drinks on at least 1 day in the past year; the reported rates were 29.1% at baseline in 2001–2003 and 29.8% at follow-up in 2004–2006 (76). Consistent with rates from studies of civilians (79), the reported rates of binge drinking were higher among veteran men than veteran women (55, 73, 76).

Other unhealthy alcohol use. Ten studies reported other types of unhealthy alcohol use in women veterans (53, 75, 76, 80–86) (Web Table 1). Because studies using the same outcome definitions also used the same data sets, we do not emphasize comparisons across studies here. However, 2 studies made internal comparisons worth noting. Among national survey respondents aged 19–30 years, similar proportions of women veterans (4.3%) and civilians (4.9%) met criteria for heavy drinking (≥1 drink per day in the past month) (difference not statistically significant; level of significance not specified) (75). Among National Guard and reserve Millennium Cohort Study participants, the rates of heavy weekly drinking for women and men (>7 and >14 drinks per week, respectively) were comparable, and after adjustment for demographics and other variables, the rates of new-onset or continued heavy drinking at follow-up were greater for women than men (76).

Diagnosed alcohol abuse or dependence. Fifteen studies assessed rates of alcohol use disorder in women veterans (53, 59, 62, 63, 73, 81, 87–95) (Web Table 2). One study that enrolled only 3 women is included for completeness (93). Two studies using pre-2001 VA administrative data reported that 24% of psychiatric patients had documented alcohol use disorder (90) and 8% of inpatients had alcohol dependence but not drug dependence (89). A pre-2001 study using diagnoses from VA administrative data reported that 2.4% of patients had alcohol use disorder (88). A study of Vietnam-era veterans using a diagnostic assessment reported that 2.4% of women had alcohol abuse or dependence (95). Later studies using overlapping VA administrative data sets reported alcohol use disorder rates of 3%–5% in OEF/OIF patients (91, 92, 94). Three other studies using overlapping VA chart review and administrative data sets reported alcohol use disorder rates of 3% for patients of all military eras (63) and, among patients aged 55 years or younger, rates of 7.9% for non-OEF/OIF patients (62) and 8.7% (62) or 9.8% (59) for OEF/OIF patients. Studies using project-specific structured diagnostic assessments reported rates of past-year alcohol use disorder of 6.4% for OEF/OIF veterans (73) and 9.9% for VA patients prior to 2001 (53, 81). Two additional studies using structured diagnostic interviews reported that lifetime rates of alcohol use disorder were 22.3% among OEF/OIF veterans (87) and 33% in a pre-2001 study of Vietnam-era women veterans (96).

Rates of diagnosed alcohol use disorder in men veterans were about 1.5–3 times the rates of women veterans in studies making direct comparisons (73, 87, 90, 91, 94).
Sixteen studies reported rates of diagnosed drug use disorder or other nonalcohol drug misuse in women veterans (58, 59, 62, 63, 68, 72, 82, 87, 88, 90–92, 94, 95, 97, 98) (Web Table 2). One study of Vietnam-era veterans reported only that none of the 432 women in the study met the criteria for drug abuse or dependence (95). Studies using pre-2001 VA administrative data reported a drug dependence rate of 7% among inpatients (98) and a drug use disorder rate of 13% among psychiatric emergency room
patients (90) and 2.1% among general patients (88). Later studies using diagnoses from VA administrative data sets reported drug use disorder rates of 0.9%–3% for OEF/OIF patients (91, 92, 94). Using overlapping VA chart review and administrative data sets, drug use disorder rates were 1% in VA patients from all military eras (63) and 5.7% in OEF/OIF patients aged 55 years or younger (59). Three studies reported rates for specific substances. Rates of past-year cannabis use disorder were 3.9% and 2.4% for OEF/OIF and non-OEF/OIF outpatients, respectively, using diagnoses from VA chart review and administrative data for patients aged 55 years or younger (62), and the lifetime cannabis

Table 3. Continued

<table>
<thead>
<tr>
<th>First Author, Year (Reference No.)</th>
<th>Data Collection, Years</th>
<th>Study Group</th>
<th>Military Era</th>
<th>Type of Substance Misuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oslin, 1997 (93)</td>
<td>1993–1994</td>
<td>VA patients</td>
<td></td>
<td>Diagnosed alcohol abuse</td>
</tr>
<tr>
<td>Hankin, 1999 (84)b</td>
<td>1994–1995</td>
<td>VA patients</td>
<td></td>
<td>Other unhealthy alcohol use</td>
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<tr>
<td>Frayne, 2003 (83)b</td>
<td>1994–1995</td>
<td>VA patients</td>
<td></td>
<td>Other unhealthy alcohol use</td>
</tr>
<tr>
<td>Becker, 2009 (97)</td>
<td>2005–2007</td>
<td>VA patients</td>
<td></td>
<td>Nonalcohol drug misuse</td>
</tr>
<tr>
<td>Nunnink, 2010 (68)</td>
<td>2006</td>
<td>VA patients</td>
<td>OEF/OIF</td>
<td>Hazardous and/or harmful alcohol use; nonalcohol drug misuse</td>
</tr>
<tr>
<td>Sadler, 2012 (106)b</td>
<td>2005–2008</td>
<td>VA patients</td>
<td></td>
<td>Substance use disorder</td>
</tr>
<tr>
<td>Booth, 2011 (100)b</td>
<td>Not reported</td>
<td>VA patients</td>
<td></td>
<td>Substance use disorder</td>
</tr>
<tr>
<td>Benedetto, 1998 (80)</td>
<td>Not reported</td>
<td>VA patients</td>
<td></td>
<td>Other unhealthy alcohol use</td>
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<tr>
<td>Hassija, 2012 (85)</td>
<td>Not reported</td>
<td>VA patients</td>
<td>Gulf War 1 and OEF/OIF</td>
<td>Other unhealthy alcohol use</td>
</tr>
<tr>
<td>Scott, 2013 (69)</td>
<td>Not reported</td>
<td>VA patients</td>
<td>OEF/OIF/OND</td>
<td>Hazardous and/or harmful alcohol use</td>
</tr>
<tr>
<td>Taft, 2009 (95)</td>
<td>1986–1988</td>
<td>Other veterans</td>
<td></td>
<td>Alcohol use disorder; drug use disorder</td>
</tr>
<tr>
<td>Eisen, 2012 (58)</td>
<td>2008–2009</td>
<td>Other veterans</td>
<td>OEF/OIF</td>
<td>Alcohol misuse; nonalcohol drug misuse</td>
</tr>
<tr>
<td>Elbogen, 2013 (65)</td>
<td>2009–2010</td>
<td>Other veterans</td>
<td>OEF/OIF</td>
<td>Hazardous and/or harmful alcohol use</td>
</tr>
<tr>
<td>Street, 2013 (86)</td>
<td>2009</td>
<td>Other veterans</td>
<td>OEF/OIF</td>
<td>Alcohol misuse</td>
</tr>
<tr>
<td>Ouimette, 1996 (96)</td>
<td>Not reported</td>
<td>Other veterans</td>
<td>Vietnam</td>
<td>Alcohol use disorder</td>
</tr>
<tr>
<td>Burnett-Zeigler, 2011 (64)</td>
<td>2009</td>
<td>National Guard and reserve</td>
<td>OEF/OIF</td>
<td>Hazardous and/or harmful alcohol use</td>
</tr>
<tr>
<td>Foster, 2011 (74)</td>
<td>2006</td>
<td>National Guard and reserve</td>
<td>OEF/OIF</td>
<td>Binge drinking</td>
</tr>
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<td>Gradus, 2008 (66)</td>
<td>Not reported</td>
<td>National Guard and reserve</td>
<td>OEF/OIF</td>
<td>Hazardous and/or harmful alcohol use</td>
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<td>Crawford, 2013 (73)a</td>
<td>2005–2011</td>
<td>VA patients and/or active duty service members</td>
<td>OEF/OIF</td>
<td>Binge drinking; alcohol use disorder</td>
</tr>
<tr>
<td>Curry, 2014 (87)a</td>
<td>2005–2012</td>
<td>VA patients and/or active duty service members</td>
<td>OEF/OIF</td>
<td>Alcohol use disorder; cannabis use disorder</td>
</tr>
<tr>
<td>Kelley, 2013 (67)a</td>
<td>2005–2012</td>
<td>VA patients and/or active duty service members</td>
<td>OEF/OIF</td>
<td>Hazardous and/or harmful alcohol use</td>
</tr>
<tr>
<td>Lehavot, 2014 (78)</td>
<td>1999–2000</td>
<td></td>
<td></td>
<td>NHANES</td>
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<tr>
<td>Grossbard, 2013 (75)a</td>
<td>2010</td>
<td></td>
<td></td>
<td>BRFSS</td>
</tr>
<tr>
<td>Lehavot, 2012 (51)a</td>
<td>2010</td>
<td></td>
<td></td>
<td>Binge drinking; other unhealthy alcohol use</td>
</tr>
</tbody>
</table>

Abbreviations: BRFSS, Behavioral Risk Factor Surveillance System; EPRP, External Peer Review Program (medical chart review); NHANES, National Health and Nutrition Examination Survey; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; OND, Operation New Dawn; SHEP, Survey of Health-Care Experiences of Patients; VA, Veterans Health Administration.

a Consecutive studies have samples that include some of the same participants but are not identical because of different inclusion criteria and/or timeframes; refer to Web Tables 1–3 for details.

b Consecutive studies use data derived from the same sample of participants; refer to Web Tables 1–3 for details.
use disorder rate was 5.5% among OEF/OIF veterans assessed via structured diagnostic instrument (87). Cocaine use disorder rates from VA chart review and administrative data for outpatients aged 55 years or younger were 0.8% and 3.6% for OEF/OIF and non-OEF/OIF patients, respectively (62). Five studies reported screen-positive nonalcohol drug misuse by using project-specific data. By using pre-2001 screening data for VA patients, the past-year drug abuse rates were 3% (72) or 4.9% (82), depending on the screening items considered positive, and the lifetime drug abuse or dependence rate was 9% (72). The rates of screen-positive drug abuse were 2% for OEF/OIF veterans (58) and 6% for OEF/OIF VA patients (68). Only one study assessed prescription drug abuse specifically by using a project-specific instrument, and the rates were 3.6% for any prescription drug misuse in the past 6 months (1.5% for frequent misuse) among women from any military era in 2005–2007 (97). The rates of diagnosed drug use disorder were higher for veteran men than veteran women (87, 90, 91), but the results for other nonalcohol drug misuse did not provide strong evidence of a difference according to gender (58, 97).

**Diagnosed substance use disorder.** Sixteen studies reported substance use disorder rates for women veterans (54, 62, 63, 88, 89, 99–109) (Web Table 2). Three pre-2001 studies using overlapping VA administrative data reported rates of 12%–14% for VA inpatients (99, 108, 109). Other pre-2001 studies reported rates of 10%–11% for VA patients in nursing homes (104, 107) and 24% (89) and 35% (101) for VA psychiatric patients. Another pre-2001 study using VA administrative data reported a rate of 3.2% for general VA women (88). Two studies using overlapping VA chart review and administrative data reported rates of 3% for outpatients from any military era (63) and 9.5% and 10.5% in OEF/OIF and non-OEF/OIF outpatients aged 55 years or younger, respectively (62). Other studies using VA administrative data reported rates of 6% in patients having noncardiac surgical procedures (54), 6.2% in OEF/OIF outpatients (105), and 7% in general OEF/OIF patients (103). Two studies using a project-specific data set and a structured assessment reported rates of 7% for past-year substance use disorder and 34% for lifetime substance use disorder among VA patients (100, 106). One study compared substance use disorder in VA patients from 2000 to 2002 by using both a diagnostic assessment and study-specific medical chart review. The rate obtained through diagnostic assessment (2.1%) was lower than the rate from the medical chart review (16%) (102); however, the diagnostic assessment reflected “current” (past-month) substance use disorder, whereas the chart review recorded any notation of a substance use disorder diagnosis in the previous 12 months. Rates of diagnosed substance use disorder were generally higher in veteran men than in veteran women, although only 2 studies performed statistical tests to assess gender differences directly (101, 104).

**Trauma exposures and comorbidities in women veterans with substance misuse**

**Trauma exposures and substance misuse.** Trauma exposure is a risk factor for the development of alcohol and drug use problems (110–112), and this association has been examined among women veterans through various project-specific surveys (Web Table 3). Two studies among patients who used VA services prior to 2001 reported 34%–35% who screened positive for alcohol abuse reported military sexual assault compared with 22% among those who screened negative (83, 84). Among VA patients prior to 2001, those with past-year binge drinking had higher rates of lifetime domestic violence than did non–binge drinkers (72). An interview-based study of veterans aged 51 years or younger reported that those with a lifetime substance use disorder were more likely than those without to have experienced rape during childhood, military sexual trauma, and lifetime rape (100). However, when women with and without past-year substance use disorder were compared, the difference in trauma exposure rates was not statistically significant (P > 0.05) (100). A study of VA patients from OEF/OIF and Operation New Dawn reported similarly high rates of assaultive trauma and scores on a combat exposure scale for women with and without past-year hazardous drinking (69).

**Depression, PTSD, and substance misuse.** VA patients with a substance use disorder diagnosis had higher rates of both depression and PTSD than did women without substance use disorder on the basis of pre-2001 VA administrative data (109). Among Vietnam-era women who served overseas, those with lifetime alcohol use disorder had higher rates of lifetime PTSD than did those without alcohol use disorder on the basis of pre-2001 interview data (96). Similarly, VA patients with past-year binge drinking had higher rates of screen-positive PTSD and depression than did non–binge drinkers according to pre-2001 survey data (72). Rates of both PTSD and depression were 28% among patients with substance use disorder diagnoses on the basis of VA administrative data (rates for those without substance use disorder diagnoses not given) (113). A project-specific survey reported that women with lifetime substance use disorder had past-year depression rates nearly twice as high as women without lifetime substance use disorder (100); those with past-year substance use disorder had higher rates of both depression and PTSD (100).

A survey of OEF/OIF veterans reported that women with past-year hazardous drinking had more severe current depressive and PTSD symptoms than did peers without hazardous drinking (69). Similarly, another survey of OEF/OIF and Operation New Dawn veterans reported that those with lifetime alcohol use disorder had higher rates of lifetime major depression than did those without alcohol use disorder; the same pattern was reported for veterans with versus without lifetime cannabis use disorder (87). A study using VA chart review and administrative data from OEF/OIF patients aged 55 years or younger reported that 62% of women with alcohol use disorder had PTSD diagnoses (59).

**Relations among trauma exposures, depression, PTSD, and alcohol misuse.** A project-specific survey of former reservists reported an association between sexual harassment and past-year harmful drinking among women and that depression mediated this relationship (66). Among OEF/OIF veterans, depression mediated the relationship between past-year alcohol problem severity and trauma exposures on the basis of project-specific interview data (67). However, although both combat exposure and postmilitary, noncombat trauma were associated with alcohol problem severity, these relationships were not...
mediated by PTSD, and PTSD was not found to be independently associated with alcohol problem severity (67).

Other psychiatric comorbidities. A study using VA medical chart diagnoses compiled by the investigators reported that 75% of women with substance use disorder had an additional psychiatric diagnosis (102). Pre-2001 VA administrative data indicated that over half of inpatients with substance use disorder had one or more psychiatric diagnoses, and rates of personality disorders, schizophrenia, bipolar disorder, and neurotic disorder were higher among women with substance use disorder than among those without (109). A study using pre-2001 project-specific survey data reported higher rates of psychiatric comorbidity as the number of substances abused increased (82). Another study using the same data reported that the proportion screening positive for current panic disorder and other anxiety disorders was higher among veterans with past-year binge drinking (53, 72), but it did not find higher rates of recent eating disorders (53). In contrast, a study using VA administrative data reported that OEF/OIF patients with alcohol use disorder were 7 times more likely, and those with substance use disorder were 6 times more likely, to have a diagnosed eating disorder than those without either alcohol use disorder or substance use disorder (92). In addition, 18% of patients with substance use disorder also had bipolar disorder according to VA administrative data (113).

Medical comorbidities. A study using project-specific data from VA medical charts in 1999–2001 reported that 75% of patients with a substance use disorder diagnosis had a concomitant medical condition (102). Another pre-2001 project-specific survey reported that VA patients with past-year binge drinking had elevated rates of lifetime hepatitis or cirrhosis, an increased risk of reporting past-year sexually transmitted diseases, and an increased risk of having 4 or more injuries in the past 3 months (72). A study using VA survey and administrative data reported that high AUDIT-C scores did not predict physical trauma in the subsequent 2 years (61), but that rates of physical trauma were very high across AUDIT-C groups (22% for women, 12% for men). A study using pre-2001 VA administrative data reported that inpatients with substance use disorder had higher rates of some diseases (skin and subcutaneous tissue, infectious and parasitic, and digestive system) compared with those without substance use disorder, but they had comparable or lower rates for other medical diseases (109). A study using VA administrative data reported that OEF/OIF veterans with substance use disorder had increased odds of having genitourinary disease and injury or poisoning, but they did not differ on 9 other conditions (105).

Mortality. In a study using VA administrative data, women with substance use disorder diagnoses in 1998 or 1999 had increased suicide rates in the following 7 years (hazard ratio = 6.62 relative to women without substance use disorder diagnoses) (88). Another study based on VA survey and administrative data reported that a patient’s odds of death were 7.09 times greater for women in the 9–12 AUDIT-C category relative to the reference category with scores of 1–4 (60).

DISCUSSION

Through this systematic review, we sought to 1) describe published estimates for rates of substance misuse in women veterans, 2) compare their rates with those of civilian women and men veterans, 3) describe the types of trauma exposures and co-occurring conditions that distinguish women veterans with and without substance misuse, and 4) examine how substance misuse and comorbidity rate estimates varied depending on the subgroup studied, source of data, and method of assessment. To this end, we identified 56 relevant studies that reported substance misuse, potential trauma exposures, and psychiatric and medical comorbidities.

Rates of substance misuse among women veterans

Women veterans’ rates of alcohol misuse defined by an AUDIT-C score of 3 or greater ranged from 12% to 37%, while for an AUDIT-C score of 5 or greater, the rates ranged from 4% to 17%. Studies of binge drinking generally reported rates of 7%–25% depending on the specific threshold used; studies using thresholds tailored to women generally reported higher rates (72, 75, 77) than those that did not (51, 73, 78). Recent studies of diagnosed alcohol use disorder, drug use disorder, or substance use disorder reported past-year rates of 3%–10% for alcohol use disorder (59, 62, 63, 73, 91, 92, 94), 1%–6% for drug use disorder (59, 62, 63, 87, 91, 92, 94), and 3%–16% for substance use disorder (54, 62, 63, 100, 102, 103, 105, 106).

Comparisons with civilian women and men veterans

Only 3 studies (using 2 data sources) compared women veterans and civilians directly and reported similar rates of binge and heavy drinking in both groups (51, 75, 78). Substance misuse rates were generally higher in men than women, although one study reported comparable or higher rates of heavy drinking in women versus men National Guard and reserve members (76).

Trauma and comorbidities in women veterans with substance misuse

Women with substance misuse generally had higher rates of trauma exposures, including childhood sexual abuse (100), military sexual trauma (83, 84, 100), and domestic violence (72) than did women without substance misuse. Trauma rates are elevated among women veterans in comparison with the general population (29), suggesting that the trauma burden among women veterans with substance misuse is especially pronounced.

Two studies reported that depressive symptoms mediate the relation between interpersonal traumas and substance misuse (66, 67). When examined at the bivariate level, women veterans with substance misuse had higher rates of depression than did those without substance misuse (69, 87, 100, 109), and most studies found the same pattern for PTSD (59, 66, 69, 72, 87, 96, 100, 109), although one using an unconventional assessment of PTSD symptomatology reported that PTSD was not associated with substance misuse (67).

Rates of other psychiatric comorbidities were higher for women veterans with substance misuse than those without, including anxiety disorders other than PTSD (72), personality disorders (109), bipolar disorder (109), and schizophrenia...
(109), while findings were mixed for eating disorders (72, 92). Several studies reported that women veterans with substance misuse were at elevated risk of having one or more additional psychiatric disorders (82, 102, 109).

Some medical comorbidities were reported to be more common among women veterans with substance misuse, including liver disease and sexually transmitted diseases (56, 72), breast pain (77), injury and poisoning (105), and parasitic diseases and skin diseases (109). Substance misuse was also associated with increased mortality and suicide rates among women veterans (60, 88). Mortality, specific medical comorbidities, and psychiatric comorbidities other than depression and PTSD have not been assessed by multiple independent studies.

Impact of subgroup, data source, and assessment method on estimates

Studies focusing on OEF/OIF veterans generally reported higher rates of substance misuse. However, the only study that directly compared 127 OEF/OIF and 1,882 non-OEF/OIF outpatients reported differences in the overall distribution of alcohol screening scores but no strong evidence that the adjusted rates of alcohol misuse or unadjusted rates of alcohol use disorder, cocaine and cannabis use disorders, or substance use disorder differed by military era (Web Tables 1 and 2) (62). Not surprisingly, rates of substance misuse in women veterans were higher in studies using gender-tailored criteria to define these outcomes. Rates of alcohol misuse and comorbid conditions also tended to be higher in studies that used survey-based assessments (VA surveys or project-specific surveys) rather than VA administrative data (including VA chart review data or VA diagnoses), a finding that is generally consistent with a recent study that reported higher rates of alcohol misuse in veterans completing survey-based assessments compared with contemporaneous clinical screening (114). Differences between clinical and survey-based results may reflect underreporting if patients feel alcohol misuse is stigmatized behavior in a health-care setting (114). Additionally, veterans may be more likely to disclose substance misuse in a study that provides confidentiality assurances than in a clinical context where such information may be entered in the medical record. Survey-based assessments could therefore generate more valid estimates of substance misuse prevalence; interpretation of such estimates should consider both the diagnostic standard used and the timeframe being studied (lifetime vs. past year).

Gaps in the published literature

Although we identified 55 studies that reported rates of substance misuse and 22 studies with information on comorbidity, this systematic review reveals important gaps in this literature. These studies represented only 33 distinct data sets, and most studies (30) included only VA patients. One advantage of using VA medical record data is the ability to present estimates for large numbers of VA patients. However, the alcohol use disorder, drug use disorder, and substance use disorder rates derived from medical chart diagnoses may be influenced by providers’ diagnostic practices that are not standardized and not well understood and, therefore, the diagnosis rates may not reflect true prevalence. Studies using structured assessments may have generated more valid prevalence estimates, but these studies were smaller than the large-scale VA medical record studies and prone to bias or a lack of generalizability because of how participants were selected, either intentionally as the result of study inclusion criteria or unintentionally because of low participation rates. Only 3 studies (using 2 data sources) examined women veterans in the general population, reporting only heavy drinking or binge drinking (51, 75, 78). No studies made direct comparisons between women VA patients and women veterans not in VA care, and we know of only one forthcoming study with the data necessary to examine alcohol misuse by VA user status (115). Thus, the literature provides scant information about substance misuse in the majority of women veterans who do not use VA care. VA users are different from VA nonusers (38, 39), and estimates of the prevalence and correlates of substance misuse obtained from studies of women VA patients may not be generalizable to women veterans as a whole. Finally, most of the studies that we identified reported results for unhealthy alcohol use or substance use disorder, and few studies reported outcomes for specific drugs; in particular, despite recent concerns about potential misuse of prescription medications in military and veteran populations (15, 116), we identified only one study that reported results for prescription drugs (97).

Limitations to the systematic review

Although we sought to be systematic and thorough in our search strategy, we may have missed published articles that were not yet indexed or did not match our search terms. In an effort to be comprehensive, we also included 6 articles not found during our main search that were coauthored or otherwise known to the authors of this review. To use all available information, we calculated rates from available data when necessary; in some cases, these calculations required assumptions we could not check (e.g., that studies had no missing data for gender). Finally, because of the heterogeneity in the types of substance misuse and comorbidities reported, we conducted a descriptive review rather than a meta-analysis. This heterogeneity is a key finding in our review, but future efforts to produce quantitative summary estimates of women veterans’ rates of substance misuse are needed as more studies of veterans from the current era are published using independent data sets and consistent outcome definitions.

Implications

In both community and VA settings, careful screening is needed to identify women veterans’ substance misuse and comorbid conditions. However, screening programs developed for men veterans may not be optimal for women veterans. The differences in the reported rates of alcohol misuse using an AUDIT-C threshold of 3 (55, 56, 59, 63) versus the higher VA threshold of 5 (54, 58–61, 63, 117) suggest that the VA’s decision to incentivize brief intervention with a threshold of 5 for both men and women (52) may lead to underascertainment of alcohol misuse in women veterans.
Therefore, some women seeking care at the VA may be at risk for having alcohol problems go undetected and untreated. In addition, there is a lack of large-scale data measuring women veterans’ rates of substance misuse and comorbidities using validated assessment measures. Future research to establish epidemiologically valid substance misuse prevalence and comorbidity estimates should use direct assessment of large numbers of women veterans outside the clinical context so confidentiality is ensured and systematic measurement of the constructs is achieved. This would also provide an opportunity to evaluate whether there are clinically important differences in substance misuse between women veterans who do and do not use VA services. In the meantime, researchers using VA administrative data on substance misuse and comorbidities should note the potential for underreporting of these phenomena as limitations to the interpretation of their results.

The results of this review suggest that many women veterans are likely in need of specialized substance use disorder treatment and that gender-tailored care may provide additional benefit by increasing comfort levels and treatment attendance (118, 119). A recent study reported that 33% of women veterans diagnosed with substance use disorder in VA in 2008 received at least one specialty substance use disorder care visit, with higher proportions seen at VA facilities with designated women’s programming within substance use disorder clinics (113). Facilities offering interventions for psychiatric comorbidities also had higher rates of substance use disorder treatment involvement among women veterans diagnosed with substance use disorder (113). Both VA and community facilities may best serve women veterans with substance use disorder if they attend to these aspects of care.

In conclusion, this review highlights the variability in reported rates of alcohol and drug misuse, abuse, or dependence, depending on the subgroup, source of data, and method of assessment. Most studies that we identified focused on VA patients, and almost all studies of more severe alcohol use disorder, drug use disorder, or substance use disorder used diagnoses from VA medical records rather than validated diagnostic instruments. Therefore, most results presented here are not true prevalence estimates, and suggestions for obtaining epidemiologically valid estimates are provided. Finally, the lack of research comparing women veterans who do and do not use VA services is striking, and future efforts to understand the needs of VA nonusers are critical to ensure that women veterans with substance misuse have their treatment needs met, regardless of where they present for health care.

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