J Gambl Stud (2018) 34:1205–1239
https://doi.org/10.1007/s10899-018-9749-z

REVIEW PAPER

Gambling Disorder in Veterans: A Review of the Literature and Implications for Future Research

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Published online: 9 February 2018

Abstract To review the scientific literature examining gambling behavior in military veterans in order to summarize factors associated with gambling behavior in this population. Database searches were employed to identify articles specifically examining gambling behavior in military veterans. Cumulative search results identified 52 articles (1983–2017) examining gambling behavior in veteran populations. Articles generally fell into one or more of the following categories: prevalence, psychological profiles and psychiatric comorbidities, treatment evaluations, measurement, and genetic contributions to gambling disorder. Results from reviewed articles are presented and implications for future research discussed. Research to date has provided an excellent foundation to inform potential screening, intervention and research activities going forward. The authors suggest that a public health approach to future research endeavors would strengthen the evidence base regarding gambling in veteran populations and better inform strategies for screening, prevention and treatment.

Keywords Veterans · Gambling disorder · Problem gambling

Introduction

Legalized gambling has enjoyed an unprecedented expansion in the United States in the past decade. In the wake of the financial crisis and subsequent recession, states have looked to gambling as a potential revenue stream to shore up budgetary shortfalls. This expansion

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has raised concerns that increased exposure to gambling opportunities such as casino gambling will result in higher rates of gambling disorder in the general population.

The negative consequences of disordered gambling behavior have been well documented (Fong 2005; National Research Council 1999). In economic terms, individuals with gambling problems suffer significant financial losses and are more likely to file for bankruptcy than those without gambling problems (Gerstein et al. 1999). The negative impact is not restricted to the individual gambler; there are often negative effects on family and other relationships. Disordered gamblers are also at increased risk for suicide, depression, criminal behavior and domestic violence, among other consequences (Fong 2005).

Recent studies indicate that rates of gambling disorder among veterans and active military are higher than those for the general population (Steenbergh et al. 2008; Westermeyer et al. 2013). Veterans may be particularly vulnerable to mental health issues post-deployment, a risk factor for development of gambling disorder. For example, a 2007 study of veterans of the Iraq and Afghanistan wars found that 25% of all veterans seeking service at VA medical centers upon their return (n = 103,788) received at least one mental health diagnosis with the most common being Post Traumatic Stress Disorder (PTSD), a diagnosis given to 13% of the entire sample (Seal et al. 2007).

Much of the research conducted to date, however, has focused largely on individuals admitted to residential inpatient treatment programs to address their disordered gambling behavior. While this research has been informative in terms of identifying risk factors for those engaged in treatment, there are likely important differences between individuals seeking inpatient treatment for gambling at VA medical centers versus veterans in the community who may or may not seek treatment. There is a clear need for more in-depth investigation of disordered gambling behavior among veteran populations. Prior research studies provide a strong initial framework for future research that systematically examines gambling behavior among larger and more diverse veteran samples in order to inform our understanding of the population prevalence of gambling disorder in veterans, screening tools, early intervention programs and evidence-based policy. To that end, the objective of this paper is to provide a comprehensive review of the published research on gambling behavior in veteran populations to date.

Definition of Problem Gambling

In the following paper, we use the term gambling disorder to denote harmful gambling behavior. Pathological gambling is the term that is most widely used in the literature based on its listing as a diagnosis in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders, known as DSM-IV (American Psychiatric Association 1994). It should be noted that this diagnosis has been revised in the latest edition of the DSM, known as DSM-5 (American Psychiatric Association 2013). The diagnosis has been renamed gambling disorder from pathological gambling in an effort to reduce social stigma associated with gambling problems. It has also been reclassified as a behavioral addiction instead of an impulse control disorder. In addition to the new nomenclature, the diagnostic criteria have also been modified. Specifically, the criterion regarding the commission of "illegal acts such as forgery, fraud, theft or embezzlement to finance gambling" was eliminated and the threshold for diagnosis has been lowered from five criteria to four criteria to improve classification accuracy and reduce false positive diagnoses of Gambling Disorder (Petry et al. 2013).

Methods of Review

Selection Criteria and Search Methods

The objective of this paper is to provide a comprehensive review of all published research on gambling behavior in veteran populations. Given this broad objective, selection criteria were equally broad. The initial database searches, conducted in spring 2016, utilized high-level keywords (e.g. wildcard searches with "gambl*") in order to take the least restrictive approach possible and ensure inclusion of all relevant publications.

Published studies regarding gambling behavior in veterans were identified through searches of the electronic databases PubMed, Embase (Elsevier), CINAHL (Ebsco), PsycInfo (Ebsco) and SCOPUS. The databases were searched first in March 2016 and again in October 2016. A final search was conducted in May 2017 to ensure inclusion of any recent publications.

For the initial search, each database was searched using the terms "gambling" and "veteran" and "gambl*" and "veteran". We chose "Any field" for the search in order to identify articles that may have included gambling behavior or gamblers but did not identify these as keywords or subjects. For the second search in October 2016, more targeted search strategies were developed in collaboration with a research librarian and included terms related to the concepts of gambling and military veterans, using a combination of text words and database-specific terminology. No date or language restrictions were applied for any of the three searches.

Figure 1 provides an overview of the database search process and results.

A total of 424 published papers were identified, of which 52 studies met the inclusion criteria and did not meet exclusion criteria.

Exclusion criteria included (1) publications that did not constitute original research (e.g. editorials, review articles, textbooks, etc.); (2) publications that did not focus on veteran populations; (3) publications that did not distinguish between veterans and non-veterans in the analysis; (4) articles that did not specifically reference gambling behavior; (5) meeting abstracts; and (6) articles that presented case reports or treatment recommendations only.

Description of Studies

The studies included in this review are largely cross-sectional observational studies. Very few presented comparisons between gamblers and non-gamblers. In addition, none of the studies identified by the search compared gambling behavior in veterans versus non-veterans.

Gambling disorder (as well as, in some instances, problem or at-risk gambling) is identified using a variety of measures. Table 1 lists the various measurement instruments used in the reviewed studies to identify disordered gambling behavior by frequency of use. Some of the studies utilized more than one measurement instrument to assess gambling behavior.

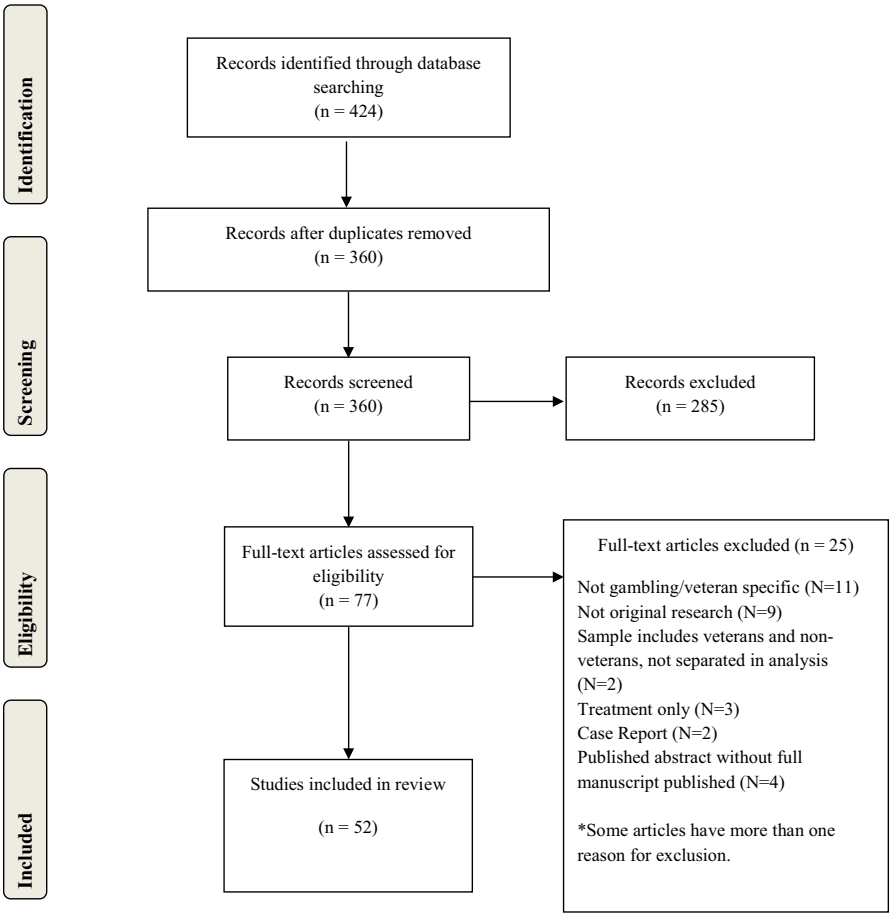

Fig. 1 Overview of search and selection process

Results

The 52 articles identified through the review were published between 1983 and 2017. For clarity and organization, the articles have been categorized according to the main objective of the study or analysis presented with some articles falling into more than one category. Table 2 provides a list of the categories and articles assigned to each.

Prevalence of Problem Gambling in Veteran Populations

Multiples studies identified in the search aimed to estimate the prevalence rates for gambling disorder. Rates presented included both lifetime and past-year using a variety of different measures and varied significantly based on the population from which the sample was drawn. For example, Edens and Rosenheck reviewed administrative data for all

Table 1 Types of measurement instruments

Measure	Number of references
Diagnostic Interview Schedule (including Quick-Diagnostic Interview Schedule)	16
South Oaks Gambling Screen (including Shortened SOGS)	16
DSM criteria, measure unspecified	10
Gambler's Self-Report Inventory	4
National Opinion Research Center DSM-IV Screen for Gambling Problems (NODS)	3
Gambling Behavior Survey	2
International Classification of Disease, Tenth Edition (ICD-10)	2
Time Line Follow Back Month Assessment	2
Brief Biosocial Gambling Screen	1
Gambling Severity Index	1
Lifetime Gambling History	1
Massachusetts Gambling Screen	1
Unspecified	7

Table 2 Summary of article categories

Category	Article yield
Prevalence	9
Clinical samples	6
Community samples	3
Psychological profiles	8
Comorbidities	20
Treatment evaluations	4
Genetic and family contribution	9
Measurement	3

veterans seeking mental health services from the VA and found that only 0.2% of veterans in their sample had a diagnosis of past-year gambling disorder (Edens and Rosenheck 2012). That rate was based on the presence of the corresponding ICD-10 code in their medical record. As the authors acknowledge, however, the presence or absence of a diagnostic code does not necessarily provide a clear estimate of the actual prevalence of gambling disorder, since screening for GD is not standard practice in VA clinical settings. Other studies observed much higher rates. Lifetime prevalence rates in clinical populations ranged from 2% (in veterans seeking any care from VA facility) to 29% (in PTSD treatment seeking veterans) (Castellani et al. 1996; Elia and Jacobs 1993; Hierholzer et al. 2010; Westermeyer et al. 2013).

Fewer studies utilized community-based samples of veterans. Eisen et al. reported a lifetime GD prevalence of 2.3% among veterans on the Vietnam Era Twin Registry (Eisen et al. 2004). In a community-based sample of American Indian and Hispanic veterans, Westermeyer et al. (2005) found lifetime GD prevalence rates of 9.9 and 4.3% respectively. In their 2017 paper, Stefanovics et al. (2017) reported a 2.2% prevalence of at-risk and problem gambling among a nationally representative sample of U.S. veterans but also

Table 3 Summary of studies estimating prevalence of gambling disorder

References	Study type	Sample	Study objective	Gambling measure	Results
Elia and Jacobs (1993)	Cross-sectional	Clinical sample n = 85 veterans admitted to the alcohol treatment ward of the Ft. Meade VAMC	To estimate prevalence of gambling disorder among Native American veterans	SOGS	Lifetime prevalence rate was 22% for Native American veterans versus 7.3% for Caucasian veterans in the sample
Castellani et al. (1996)	Cross-sectional	Clinical sample; n = 154 formerly homeless veterans who completed a substance abuse treatment program	To assess gambling behavior, coping and affect among formerly homeless veterans who completed substance abuse treatment 6 months prior	SOGS	Lifetime prevalence of GD (SOGS ≥ 5) = 14.2%
Eisen et al. (2004)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 8169	Estimate prevalence of psychiatric disorders among nationally distributed sample of Vietnam Era veterans	Diagnostic Interview Schedule Version 3, Revised	Lifetime prevalence of gambling disorder = 2.3%
Biddle et al. (2005)	Cross-sectional	Clinical sample; n = 153 Australian veterans entering posttraumatic stress treatment programs	To estimate prevalence of GD in veterans with PTSD	SOGS, DSM-IV criteria	Lifetime prevalence based on SOGS scores = 29% probable GD; Based on DSM-IV 17% met GD criteria. Timeframe for DSM-IV measure is not defined
Westermeyer et al. (2005)	Cross-sectional	Community-based sample; n = 1228 American Indian and Hispanic American veterans	To examine prevalence and correlates of GD among American Indian and Hispanic veterans	Quick-Diagnostic Interview Schedule (Q-DIS; DSM-IV criteria)	Lifetime prevalence of GD in American Indian and Hispanic veterans 9.9 and 4.3% respectively
Hierholzer et al. (2010)	Cross-sectional	Clinical sample, n = 120 veterans receiving counseling services at the Fresno Vet Center	To determine prevalence of GD in combat veterans receiving VA mental health services	SOGS	Probable GD = 20%; Problem gambler 4.2%

Table 3 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Edens and Rosenheck (2012)	Cross-sectional	Clinical sample, population-based; n = 1,102,846 VA specialty mental health service users in FY2009	To assess rates and correlates of diagnosed gambling disorder among VA mental health patients	ICD-10 code	Past-year prevalence of GD = 0.2%
Westermeyer et al. (2013)	Cross-sectional	Clinical sample selected randomly from veterans receiving care in either the Albuquerque or Minneapolis VA catchment areas; n = 1999	To estimate prevalence of gambling disorder and problem gambling among VA patients	Computerized Diagnostic Interview Schedule-IV	Lifetime prevalence of GD = 2%; 1-year prevalence rate of GD = 0.9% Lifetime prevalence rate of problem gambling (1–4 symptoms of DSM-IV) = 8.8%
Stefanovics et al. (2017)	Cross-sectional	Community sample; nationally representative sample of U.S. veterans drawn from the Knowledge Panel®, a probability-based online survey panel; n = 3157	To assess prevalence of past-year recreational and at-risk or disordered gambling and examine demographic and psychiatric correlates	Brief Biosocial Gambling Screen and 2 questions from the SOGS (most common type of gambling; money spent gambling in typical month)	Past year prevalence of at-risk/disordered gambling was 2.2%. Prevalence of recreational gambling was 35.1%

found high levels of recreational gambling with more than one-third (35.1%) of the sample engaging in some type of gambling activity in the past 12 months.

Table 3 provides an overview of studies reporting prevalence of disordered gambling in veteran samples.

Psychological Profiles and Psychiatric Comorbidities

The early work examining gambling behavior in veterans (i.e., published roughly between 1983 and 1993), was largely concerned with establishing the psychological profile of the disordered gambler. Gambling treatment programs offered through various VA medical centers in the U.S. largely led these efforts. The first of these programs, the Gambling Treatment Program at the Brecksville VA Medical Center in Brecksville, Ohio made significant contributions to the literature of gambling disorder in veterans. A full 35% of studies included in this review utilized data collected from participants in that program. Further, all of the early studies assessing psychological profile drew their samples from clinical populations. Table 4 provides a summary of the articles that fall into this category.

The studies, which tended to take a highly psychoanalytic approach, clearly established that veterans with gambling disorder are highly likely to meet criteria for other disorders such as depression, alcoholism and substance use disorder (Graham and Lowenfeld 1986; McCormick and Taber 1988; McCormick et al. 1989).

Other studies focused on personality characteristics such as ego strength, achievement motivation, self-control and social presence, finding that ego strength, achievement motivation and self-control were significantly lower than standardized group norms or control group while social presence and intelligence was higher for gamblers than for controls (Graham and Lowenfeld 1986; McCormick et al. 1987; Moravec and Munley 1983; Taber et al. 1986). In a study of coping skills among a sample of veterans receiving inpatient treatment for substance abuse, McCormick noted that participants with comorbid disordered gambling behavior demonstrate significant coping skill deficits compared to participants with substance use disorder only, relying, for example, on avoidant and confrontive coping mechanisms characterized by impulsivity and problem minimization (McCormick 1994). Disordered gamblers also scored significantly higher on measures of impulsivity compared to fellow inpatients seeking treatment for alcohol dependence or cocaine dependence (Castellani and Rugle 1995).

Subsequent research contributed to the knowledge base by providing additional evidence of associations between gambling disorder and numerous psychiatric comorbidities. For example, nearly all veterans in a sample of gamblers seeking treatment at the Brecksville GTP met criteria for at least one affective disorder with more than a third meeting diagnostic criteria for more than one disorder (McCormick et al. 1984). Major depressive disorder was most prevalent, affecting 76% of participants in the study. In contrast, however, no significant relationship was observed between disordered gambling behavior and depression in a sample of Australian veterans entering PTSD treatment programs (Biddle et al. 2005).

Numerous studies identified in this review utilized samples from alcohol and substance abuse disorder treatment settings. Rates of gambling disorder are significantly higher among veterans with comorbid substance use disorders but few studies have established temporality of the co-occurring disorders (Kausch 2003a; Scherrer et al. 2007a). Mood disorders and substance use disorders were found to be more prevalent even among veterans

Table 4 Studies on the psychological profile of veterans with gambling disorder

References	Study type	Sample	Study objective	Gambling measure	Results
Moravec and Munley (1983)	Cross-sectional	Clinical sample; n = 23 male veterans entering the Gambling Treatment Program at the Miami VAMC	To assess intelligence and personality traits of veterans seeking treatment for gambling disorder	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	On average participant intelligence test results indicate bright normal or high average intelligence. Personality inventory results indicate elevations on the psychopathic deviate and depression scales
Graham and Lowenfeld (1986)	Cross-sectional	Clinical sample; n = 100 patients admitted to the Gambling Treatment Program at the Cleveland VAMC	To provide data on the personality characteristics of disordered gamblers based on responses to the Minnesota Multiphasic Personality Inventory	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	Confirms results from Moravec and Munley study indicating elevation in psychopathic deviate scale. Identifies four personality profiles
Taber et al. (1986)	Cross-sectional	Clinical sample; n = 57 patients admitted to the Gambling Treatment Program at the Cleveland VAMC	To assess ego strength and achievement motivation in veterans seeking treatment for GD	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	Disordered gamblers in sample were deficient in ego strength compared to standardized group norms for the instrument
McCormick et al. (1987)	Cross-sectional	Clinical sample; three samples of 70 participants each drawn from (1) patients admitted to the Gambling Treatment Program at the Cleveland VAMC (2) control group admitted to medical and surgical programs at Cleveland VAMC (3) veterans admitted to inpatient alcohol treatment program	To compare personality profiles of patients seeking treatment for gambling, alcohol dependence with a control group	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	GD and AD patients scored significantly lower on measures of socialization, self-control and ego control than the control group

Table 4 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
McCormick and Taber (1988)	Longitudinal	Clinical sample; n = 54 male veterans admitted to the Gambling Treatment Program at the Cleveland VAMC	To assess attributional style of disordered gamblers in treatment and its relationship to depression and predictive value of these factors on abstinence post-treatment	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	Positive relationship found between depression and tendency to attribute negative events to internal, stable and global causes correlating with the learned helplessness model of depression
McCormick et al. (1989)	Cross-sectional	Clinical sample; n = 99 patients admitted for treatment to the Alcohol Treatment (40) and Gambling Treatment (59) Programs at the Cleveland VAMC	To assess the relationship between attributional style and PTSD	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	Subanalysis looking at gamblers alone replicates findings from Taber et al. (1987a, b) demonstrating that there is a significant relationship between PTSD and depression, avoidant personality, lack of ego strength, and concomitant substance use
McCormick (1994)	Cross-sectional	Clinical sample; n = 1129 patients admitted for substance abuse treatment at the Cleveland VAMC	To assess coping styles in substance abusers with GD	SOGS	Substance abusers with GD were significantly more likely to use confrontive and escape/avoidance style coping mechanisms than non-disordered gamblers
Castellani and Rugle (1995)	Cross-sectional	Clinical sample; n = 843 consecutive admissions to Brecksville VA recovery for GD, alcohol dependence (AD) or cocaine dependence (CD)	To compare disordered gamblers with alcholics and cocaine misusers on impulsivity, sensation seeking, and craving	SOGS, DIS-III-R	Disordered gamblers more impulsive than AD and CD patients on all scales. GD patients also scored higher on craving. No differences in sensation seeking between groups

Table 5 Summary of studies examining gambling disorder and psychiatric comorbidities

References	Study type	Sample	Study objective	Gambling measure	Results
McCormick et al. (1984)	Cross-sectional	Clinical sample; n = 50 consecutive admissions to the Gambling Treatment Program at the Cleveland VAMC	To assess prevalence of affective disorders among veterans seeking treatment for gambling disorder	DSM-III criteria	76% of patients in sample met diagnostic criteria for major depressive disorder; 12% had attempted suicide in 12 months prior to admission
Taber et al. (1987a, b)	Cross-sectional	Clinical sample; n = 44 consecutive admissions to the Gambling Treatment Program at the Cleveland VAMC	To compare pathological gamblers with history of major traumatic events to gamblers with insignificant to moderate trauma histories	DSM-III criteria	Participants with history of severe trauma experience significantly higher levels of depression and anxiety, were more likely to abuse alcohol or other substances, had markedly higher (although not significant) scores indicative of avoidant personality
McCormick (1993)	Cross-sectional	Clinical sample; n = 2171 patients admitted for comprehensive substance abuse treatment at the Cleveland VAMC	To compare behavioral disinhibition and negative affectivity among substance abusers with and without a disordered gambling problem	SOGS	Prevalence of probable GD was 13%. Rates of probable GD were highest among participants who met criteria for abusing more than one substance. Direct relationship between severity of gambling problem and impulsivity, disinhibition of hostility and aggression and negative affectivity

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Daghestani et al. (1996)	Cross-sectional	Clinical sample; n = 276 veterans seeking inpatient treatment for substance abuse at the Hines VA Hospital, Hines, IL	To assess prevalence of gambling disorder among veterans hospitalized for substance abuse treatment and examine patterns of comorbidity	SOGS	Thirty-three percent of patients met criteria for probable gambling disorder. Data for a subset was analyzed and differed significantly in reported history of family participation in gambling activities (68% disordered gamblers vs. 22.4% non-disordered gamblers)
O'Toole et al. (1998)	Cross-sectional	Community sample; n = 1000 Australian veterans of Vietnam War randomly selected from a national cohort of all Vietnam Veterans	To examine relationship between PTSD and comorbid psychiatric diagnoses	DIS-III	Gambling disorder not significantly associated with PTSD or combat exposure
Kausch (2003a)	Cross-sectional	Clinical sample; n = 113, retrospective chart review of consecutive admissions to GTP at Brecksville VAMC	To examine substance abuse histories of veterans seeking treatment for gambling disorder	DSM-IV criteria, Gambler's Self-Report Inventory	66.4% of participants reported lifetime history of any substance abuse or dependence. Substance abuse history varied by age with younger (< 60) gamblers significantly more likely to report past substance use. 58.1% reported substance use/dependence in year prior to admission to gambling treatment

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Kausch (2003b)	Cross-sectional	Clinical sample; n = 114, retrospective chart review of consecutive admissions to GTP at Brecksville VAMC	To assess history of suicide attempts among veterans seeking treatment for gambling disorder	SOGS, DSM-IV criteria	39.5% of participants had attempted suicide at some point in their lives. Of those who had attempted suicide, 56% had made 2 or more attempts. Of those who attempted suicide, 40% made their most recent attempt in the 12 months prior to admission to the Gambling Treatment Program. Sixty-four percent reported that most recent attempt was related to gambling
Kausch (2004)	Cross-sectional	Clinical sample; n = 37 elderly (age ≥ 60) veterans admitted to GTP at Brecksville VAMC	To examine comorbidities and other factors in elderly disordered gamblers	DSM-IV criteria, Gambler's Self-Report Inventory	Elderly gamblers less likely to have ever made a suicide attempt, have history of any substance abuse/dependence, or have history of trauma compared to a cohort of younger gamblers. However, elderly gamblers who had attempted suicide were more likely to have made that attempt in the 3 years (100 vs. 52.8%) prior to admission to the gambling treatment program

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Kausch et al. (2006)	Cross-sectional	Clinical sample; n = 111, retrospective chart review of consecutive admissions to GTP at Brecksville VAMC	To examine history of trauma among veterans seeking treatment for gambling disorder	DSM-IV criteria, Gambler's Self-Report Inventory	The majority of participants (64%) in the sample reported a history of abuse. Female gamblers were significantly more likely to report a history of abuse. Gamblers reporting history of physical and emotional abuse were significantly more likely to have attempted suicide
Kruedelbach et al. (2006)	Cross-sectional	Clinical sample; n = 162 consecutive admissions to the Gambling Treatment Program at the Cleveland VAMC	To analyze comorbidities in treatment seeking disordered gamblers, esp. addictions and personality disorders	DSM-IV criteria, SOGS, Gambler's Self-Report Inventory, Gambling Severity Index	More than 60% of participants presented with personality disorders. Lifetime substance dependence was reported by 63% of the sample

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Westermeyer et al. (2006)	Cross-sectional	Community sample; n = 132 American Indian and Hispanic veterans from North Central and Southwest regions of U.S who met criteria for lifetime gambling disorder	To determine 1-year gambling disorder remission rates and associated factors	DSM-III-R criteria via the Quick-Diagnostic Interview Schedule	Seventy percent of the sample met criteria for past year GD with the remaining 30% in remission from GD for the last year or more. Participants in remission were significantly less likely to have a current Axis I psychiatric diagnosis. Remitters did not differ significantly from non-remitters on demographic characteristics (i.e. age, gender, ethnicity, education, employment) or diagnosis of Antisocial Personality Disorder. Absence of PTSD associated with remission (10% remitters vs. 33% non-remitters)

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Scherrer et al. (2007b)	Cross-sectional	Community sample; subsample of participants from the Vietnam Era Twin Registry where at least one member of twin pair endorsed one or more DSM-III-R criteria in prior survey round plus a random sample of unaffected twin pairs; n = 1675	To examine associations between exposure to traumatic events and at-risk gambling (1–2 DSM criteria), problem gambling (3–4 DSM criteria) and GD (5+ DSM criteria)	DSM-IV criteria	Childhood physical abuse and child neglect associated with GD before and after adjustment for covariates. Witnessing someone badly injured or killed and being physically attacked were also significantly associated with GD. Risk/severity of gambling problem increased with number of lifetime traumatic events experienced. Co-twin analysis suggests that association between trauma and GD symptoms (excluding witnessing someone badly injured or killed) is explained in part by genetics/family environment

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Scherrer et al. (2007a)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 1675	To examine the relationship between problem and disordered gambling behavior, genetic vulnerability and history of psychiatric disorders	DSM-III-R	Past history of problem and disordered gambling behavior was a strong predictor of current disordered gambling behavior, after controlling for genetic/family influence. Lifetime history of antisocial personality disorder, drug dependence, depression/dysthymia, PTSD and nicotine dependence were significantly associated with increased risk of past-year gambling disorder

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Westermeyer et al. (2008)	Cross-sectional	Community sample; n = 557 American Indian veterans from the North Central region of the U.S.	To compare demographic and mental health characteristics of non-problem gamblers versus non-gamblers	DSM-III-R criteria collected via Q-DIS	58% were non-gamblers (gambled < 5 times lifetime) and 17% qualified as non-problem gamblers. No significant difference by gender or combat exposure but veterans who had experienced life threatening or horrific trauma were more likely to be gamblers in univariate analysis. Regression analysis found tobacco dependence and antisocial personality disorder were significantly associated with gambling. PTSD and experience of life threatening/horrific trauma no longer certificate when included in regression model
Xian et al. (2008a)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 1354	To examine the association between cognitive distortions and disordered gambling in adult males	NODS	A higher mean cognitive distortion score was significantly associated with NODS groups of higher gambling severity As NODS gambling symptoms increased, the proportion of higher cognitive distortion scores increased

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Xian et al. (2008b)	Cross-sectional	Community sample; subsample of participants (n = 2720) from the Vietnam Era Twin Registry who were assessed for gambling behavior	To apply latent class analysis to GD diagnostic criteria and assess the relationship between the classes and other psychiatric disorders	DIS-III-R	A four-class model was found to best fit the data. Classes 1–3 were characterized increasing severity of problem gambling behavior and number of diagnostic criteria endorsed with class 0 comprising individuals who did not gamble frequently (< 25 times per year). Prevalence of lifetime psychiatric diagnoses increased across all four classes. Members of Classes 2 and 3 were significantly more likely to experience all psychiatric disorders than class 0, except for bipolar disorder in class 2

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Dickerson et al. (2009)	Cross-sectional	Community sample; n = 480 American Indian male veterans in North Central US	To examine the relationship between nicotine dependence and psychiatric disorders including gambling disorder	Q-DIS used to determine DSM-III-R	The lifetime prevalence of gambling disorder among subjects was 9.4%. Lifetime and current nicotine dependence were found to be significantly associated with gambling disorder. 17.1% of those with lifetime nicotine dependence presented with gambling disorder [OR = 2.72, 95% CI (1.4–5.1)]; 12.2% of those with current nicotine dependence presented with gambling disorder [OR = 2.32, 95% CI (1.1–5.0)]
Edens et al. (2011)	Cross-sectional	Clinical sample, population-based; n = 1120,424 veterans who used VA specialty mental health service users in FY2009	To compare homeless veterans to non-homeless veterans to identify risk and protective factors for homelessness	Clinical diagnosis for GD as recorded in the electronic medical record	Illicit drug use and GD were the two strongest predictors of homelessness in the sample, controlling for demographic factors and other mental illness diagnoses. Among a subsample of veterans with historically low risk for homelessness, veterans with GD were two times more likely to be homeless than not. (OR = 2.0, $p < .001$)

Table 5 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Westermeyer et al. (2013)	Cross-sectional	Clinical sample; n = 1999 randomly selected veterans from VA centers and clinics in Minneapolis, MN and Albuquerque, NM	To determine the prevalence of disordered and problem gambling in VA patients	C-DIS-IV	Lifetime prevalence of mood, anxiety and substance use disorders was higher among patients with pathological or problem gambling Lifetime substance use disorder increased risk of pathological gambling by 3.11. Patients with lifetime mood disorder were 2.42 times more likely to develop gambling disorder Female veterans had higher rates of pathological gambling than observed in other surveys of women
Whiting et al. (2016)	Cross-sectional	Community sample from the Survey of the Experiences of Returning Veterans (SERV) study; n = 738	To investigate pre-, peri- and post-deployment factors related to at-risk and disordered gambling behavior	MAGS, DSM-IV criteria	Veterans with PTSD were significantly more likely to engage in at-risk gambling behavior (≥ 2 diagnostic criteria). Post-deployment stressful life events and social support were significantly associated with at-risk gambling behavior, adjusting for depression, such that experience of stressful life events and less social support increased the probability of at-risk gambling behavior

who gambled but did not meet any diagnostic criteria for gambling disorder (Westermeyer et al. 2008).

Two subcategories, suicide and PTSD are highlighted below, as these are concerns of particular relevance to veteran populations. Information on all studies addressing comorbidities can be found in Table 5.

Suicide

Elevated rates of suicidality have been found in veterans with gambling disorder since the early days of research on this population. McCormick et al. (1984) found that 12% of veterans in their sample had attempted suicide in the prior 12 months (McCormick et al. 1984). In 2003, Kausch et al. reported that nearly 40% of veterans admitted to the Gambling Treatment Program at the Brecksville VA had attempted suicide at some point in their lives. Of these, more than two-thirds (64.3%) indicated that their suicide attempt was related to gambling. Further, more than half of those who had attempted suicide made two or more attempts (Kausch 2003b). A 2004 study comparing younger and older cohorts of treatment-seeking veterans with gambling disorder found that veterans in the older cohort (age $\geq$ 60) were much more likely to have attempted suicide in the 3 years prior to admission (Kausch 2004). In the only study examining suicide in a community sample of veterans, Stefanovics et al. (2017) found that veterans who engaged in at-risk problematic gambling were significantly more likely to report a suicide attempt and suicidal ideation than recreation or non-gambling veterans.

Although the literature on gamblers generally and veterans with gambling disorder specifically suggests that there is an increased risk for suicide, it should be noted that one study of active military Marine Corps members found no association between a history of gambling behavior and suicide risk (Holmes et al. 1998).

Posttraumatic Stress Disorder (PTSD) and Trauma

Several studies examined the relationship between PTSD and gambling behavior but the nature of that relationship remains unclear. Biddle et al. (2005) found high rates of problem gambling (as defined by subclinical scores on the SOGS and DSM-IV scales) among PTSD treatment seeking veterans but no relationship between PTSD and disordered gambling. Similarly, in a study of a community sample comparing non-disordered gamblers to non-gamblers, Westermeyer et al. (2008) found that gamblers were more likely to have a diagnosis of PTSD but no association was found between combat exposure and likelihood of gambling. Research conducted by Whiting et al. found results similar to Biddle in a national community-based sample of veterans with PTSD diagnoses significantly more likely among veterans engaged in at-risk and disordered gambling. The at-risk and disordered gambling categories were combined in that analysis due to small numbers in the latter group.

In their analysis of the association between exposure to traumatic events, problem gambling and gambling disorder in a community sample of 1675 male twin veterans, Scherrer and colleagues found that the prevalence of traumatic life events was much higher for respondents with gambling disorder than without (Scherrer et al. 2007b). For example, disordered gamblers were 13 times more likely to have been seriously neglected as children than those reporting no symptoms of GD before inclusion of covariates; they were five times more likely after adjustment for income, marital status, psychiatric and substance

use disorders. Witnessing someone badly injured or killed as well as experiencing a physical attack were also significantly associated with GD. No association was found, however, between problem or disordered gambling and combat exposure.

The researchers also conducted a cotwin analysis of monozygotic twins with discordant gambling behavior. In that analysis, only witnessing someone badly injured or killed was significantly associated with report of one or more symptoms of gambling disorder, suggesting that genetic and/or family factors partially explain the relationship between trauma and GD (Scherrer et al. 2007b).

In their survey of a community sample of veterans recently returned from active status in Iraq and Afghanistan, Whiting et al. (2016) found that veterans with PTSD were more likely to engage in at-risk/disordered gambling behavior. They specifically examined stressful life experience pre-, peri- and post-deployment and found that stressful life events and lower social support post-deployment increased participants' risk of problem gambling behavior (Whiting et al. 2016).

Overall, the mechanisms by which trauma influences gambling behavior are not well understood and warrant additional research.

Evaluation of Treatment Programs in Veteran Samples

As noted earlier, the Gambling Treatment Program (GTP) at the Brecksville VA Medical Center outside of Cleveland, Ohio was the first inpatient program for the treatment of disordered gambling. Established in 1972, the program is a 4-week residential program that admits veterans with gambling disorder from across the country. In addition to providing important contributions regarding the psychological makeup of the disordered gambler, the GTP has also provided some of the first publications on evaluation of gambling disorder treatment. For instance, Russo et al. (1984) conducted a follow up assessment with 60 veterans who had participated in the GTP and found 55% were completely abstinent in the 12 months following discharge from the program (Russo et al. 1984). Several years later, Taber et al. (1987a, b) looked at 6-month abstinence in a different cohort of former GTP participants and found a 56% abstinence rate. Both evaluations noted significant improvements in other aspects of participants' lives such as improved relationships, financial wellbeing, and psychological status (e.g. decreased depression, suicidality). McCormick and Taber conducted a 12-month follow-up on a subsample (68%) from that 1987 study (McCormick and Taber 1991). Of those successfully reached, 55% percent fully abstained from gambling in the 12 months since program completion. Breen et al. (2001) noted significant improvement in participant attitudes and beliefs about gambling post-treatment for gambling disorder. A summary of publications addressing evaluation of treatment is provided in Table 6. All studies listed drew their samples from the Brecksville GTP patient population.

Genetic and Familial Contributions

There has been recognition in the field for several decades that family context plays an important role in the risk profile of individuals who develop gambling problems. Gambino et al. (1993) noted that veterans in treatment for substance abuse who reported that their parents were problem gamblers were three times as likely to be disordered gamblers themselves.

Table 6 Summary of studies addressing gambling treatment in veterans

References	Study type	Sample	Study objective	Gambling measure	Results
Russo et al. (1984)	Longitudinal	Clinical sample; n = 60 male veterans who completed the Brecksville Gambling Treatment Program	Assess gambling behavior 1 year after discharge from gambling treatment	Specific measure not provided; veterans have met diagnostic criteria in order to participate in inpatient treatment	55 and 21.5% of respondents reported total and partial abstinence 12 months post-discharge. Significant improvements in financial wellbeing, depression and interpersonal relationships
Taber et al. (1987a, b)	Longitudinal	Clinical sample; n = 57 male veterans who completed the Brecksville Gambling Treatment Program	To evaluate a structured inpatient treatment program for GD 6 months after treatment completion	DSM-III criteria; Time Line Follow Back Month; Gambling Behavior Survey	56 and 67% reported total and partial abstinence in 6-month period. Significant improvements in gambling behavior (# days gambled, $ spent)
McCormick and Taber (1991)	Longitudinal	Clinical sample; n = 45 male veterans who completed the Brecksville VA GTP	To evaluate treatment effectiveness for 28-day inpatient gambling treatment program	DSM-III criteria; Time Line Follow Back Month; Gambling Behavior Survey	55% of respondents had been completely abstinent in the 12 months since program completion; 33% were not abstinent; Pretreatment severity and intellectual functioning were both predictive of abstinence
Breen et al. (2001)	Longitudinal (pre- and post-)	Clinical sample; n = 66 male veterans admitted to the Brecksville Gambling Treatment Program	To assess the effect of 28-day inpatient treatment program on gambling-specific beliefs and attitudes	SOGS, GABS; DSM-IV criteria	Mean scores on the Gambling Attitudes and Beliefs Survey fell from 96.95 to 77.66 at discharge ($p < .001$). Post-treatment score corresponds to scores in non-GD samples

Further, respondents who perceived their grandparents to have gambling problems were twelve times as likely to meet the threshold for probable GD on screening measures.

More recent studies of gambling in veterans have examined the contribution of genetics to gambling disorder. Numerous studies published using data from the Vietnam Era Twin (VET) Registry, a registry made up of 7369 male twin pairs who served in the military during the Vietnam War era suggest that genetic factors as well as shared family environment play an important role in susceptibility to gambling disorder. Eisen et al. (1998) found that genetic factors explained between 35 and 54% of the liability for developing any symptom of gambling disorder (Eisen et al. 1998). Genetics and shared environment explained 62% of the liability for a clinical diagnosis of gambling disorder.

Other studies have shed light on the genetic aspects of gambling disorder and comorbidities. For instance, Potenza et al. (2005) found high rates of co-occurring lifetime GD and major depression in the VET sample, explained in part by the genetic overlap between the two disorders (Potenza et al. 2005). A 2015 analysis by Scherrer et al. (2015) found shared genetic variance between GD and obsessive–compulsive spectrum disorders.

Table 7 summarizes the studies addressing the contribution of genetics and family environment.

Measurement

Several articles identified in the review analyzed specific measures of gambling behavior, utilizing veteran samples. Recognizing that disordered gambling behavior varies over the course of an individual's lifetime, Sartor et al. (2007) analyzed the test–retest reliability of the Lifetime Gambling History (LGH) with a subsample of veterans enrolled in the Vietnam Era Twin Registry (Sartor et al. 2007). The LGH asks respondents to retrospectively assess their gambling behavior over time and self-identify distinct phases of gambling behavior. They found moderate consistency in reports on number of gambling phases, age at first gambling phase and age of gambling disorder symptom onset and strong consistency in report of any symptoms and increases, concluding that the LGH may be a useful clinical tool in assessing gambling behavior over time.

Wickwire et al. (2008) conducted a psychometric evaluation of the National Opinion Research Center DSM-IV Screen for Gambling Problems (NODS) among a sample of veterans receiving inpatient treatment for substance use disorder. In addition to establishing the internal reliability and concurrent validity of the measure, the researchers also found gambling disorder prevalence (based on NODS) of 15.9% with an additional 26.1% of the sample categorized as at-risk or problem gamblers, confirming other studies that have found high rates of at-risk and disordered gambling behavior among individuals with substance use disorder (Wickwire et al. 2008). The Wickwire study is also notable as the only study included in the review with strong representation (62.2%) of African-American veterans in the study sample.

Table 8 describes the studies examining measurement issues with military veterans study samples.

Discussion and Implications for Future Research

In many respects, a review of research on disordered gambling in veterans is a review of the research on gambling disorder in general. Much of the knowledge gleaned about the

Table 7 Summary of studies addressing genetic and familial aspects of gambling disorder in veterans

References	Study type	Sample	Study objective	Gambling measure	Results
Gambino et al. (1993)	Cross-section	Clinical sample, n = 93 veterans in substance abuse treatment at Boston VAMC	To examine association between risk of GD and history of problem gambling behavior in parents or grandparents	SOGS	Individuals who reported parental and grandparental problem gambling were at 3× and 12× greater risk for GD
Eisen et al. (1998)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 6718	To estimate familial contributions to GD and associated symptoms	DIS-III-R	Genetic factors explain 35–54% of liability for developing any symptom of GD Familial factors (genetics and shared environment) explain 62% of liability for clinical diagnosis of GD
Slutske et al. (2000)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 8169	To assess the validity of a continuum of GD liability; To examine the causes of comorbidity between GD and alcohol dependence	DIS-III-R	Genetic factors accounted for 64% of the variance for comorbidity of GD and alcohol dependence. 12–20% of genetic variation and 3–8% of unique environmental variation in risk for GD was accounted for by variation in alcohol dependence risk
Slutske et al. (2001)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 7869	To examine the association between GD and antisocial personality disorder (ASPD) and genetic/familial contributions to the association	DIS-III-R	Individuals with GD were 6.4 times more likely to have a lifetime diagnosis of ASPD. Antisocial behavior disorders (ASPD, adult antisocial behaviors and childhood conduct disorder) accounted for 28% of the genetic variation in GD risk

Table 7 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Potenza et al. (2005)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 7869	To estimate environmental and genetic contributions to GD and major depression (MD) and lifetime co-occurrence of each	CDIS-IV	Genetic factors accounted for 66% of variance in GD and 41% for MD. Approx. 1/3 of genetic variance for each disorder also contributed to that of the other disorder
Scherrer et al. (2005)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 1669	To model differences in health-related quality of life (HRQoL) among non-problem gamblers, problem gamblers and disordered gamblers	CDIS-IV	Problem and disordered gamblers had significant deficits in HRQoL on all mental subscales versus non-problem gamblers. Controlling for genetics and family environment, data suggest that these factors, as well as lifetime co-occurring substance use disorders, account for differences between non-problem gambling twins and brothers with problem gambling or GD
Xian et al. (2007)	Longitudinal	Community sample from Vietnam Era Twin Registry; n = 1675	To examine the contribution of genetic and environmental factors to lifetime baseline GD symptoms and past year GD symptoms	DIS-III-R	Genetic factors explained 48.9% of the variance in risk for lifetime GD symptoms at baseline and 57.5% at 10-year follow up. There is no evidence that genetic contributions changed between baseline and follow up. Unique environmental factors contributed to 30% of the variance in risk of GD symptoms at follow up with only 13% overlap with baseline

Table 7 (continued)

References	Study type	Sample	Study objective	Gambling measure	Results
Xian et al. (2014)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 7869	To examine contribution of genetic and environmental factors to co-occurrence of GD and drug abuse/dependence	CDIS-III-R; participants who acknowledge 1 or more criteria were categorized as problem/pathological gamblers	Genetic and non-shared environmental factors contributed to co-occurrence of problem/pathological gambling and cannabis abuse/dependence and nicotine dependence. Only genetic factors contributed to stimulant (e.g. speed, cocaine) abuse/dependence
Scherrer et al. (2015)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 1675	To examine association and genetic correlation between features of GD and obsessive compulsive spectrum disorder	CDIS-III-R; used DSM-5 criteria for GD	Genetic factors account for 37 and 64% of total variance in OC and GD respectively. Shared genetic variance of 19.4% suggesting genetic influence on co-occurrence

Table 8 Summary of studies examining measurement of gambling behavior with veteran sample populations

References	Study type	Sample	Study objective	Gambling measure	Results
Sartor et al. (2007)	Cross-sectional	Community sample from Vietnam Era Twin Registry; n = 1343; test–retest reliability conducted on subsample n = 196	To assess course of gambling disorder over an individual's lifetime and asses test–retest reliability of Lifetime Gambling History (LGH) among a sample of veterans	NODS, LGH	LGH demonstrated high reliability over a 2–4 weeks test–retest period for report of one or more symptoms (r = 0.82) and reported increases in symptoms over time (r = .86) and moderate-high reliability in number of gambling phases (r = .56), age at beginning of first gambling phase (r = .73) and age of GD symptom onset (r = .80)
Nelson and Oehlert (2008)	Cross-sectional	Clinical sample; n = 316 veterans consecutively admitted to the Dwight D. Eisenhower Addiction Treatment Program, Leavenworth, KS	To assess reliability of a shortened (7-item) version of the South Oaks Gambling Screen in a sample of veterans seeking treatment for addiction	SSOGS	SSOGS demonstrated internal consistency reliability of .79. Using a two-point cutoff, the SSOGS demonstrated high sensitivity (.977), specificity (.952), and positive predictive power (.778) when compared with scores on the full SOGS
Wickwire et al. (2008)	Cross-sectional	Clinical sample, n = 157 male veterans consecutively admitted to substance abuse treatment at VAMC in Jackson, MS	To assess reliability of the NODS measure of gambling disorder in a sample of veterans receiving treatment for substance use disorder	NODS, SOGS	NODS demonstrated internal consistency reliability (α = .88) as well as strong concurrent validity with the SOGS (r = .85, $p < .001$). NODS scores indicated lower levels of gambling disorder than the SOGS

disorder has come from studies of veteran populations, particularly among veterans seeking treatment for disordered gambling.

As this review makes clear, there is a critical need for data on veterans from racial and ethnic minorities. Studies to date have relied on samples that are overwhelmingly white, older and male. Demographic trends, however, suggest that racial and ethnic minorities comprise a growing proportion of both active duty personnel and veteran populations. The National Center for Veterans Analysis and Statistics found a nearly 50% increase in the proportion of veterans identifying as Hispanic in the pre-9/11 (8.7%) versus post-9/11 (12.4%) periods of service (National Center for Veterans Analysis and Statistics 2016a). Whites constitute a decreasing proportion of the veteran population, comprising 82.7% of the Vietnam-era veteran population versus 65.5% in the post-9/11 veteran cohort (National Center for Veterans Analysis and Statistics 2016a). Similar trends are seen among active military personnel (U.S. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy 2015). Further, research on gambling behavior among active military suggests that veterans from racial and ethnic minorities have higher rates of at-risk and disordered gambling behavior (Steenbergh et al. 2008).

Relatively few of the studies cited (33%) included women in their sample. This is due in part to the gender composition of the military at the time many of these studies were conducted. However, women also comprise an increasing percentage of the active duty military population (15.4% of all active duty members according to a 2015 Department of Defense report) (U.S. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy 2015). Others have noted the increasing "feminization" of gambling disorder, highlighting the importance of gaining a better understanding of the course and risk factors for GD in women (Volberg 2003). In addition, female veterans are generally younger and more likely to be minorities than the male veteran population, factors associated with increased risk for gambling disorder (National Center for Veterans Analysis and Statistics 2016b; Westermeyer et al. 2013).

In addition to more diverse samples, there is also a need for more community-based research. The majority of published research has focused on inpatient populations seeking treatment for pathological gambling. As noted, the Gambling Treatment Program, originally started in the Brecksville Veterans Affairs Hospital, provided data for 35% of the studies described above.

There may be important differences between treatment seeking populations and the general veteran population. To date, however, examination of problem gambling among veterans in community settings is quite limited. Since only a small portion of veterans receives their care through VA medical centers, research on veterans in the community at large is paramount to the design and implementation of prevention efforts.

Exposure to Gambling

It is noteworthy that none of the reviewed studies examined exposure to slot machine gambling on military bases overseas. In 2001, in response to a legislative mandate, the Secretary of Defense issued a report on the effect of the availability of slot machines on active military including impact on personal financial stability and morale. According to the report, the military, at that time, was operating approximately 1500 slot machines on military bases overseas, generating more than $59 M annually across the service branches. Unsurprisingly, the report found that the operation of the machines had no negative effect, concluding instead that the machines are overall a positive activity as they generate

substantial revenue to fund other recreation activities. More recent figures put the number of machines at around 3000 with revenue in excess of $100 M annually.

Recent legislative activity, however, suggests an increased awareness of gambling disorder among active military. The National Defense Authorization Act for fiscal year 2016, passed in late 2015, included an amendment requiring the U.S. Government Accountability Office to conduct a study of gambling behavior among active members of the Armed Forces. The study, issued in early 2017, reviewed existing military health system data to determine the prevalence of gambling disorder and assess current screening and treatment practices for those meeting criteria for GD (U.S. Government Accountability Office 2017). Of note, the report found that neither the Department of Defense nor the Coast Guard is systematically screening for gambling disorder based on those agencies' findings that the prevalence rates for gambling disorder and at-risk gambling behavior are low. However, the authors note, these rates are based on limited data that may not accurately reflect the true extent of gambling disorder among active military.

In addition to inadequate screening, the report also highlights the lack of formal guidance for military personnel to address gambling disorder when identified in a service member, in contrast to other addictive disorders. Further, the report provides an updated count of slot machines on overseas U.S. military bases. The count as of July 2016 was 3141, more than double the number of machines noted in the DOD's 2001 report. For fiscal years 2011–2015, these machines generated a total of $539 M in revenue, averaging approximately $108 M annually (U.S. Government Accountability Office 2017).

The report is an important step in raising awareness of gambling disorder as a potential health issue among active military and presumably veteran populations once they retire from active status and highlights the potential impact of disordered gambling not only on the individual service member but also possible negative consequences for military readiness given the increased suicide risk among disordered gamblers, high rates of comorbid psychiatric disorders, and severe financial consequences. In its comments responding to the report's recommendation, the DOD declined to concur with the recommendation that systematic screening for gambling disorder be included in current processes for screening for other addictive disorders, citing the low prevalence of the disorder in the military population.

It is yet to be determined whether the GAO report will generate sufficient public interest and political will to encourage more in-depth investigation of gambling disorder in veterans or active military. Our review suggests that the logical next phase for research in this population might be a broader based public health approach focused on the identification and evaluation of effective screening tools, development of sound prevention programs to address individuals at risk for developing gambling disorder and implementation of evidence-based treatment programs.

Conclusion

The studies identified in this review have made important contributions to the state of the knowledge of gambling behavior in veterans as well as the broader field of gambling disorder research. Although gambling behavior in veteran populations has been studied for nearly four decades, there remains considerable opportunity to examine in greater depth risk factors specific to the military and veteran experience. Study design that allows for comparison of veteran and non-veteran populations as well as research that is less focused on prevalence but instead emphasizes evaluation of screening, prevention and treatment

programs will also be important to this effort. Renewed interest in gambling disorder and problem gambling in veterans among legislators may help to advance this work.

Funding Funding for this project was provided by the Maryland Department of Health and Mental Hygiene, Behavioral Health Administration (#M00B4400404; PI: J. K. Tracy).

Compliance with Ethical Standards

Conflict of interest Authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders: DSM-IV*. Washington, DC: American Psychiatric Association.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders: DSM-5*. Washington, DC: American Psychiatric Association.

Biddle, D., Hawthorne, G., Forbes, D., & Coman, G. (2005). Problem gambling in australian PTSD treatment-seeking veterans. *Journal of Traumatic Stress, 18*(6), 759–767.

Breen, R. B., Kruedelbach, N. G., & Walker, H. I. (2001). Cognitive changes in pathological gamblers following a 28-day inpatient program. *Psychology of Addictive Behaviors, 15*(3), 246–248.

Castellani, B., & Rugle, L. (1995). A comparison of pathological gamblers to alcoholics and cocaine misusers on impulsivity, sensation seeking, and craving. *International Journal of the Addictions, 30*(3), 275–289.

Castellani, B., Wootton, E., Rugle, L., Wedgeworth, R., Prabucki, K., & Olson, R. (1996). Homelessness, negative affect, and coping among veterans with gambling problems who misused substances. *Psychiatric Services, 47*(3), 298–299.

Daghestani, A. N., Elenz, E., & Crayton, J. W. (1996). Pathological gambling in hospitalized substance abusing veterans. *Journal of Clinical Psychiatry, 57*(8), 360–363.

Dickerson, D. L., O'Malley, S. S., Canive, J., Thuras, P., & Westermeyer, J. (2009). Nicotine dependence and psychiatric and substance use comorbidities in a sample of american indian male veterans. *Drug and Alcohol Dependence, 99*(1–3), 169–175.

Edens, E. L., Kasprow, W., Tsai, J., & Rosenheck, R. A. (2011). Association of substance use and VA service-connected disability benefits with risk of homelessness among veterans. *The American Journal on Addictions, 20*(5), 412–419.

Edens, E. L., & Rosenheck, R. A. (2012). Rates and correlates of pathological gambling among VA mental health service users. *Journal of Gambling Studies, 28*(1), 1–11.

Eisen, S. A., Griffith, K. H., Xian, H., Scherrer, J. F., Fischer, I. D., Chantarujikapong, S., et al. (2004). Lifetime and 12-month prevalence of psychiatric disorders in 8,169 male vietnam war era veterans. *Military Medicine, 169*(11), 896–902.

Eisen, S. A., Lin, N., Lyons, M. J., Scherrer, J. F., Griffith, K., True, W. R., et al. (1998). Familial influences on gambling behavior: An analysis of 3359 twin pairs. *Addiction, 93*(9), 1375–1384.

Elia, C., & Jacobs, D. F. (1993). The incidence of pathological gambling among native americans treated for alcohol dependence. *International Journal of the Addictions, 28*(7), 659–666.

Fong, T. W. (2005). The biopsychosocial consequences of pathological gambling. *Psychiatry (Edgmont), 2*(3), 22–30.

Gambino, B., Fitzgerald, R., Shaffer, H. J., Renner, J., & Courtnage, P. (1993). Perceived family history of problem gambling and scores on SOGS. *Journal of Gambling Studies, 9*(2), 169–184.

Gerstein, D., Volberg, R., Toce, M., Harwood, H., Johnson, R., Buie, T., et al. (1999). *Gambling impact and behavior study: Report to the national gambling impact study commission*. Chicago, IL: National Opinion Research Center at the University of Chicago.

Graham, J. R., & Lowenfeld, B. H. (1986). Personality dimensions of the pathological gambler. *Journal of Gambling Behavior, 2*(1), 58–66.

Hierholzer, R., Vu, H., & Mallios, R. (2010). Pathological gambling in combat veterans. *Federal Practitioner, 27*(7), 8.

Holmes, E. K., Mateczun, J. M., Lall, R., & Wilcove, G. L. (1998). Pilot study of suicide risk factors among personnel in the united states marine corps (pacific forces). *Psychological Reports, 83*(1), 3–11.

Kausch, O. (2003a). Patterns of substance abuse among treatment-seeking pathological gamblers. *Journal of Substance Abuse Treatment, 25*(4), 263–270.

Kausch, O. (2003b). Suicide attempts among veterans seeking treatment for pathological gambling. *Journal of Clinical Psychiatry, 64*(9), 1031–1038.

Kausch, O. (2004). Pathological gambling among elderly veterans. *Journal of Geriatric Psychiatry and Neurology, 17*(1), 13–19.

Kausch, O., Rugle, L., & Rowland, D. Y. (2006). Lifetime histories of trauma among pathological gamblers. *The American Journal on Addictions, 15*(1), 35–43.

Kruedelbach, N., Walker, H. I., Chapman, H. A., Haro, G., Mateu, C., & Leal, C. (2006). Comorbidity on disorders with loss of impulse-control: Pathological gambling, addictions and personality disorders. *Actas Españolas de Psiquiatría, 34*(2), 76–82.

McCormick, R. A. (1993). Disinhibition and negative affectivity in substance abusers with and without a gambling problem. *Addictive Behaviors, 18*(3), 331–336.

McCormick, R. A. (1994). The importance of coping skill enhancement in the treatment of the pathological gambler. *Journal of Gambling Studies, 10*(1), 77–86.

McCormick, R. A., Russo, A. M., Ramirez, L. F., & Taber, J. I. (1984). Affective disorders among pathological gamblers seeking treatment. *American Journal of Psychiatry, 141*(2), 215–218.

McCormick, R. A., & Taber, J. I. (1988). Attributional style in pathological gamblers in treatment. *Journal of Abnormal Psychology, 97*(3), 368–370.

McCormick, R. A., & Taber, J. I. (1991). Follow-up of male pathological gamblers after treatment: The relationship of intellectual variables to relapse. *Journal of Gambling Studies, 7*(2), 99–108.

McCormick, R. A., Taber, J. I., & Kruedelbach, N. (1989). The relationship between attributional style and post-traumatic stress disorder in addicted patients. *Journal of Traumatic Stress, 2*(4), 477–487.

McCormick, R. A., Taber, J., Kruedelbach, N., & Russo, A. (1987). Personality profiles of hospitalized pathological gamblers: The california personality inventory. *Journal of Clinical Psychology, 43*(5), 521–527.

Moravec, J. D., & Munley, P. H. (1983). Psychological test findings on pathological gamblers in treatment. *International Journal of the Addictions, 18*(7), 1003–1009.

National Center for Veterans Analysis and Statistics. (2016a). *2014 minority veterans report*. Washington, DC: U.S. Department of Veterans Affairs.

National Center for Veterans Analysis and Statistics. (2016b). *Profile of women veterans: 2015*. Washington, DC: Department of Veterans Affairs.

National Research Council. (1999). *Pathological gambling: A critical review*. Washington, DC: The National Academies Press.

Nelson, K. G., & Oehlert, M. E. (2008). Evaluation of a shortened south oaks gambling screen in veterans with addictions. *Psychology of Addictive Behaviors, 22*(2), 309–312.

O'Toole, B. I., Marshall, R. P., Schureck, R. J., & Dobson, M. (1998). Posttraumatic stress disorder and comorbidity in australian vietnam veterans: Risk factors, chronicity and combat. *Australian and New Zealand Journal of Psychiatry, 32*(1), 32–42.

Petry, N. M., Blanco, C., Stinchfield, R., & Volberg, R. (2013). An empirical evaluation of proposed changes for gambling diagnosis in the DSM-5. *Addiction, 108*(3), 575–581.

Potenza, M. N., Xian, H., Shah, K., Scherrer, J. F., & Eisen, S. A. (2005). Shared genetic contributions to pathological gambling and major depression in men. *Archives of General Psychiatry, 62*(9), 1015–1021.

Russo, A. M., Taber, J. I., McCormick, R. A., & Ramirez, L. F. (1984). An outcome study of an inpatient treatment program for pathological gamblers. *Hospital and Community Psychiatry, 35*(8), 823–827.

Sartor, C. E., Scherrer, J. F., Shah, K. R., Xian, H., Volberg, R., & Eisen, S. A. (2007). Course of pathological gambling symptoms and reliability of the lifetime gambling history measure. *Psychiatry Research, 152*(1), 55–61.

Scherrer, J. F., Slutske, W. S., Xian, H., Waterman, B., Shah, K. R., Volberg, R., et al. (2007a). Factors associated with pathological gambling at 10-year follow-up in a national sample of middle-aged men. *Addiction, 102*(6), 970–978.

Scherrer, J. F., Xian, H., Kapp, J. M., Waterman, B., Shah, K. R., Volberg, R., et al. (2007b). Association between exposure to childhood and lifetime traumatic events and lifetime pathological gambling in a twin cohort. *The Journal of Nervous and Mental Disease, 195*(1), 72–78.

Scherrer, J. F., Xian, H., Shah, K. R., Volberg, R., Slutske, W., & Eisen, S. A. (2005). Effect of genes, environment, and lifetime co-occurring disorders on health-related quality of life in problem and pathological gamblers. *Archives of General Psychiatry, 62*(6), 677–683.

Scherrer, J. F., Xian, H., Slutske, W. S., Eisen, S. A., & Potenza, M. N. (2015). Associations between obsessive-compulsive classes and pathological gambling in a national cohort of male twins. *JAMA Psychiatry, 72*(4), 342–349.

Seal, K. H., Bertenthal, D., Miner, C. R., Sen, S., & Marmar, C. (2007). Bringing the war back home: Mental health disorders among 103,788 US veterans returning from iraq and afghanistan seen at department of veterans affairs facilities. *Archives of Internal Medicine, 167*(5), 476–482.

Slutske, W. S., Eisen, S., True, W. R., Lyons, M. J., Goldberg, J., & Tsuang, M. (2000). Common genetic vulnerability for pathological gambling and alcohol dependence in men. *Archives of General Psychiatry, 57*(7), 666–673.

Slutske, W. S., Eisen, S., Xian, H., True, W. R., Lyons, M. J., Goldberg, J., et al. (2001). A twin study of the association between pathological gambling and antisocial personality disorder. *Journal of Abnormal Psychology, 110*(2), 297–308.

Steenbergh, T. A., Whelan, J. P., Meyers, A. W., Klesges, R. C., & DeBon, M. (2008). Gambling and health risk-taking behavior in a military sample. *Military Medicine, 173*(5), 452–459.

Stefanovics, E. A., Potenza, M. N., & Pietrzak, R. H. (2017). Gambling in a National U.S. Veteran Population: Prevalence, socio-demographics, and psychiatric comorbidities. *Journal of Gambling Studies, 33,* 1099–1120.

Taber, J. I., McCormick, R. A., & Ramirez, L. F. (1987a). The prevalence and impact of major life stressors among pathological gamblers. *International Journal of the Addictions, 22*(1), 71–79.

Taber, J. I., McCormick, R. A., Russo, A. M., Adkins, B. J., & Ramirez, L. F. (1987b). Follow-up of pathological gamblers after treatment. *American Journal of Psychiatry, 144*(6), 757–761.

Taber, J. I., Russo, A. M., Adkins, B. J., & McCormick, R. A. (1986). Ego strength and achievement motivation in pathological gamblers. *Journal of Gambling Behavior, 2*(2), 69–80.

U.S. Department of Defense, Office of the Deputy Assistant Secretary of Defense for Military Community and Family Policy. (2015). *2015 demographics: Profile of the military community*. Washington, DC: U.S. Department of Defense.

U.S. Government Accountability Office. (2017). *Military personnel: DOD and the coast guard need to screen for gambling disorder addiction and update guidance: Report to congressional committees*. Washington, DC: U.S. Government Accountability Office. **(report nr GAO-17-114)**.

Volberg, R. (2003). Has there been a "feminization" of gambling and problem gambling in the United States? *Journal of Gambling Issues*. https://doi.org/10.4309/jgi.2003.8.7.

Westermeyer, J., Canive, J., Garrard, J., Thuras, P., & Thompson, J. (2005). Lifetime prevalence of pathological gambling among american indian and hispanic american veterans. *American Journal of Public Health, 95*(5), 860–866.

Westermeyer, J., Canive, J., Thuras, P., Kim, S. W., Crosby, R., Thompson, J., et al. (2006). Remission from pathological gambling among hispanics and native americans. *Community Mental Health Journal, 42*(6), 537–553.

Westermeyer, J., Canive, J., Thuras, P., Oakes, M., & Spring, M. (2013). Pathological and problem gambling among veterans in clinical care: Prevalence, demography, and clinical correlates. *The American Journal on Addictions, 22*(3), 218–225.

Westermeyer, J., Canive, J., Thuras, P., Thompson, J., Kim, S. W., Crosby, R. D., et al. (2008). Mental health of non-gamblers versus "normal" gamblers among American Indian veterans: A community survey. *Journal of Gambling Studies, 24*(2), 193–205.

Whiting, S. W., Potenza, M. N., Park, C. L., McKee, S. A., Mazure, C. M., & Hoff, R. A. (2016). Investigating veterans' pre-, peri-, and post-deployment experiences as potential risk factors for problem gambling. *Journal of Behavioral Addictions, 5*(2), 213–220.

Wickwire, E. M., Jr., Burke, R. S., Brown, S. A., Parker, J. D., & May, R. K. (2008). Psychometric evaluation of the national opinion research center DSM-IV screen for gambling problems (NODS). *The American Journal on Addictions, 17*(5), 392–395.

Xian, H., Giddens, J. L., Scherrer, J. F., Eisen, S. A., & Potenza, M. N. (2014). Environmental factors selectively impact co-occurrence of problem/pathological gambling with specific drug-use disorders in male twins. *Addiction, 109*(4), 635–644.

Xian, H., Scherrer, J. F., Slutske, W. S., Shah, K. R., Volberg, R., & Eisen, S. A. (2007). Genetic and environmental contributions to pathological gambling symptoms in a 10-year follow-up. *Twin Research and Human Genetics, 10*(1), 174–179.

Xian, H., Shah, K. R., Phillips, S. M., Scherrer, J. F., Volberg, R., & Eisen, S. A. (2008a). Association of cognitive distortions with problem and pathological gambling in adult male twins. *Psychiatry Research, 160*(3), 300–307.

Xian, H., Shah, K. R., Potenza, M. N., Volberg, R., Chantarujikapong, S., True, W. R., et al. (2008b). A latent class analysis of DSM-III-R pathological gambling criteria in middle-aged men: Association with psychiatric disorders. *Journal of Addiction Medicine, 2*(2), 85–95.