



Gambling Problems in US Military Veterans

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Published online: 24 April 2020

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Abstract

Purpose of Review Gambling disorder (GD) is a debilitating mental illness characterized by persistent patterns of dysregulated gambling behaviors. Recent evidence suggests that US military veterans are a high-risk population vulnerable to the development of problem gambling. This systemic review examined the published literature on the rates, correlates, comorbidities, treatment, and genetic contributions to US veterans' gambling behaviors in 39 studies.

Recent Findings Overall, we found that US military veterans have higher rates of GD (including subthreshold problem gambling/at-risk problem gambling) compared with civilian populations. Further, we found that GD often co-occurred with trauma-related conditions, substance use, and suicidality, which may complicate treatment outcomes. We also noted a lack of published interventions tested among US veterans and standardized screening for gambling problems among veterans across US federal agencies (i.e., Department of Defense, Department of Veterans Affairs) is lacking and remains a significant gap for ongoing prevention and treatment efforts.

Summary Despite growing evidence that individuals from military backgrounds (active-duty personnel, retired military veterans) are vulnerable to developing problem gambling, limited research has been centered on developing prevention and treatment interventions for affected individuals and their families. The lack of standardized screening for problem gambling among healthcare providers that work directly with US military populations remains a significant barrier to care for problem gamblers.

Keywords Gambling disorder · Military · Veterans · Problem gambling

Introduction

Gambling disorder ([GD]; formerly labeled pathological gambling [PG]) is a debilitating mental illness characterized by persistent patterns of dysregulated gambling behaviors that negatively affect life domains such as social relationships, personal well-being, financial well-being, employment, and legal issues [1]. Importantly, beyond diagnosable GD itself, gambling behaviors may also be problematic without meeting

full criteria for a diagnosis of GD. Subthreshold GD has been described by the terms “problem gambling” or “at-risk gambling” (e.g., 2-3 inclusionary criteria for GD).

The estimated lifetime prevalence of PG/GD among US adults ranges from 0.4 to 1.6% [2–4] and between 1.0 and 4.0% for problem gambling [5, 6]. A growing body of research has established that many factors are associated with greater risk of PG/GD, including younger age, male gender, US military service history, racial and/or ethnic minority status, lower education level, pre-existing mental health and substance use disorders, and delinquency/illegal acts [7–11].

For the current study, we use the term “veteran” to describe US adults who are “a person who served in the active military, naval, or air service and who was discharged or released under conditions other than dishonorable” [12]. Available estimates place the lifetime rates of GD in US military veterans around 2.0%, while the lifetime rates of problem gambling (clinical subthreshold) are as high as 9.0% [13, 14•, 15].

Research has also found that GD is associated with increased risk of obesity [16], stress [17], alcohol abuse/dependence [18], mood and anxiety disorders [19••], and

This article is part of the Topical Collection on *Gambling*

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personality disorders [20]. Among individuals with GD, researchers have found higher rates of psychiatric disorders [21], particularly among those with co-morbid GD and alcohol use disorders [22]. For instance, GD is associated with greater odds of experiencing incidents of negative mood, anxiety, or substance use disorders three years later [23]. Gambling frequently co-occurs with symptoms of post-traumatic stress disorder (PTSD) [24]. Traumatic experiences have also been found to predict problems with gambling in the future [25]. Individuals with both GD and PTSD are often highly distressed, more prone to suicidality [26], and high-utilizers of mental health treatment services [27]. Among treatment-seeking US Department of Veterans Affairs (VA) patients diagnosed with GD, research has also revealed high co-occurrences of substance use disorders and PTSD [10, 28].

Despite the many negative health and social outcomes associated with GD, only a small minority of individuals with GD (including subthreshold problem gambling) seek professional help for problem gambling [29]. Only an estimated 11% of individuals with GD will ever seek professional help in their lifetime [7, 30, 31]. This small number is particularly striking given that rates of natural recovery are low, with only a third of individuals with PG recovering naturally without professional intervention [31]. Among individuals who reached natural recovery, median time of recovery was 19 years. [32], suggesting that problem gamblers often suffer for nearly two decades before getting better. The reticence to obtain treatment for GD may be even stronger in active military members, who often state concerns about the confidentiality of their information and how such information could negatively impact their employment within the US armed forces [33].

Despite recent works highlighting the increased risk for GD among US veterans, particularly those with trauma histories [28], this population remains largely understudied. The purpose of this article is to review study findings on GD (including subthreshold problem gambling) in US military veterans and to highlight present concerns for this high-risk population. Recently, Section 733 of Public Law 115-232 H.R.5515 John S. McCain National Defense Authorization Act for Fiscal Year 2019 was passed by the US Congress requiring the Department of Defense (DOD) to “incorporate medical screening questions specific to gambling disorder into the annual Periodic Health Assessments of members of the Armed Forces” [34]. This legislation also requires the DOD to include questions about GD in their research using the Health-Related Behaviors Survey with active-duty personnel and reservists. Although research has found that gambling is associated with both family and personal problems for international veterans from the UK [35], overall there are few studies investigating the impact of GD on international samples of military veterans. As such, for this systematic review, we chose to include only studies using samples comprised of

US military veterans/active-duty personnel. Specifically, we will examine the published literature on the rates, correlates, comorbidities, treatment, and genetic contributions to US veterans’ gambling behaviors. The intended results from this review are to help inform US federal policies specific to the identification and treatment of GD among military populations and will mainly focus on US military veterans.

Methods

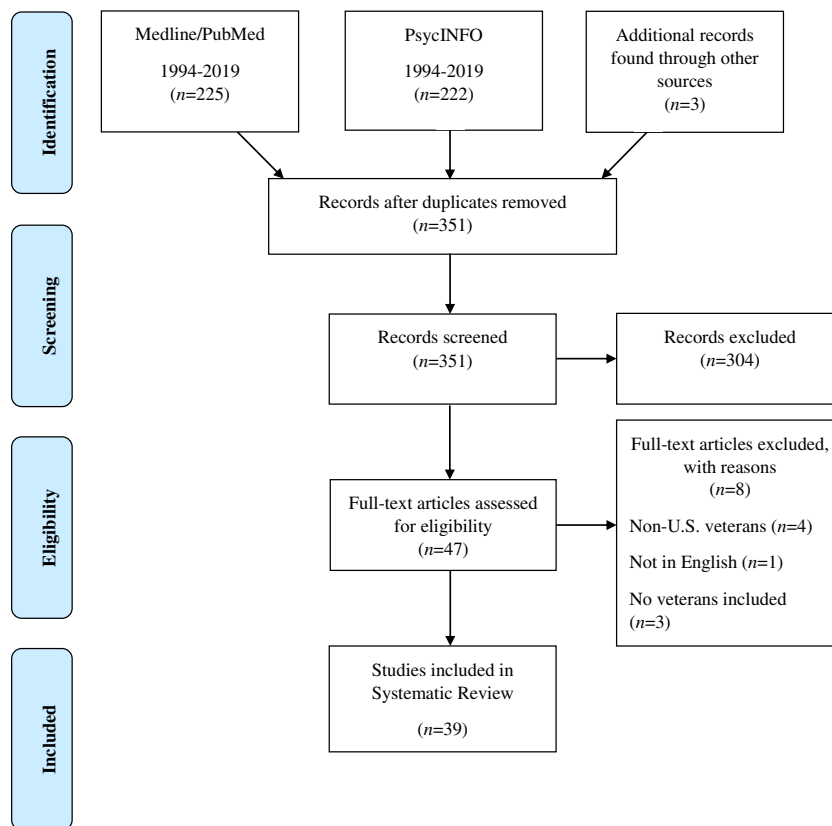
Search Strategy

Protocols and strategies used in this systematic review were in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. We first queried electronic databases (Medline/PubMed and PsycINFO) for peer-reviewed journal articles published between January 1, 1994 and November 23, 2019. PsycINFO covers 2290 journals and Medline/PubMed have a combined search of 5200 worldwide journals in over 40 languages. These dates were selected to obtain up-to-date information of GD in US military veterans while retaining relevant earlier studies of GD in military populations. The following key words were employed in this search: (gambl* AND military) OR (gambl* AND veteran). The study selection and screening process of identified studies is described in Fig. 1. Reference lists of included articles were checked manually for additional relevant publications.

Inclusion Criteria and Review Process

Articles were excluded if they were in languages other than English; they were a meta-analysis or systematic review; they were not peer-reviewed journal sources; the participants were adolescents or children; if the study used non-human participants; if the study did not include US veteran populations; and lastly, if the study was deemed to not be relevant to GD in veteran populations. Studies on the psychological and intellectual profile of veterans with GD were also excluded but have been discussed in a previous review [36]. The resulting full-text copies of all articles considered relevant to GD (including subthreshold GD) in US military veteran populations were retrieved and screened. Author RE reviewed all abstracts, and subsequently for the full text review, all authors collaborated to come to a consensus on the articles included in the final review. Three additional articles were found after the full text review, by searching article references and these were included in the final review, which encompassed 39 articles in total which are described below (see Table 1 for a summary of article categories).

Fig. 1 PRISMA flow diagram of the systematic review phases



Description of Studies and Measures Reported in Reviewed Studies

The articles covered in this review are typically cross-sectional studies with high proportions of white, male veterans. GD (or in some cases, “at-risk/problem gambling” which was defined by endorsing at least one GD symptom on a brief screening measure) was identified by a variety of measures, with the most popular measures described below. The South Oaks Gambling Screen (SOGS) [37] was the most commonly used measure for assessing gambling behavior and severity.

The SOGS [37] is a well-validated and reliable 20-item screener used to assess gambling severity (both GD and problem gambling) and maps on well to GD diagnosis criteria in the third, fourth, and fifth editions of the Diagnostic and

Statistical Manual for Mental Disorders (DSM). A score of 5 or more is indicative of GD or “probable GD” and a score of 3–4 is considered to represent an at-risk/problem gambler. Furthermore, several studies assessed GD by use of diagnostic interviews (clinician-administered semi-structured or structured clinical interviews) or direct questions about GD symptoms corresponding to DSM-IV [38] or DSM-5 [39] GD criteria.

Results

Gambling Behaviors Among Veterans: Rates and Frequency

The US Government Accountability Office (GAO) reviewed the Military Health System records of the DOD and Coast Guard (CG) from fiscal year 2011 to 2015 and reported that less than 0.03% of the average number of active-duty service members each year were diagnosed with gambling disorder or seen for problem gambling within the healthcare system. The report also notes that neither the DOD nor the CG systematically screen for problem gambling. However, Congressional legislation passed in 2019, which required standard screening among US active-duty personnel in order to estimate the rates of GD diagnoses, but screening has not yet been widely

Table 1 Summary of article categories

Category	Articles found
Rates	8
Comorbidities	8
Suicide, PTSD, and trauma-related conditions	9
Treatment	2
Genetic and environmental contributions	12

implemented by DOD. Similarly US veterans, researchers observed a reported past-year GD rate of 0.2% in a large sample of 1,102,424 veteran users of VA mental health services [40••]. However, the GD rate in this study was determined by ICD-10 codes located in veterans' medical records, which provides support for underdiagnoses of GD in this population. Viewing only the presence or absence of a diagnostic code does not provide accurate rate estimates, especially when considering that GD screening is uncommon in VA settings. Standardized screening for GD has not been widely implemented across the US VA hospitals or among active military members, which suggests that the diagnosed GD cases may only be severe presentations (e.g., legal or financial problems related to gambling). This is a possible explanation for the low rates of GD found by both reports and underestimates the actual rate of GD among US military members. Below, we will further review studies examining rate estimates of PG/GD among veterans within clinical and convenience samples, recognizing that precise estimates remain elusive at this time for veterans both within and outside of VA. Table 2 contains a summary with more detailed information on the rates of GD in veterans.

The rates of GD found in other studies with clinical samples are much higher. For example, researchers reported that of 120 veterans receiving counseling at a VA center, 20% presented with "probable GD" (SOGS scores of > 5) and an additional 4.2% of veterans were classified as "problem gamblers" (SOGS scores of 3 or 4) [41]. The large increase in GD rates is likely because psychiatric and substance use disorders often co-occur with GD; therefore, higher rates of GD would be expected in a clinical sample. Lastly, a study by Westermeyer and colleagues found that a clinical sample of 1999 veterans showed weighted lifetime rates of 1.9% for GD and 8.8% for problem gambling [14••].

Several other studies aimed to examine GD rates in representative samples of veterans. One study estimated the rate of past-year at-risk/problem gambling to be 2.2% in a nationally representative sample of 3157 veterans [42]. In another study using the Vietnam Twin Era Registry (VET-R), investigators reported lifetime GD rates of 2.3% for veterans ($n = 8169$) from the Vietnam era [43]. Slightly higher rates were seen in a minority-based sample of 1228 American Indian and Hispanic veterans, as researchers found lifetime GD rates of 9.9% and 4.3%, respectively [44]. In the only study investigating both veteran and non-veteran GD rates, researchers found that for the overall sample ($n = 9578$), there was a problem gambling rate of 1.3% [45•]. For the veteran subsample, there was a significant increase in problem gambling rate, as 26 of the 923 veterans (2.8%) were classified as problem gamblers, which represented 20.6% of the overall number of problem gamblers. Additionally, in this subsample, 12.9% ($n = 119$) of veterans were represented in a combined at-risk/problem gambling group. However, it should be noted that

this study only included veterans and non-veterans in the state of Massachusetts. A recent study examined GD rates in a cohort of current ($n = 911$) and former ($n = 642$) Ohio Army National Guard members and found a lifetime potential problematic gambling rate of 8% [13]. Furthermore, past-year frequent gambling (at least once per week) was demonstrated by 13% of the cohort.

Psychiatric Comorbidities with GD

GD is frequently comorbid with other psychiatric disorders, and it is important to study the possible effects of comorbidities, particularly when considering that veterans are at a higher risk compared with non-veterans for many psychiatric conditions [46]. Thus far, numerous studies have examined patterns and associations between GD and substance, alcohol, or nicotine use among veterans. Table 3 provides a summary of articles investigating psychiatric comorbidities of GD in veterans.

A 1996 study showed that among hospitalized, treatment-seeking, substance-abusing veterans, 33% of veterans met criteria for comorbid substance abuse and GD [47]. Similarly, in a recent study of veterans receiving residential treatment for GD, 32.6% also had a current substance use disorder [48•]. Researchers also investigated substance use and gambling behaviors in veterans seeking substance use treatment at a VA program [49]. In this sample, 79% of veterans indicated that they experienced cravings/urges to gamble, and 27% of veterans reported problems due to gambling. Another study examined substance abuse patterns of veterans seeking treatment for GD and found that 66.4% of veterans reported a lifetime history of substance abuse or dependence [50]. Prior works also suggest that the onset of substance dependence preceded the onset of problem gambling. Researchers examined the association between nicotine dependence and comorbid psychiatric disorders in a representative sample of male, American Indian veterans [51]. The lifetime GD rate for these veterans was 9.4% and both current and lifetime nicotine dependence were associated with GD.

Some studies have focused more generally on the global psychiatric comorbidities of GD in veteran populations. One study found psychiatric profile differences when comparing a clinical sample of elderly (> 60 years) and younger veterans admitted to a VA hospital gambling treatment program [52]. This study found that the elderly cohort was just as likely as the younger cohort to carry a psychiatric diagnosis, but the younger cohort showed significantly higher psychiatric severity. In another treatment-seeking sample of veterans with GD, 41% of veterans showed a lifetime history of a mood disorder, 29.5% presented a lifetime diagnosis of PTSD, and 77% of veterans reported lifetime substance use [10]. Researchers examined rates of GD among American Indian and Hispanic veterans [53]. Specifically, they found that veterans in

Table 2 Summary of studies investigating rates of gambling disorder

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Edens and Rosenheck (2012)	Clinical sample, population-based; <i>n</i> = 1,120,424 veteran users of VA specialty mental health service during FY2009	25% white 91% male	To evaluate rates of GD, and related demographic and diagnostic correlates within a national sample of VA mental health patients	ICD-10 code. GD only	The past-year rate of GD diagnosis = 0.2%, which suggests underdiagnosis among VA patients
Eisen et al. (2004)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 8169	93.5% white 100% male 42 \pm 2.8 years	To investigate the rates of psychiatric disorders (including GD) among a nationally distributed sample of Vietnam Era veterans	Diagnostic Interview Schedule Version 3, Revised. GD only	61.1% of respondents had a lifetime history of at least one disorder and 23.4% met the criteria for at least one disorder in the 12 months before the interview. GD lifetime rate = 2.3%
Freeman, Volberg, and Zorn (2019)*	Representative sample, Massachusetts population-based; <i>n</i> = 9578 overall including a subsample of <i>n</i> = 923 veterans	91.5% white 92.2% male	To explore problem gambling rates among veterans using non-VA data in a general population sample, and to examine variables associated with problem gambling	Problem and Pathological Gambling Measure. Included ARPG veterans and recreational gamblers	In the overall sample, 129 problem gamblers (1.3%) were identified. Of the 923 veterans sampled, 26 (2.8%) were classified as GD/problem gamblers. Additionally, 119 (12.9%) of veterans were classified in an ARPG group
Galloway et al. (2019)	Representative sample; <i>n</i> = 1553 current and former Ohio Army National Guard members from an annual cohort survey (data used from years 2015 and 2016)	85% male 36.2 \pm 10.4 years	To assess the rates of GD among a cohort of Ohio US National Guard members	National Opinion Research Center Diagnostic Screen—Loss of Control, Lying, and Preoccupation Screen. Problem gamblers only	Past-year frequent gambling (at least once per week) 13% of cohort. Lifetime potential problematic gambling = 8% of cohort only
Hierholzer et al. (2010)	Clinical sample, <i>n</i> = 120 veterans receiving counseling services at a veteran center	Not reported	To determine the rates of GD in a group of combat veterans receiving VA mental health services	SOGS. GD and problem gamblers	Probable GD = 20% of veterans. Problem gamblers 4.2% of veterans
Stefanovics, Potenza, and Pietrzak (2017)	Representative sample; nationally representative sample of US veterans drawn from a probability-based online survey panel (the Knowledge Panel®); <i>n</i> = 3157	76.2% white 89% male 60.3 \pm 13.1 years	To determine rates of past-year gambling (recreational, ARPG) and examine demographic and psychiatric correlates	Brief Biosocial Gambling Screen and two questions from the SOGS (most common type of gambling; money spent gambling in typical month). Included ARPG, and recreational gamblers	ARPG past-year rate was 2.2%. The rate of recreational gambling was 35.1%. ARPG was associated with greater psychiatric comorbidities and traumas
Westermeyer et al. (2005)	Representative-based sample; <i>n</i> = 1228 American Indian and Hispanic American veterans	0% white 81.7% male 47.3 \pm 13.9 years	To assess the rates and clinical correlates of GD in American Indian and Hispanic American veterans	Quick-Diagnostic Interview Schedule based on DSM-IV criteria. GD only	Lifetime rates of GD in American Hispanic and Indian veterans 4.3 and 9.9% respectively
Westermeyer et al. (2013)	Clinical sample; <i>n</i> = 1999 randomly selected veterans from VA centers	78% white 65.5% male 51.6 \pm 15.5 years	To estimate rates of GD and problem gambling among veterans receiving VA care	Computerized Diagnostic Interview Schedule-IV. GD and problem gamblers	10.7% of veterans overall had weighted lifetime GD (1.9%) or problem gambling (8.8%). Veterans with lifetime mood disorder or substance use disorder were more likely to have lifetime GD. There was a greater rate of GD for younger veterans aged 20–29 (1.3%) compared with veterans aged 30–39 (.8%)

*Demographics from gambling veterans (*n* = 731), which included recreational and at-risk/problem gamblers

GD, gambling disorder; SOGS, South Oaks Gambling Screen; ARPG, at-risk/problem or disordered gamblers

Table 3 Summary of studies examining gambling disorder and comorbidities

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Daghestani et al. (1996)	Clinical sample; <i>n</i> = 276 veterans seeking inpatient treatment for substance abuse at a VA hospital	30% white 97.8% male 41.4 \pm 8.4 years	To explore the rates of GD among hospitalized, substance-abusing veterans and to examine potential patterns of comorbidity	SOGS. GD only	33% of veterans met criteria for comorbid substance abuse and GD. Over three times as many comorbid veterans reported gambling with other family members as a child compared with substance-abusing-only veterans (68.2% vs 22.4%)
Davis et al. (2017)*	Clinical sample; <i>n</i> = 833 seeking substance use treatment at a VA outpatient program. Subset of <i>n</i> = 288 veterans with recent gambling (within last 30 days)	70% white 96% male 49.5 \pm 13.2 years	To evaluate the rates and correlates of gambling among veterans with recent substance use	Used a custom gambling measure analyzing past month gambling and related outcomes. Not specified	79% of veterans reported they experienced cravings/urges to gamble, 27% of veterans reported problems due to gambling. In a binary logistic regression, older age, binge drinking, and non-partner aggression all were related to higher odds of gambling
Dickerson et al. (2009)	Representative sample; <i>n</i> = 480 American Indian male veterans	0% white 100% male 47.6 \pm 12.6 years	To examine the association between nicotine dependence and comorbid psychiatric disorders (one of which was GD)	Quick-Diagnostic Interview Schedule to determine DSM-III-R. GD only	Lifetime GD rate = 9.4% of veterans. Both current and lifetime nicotine dependence were associated with GD. 17.1% of those with lifetime nicotine dependence had comorbid GD; 12.2% of those with current nicotine dependence had comorbid GD
Kausch (2004)	Clinical sample; <i>n</i> = 37 elderly veterans (> 60) admitted to a VA treatment gambling program and <i>n</i> = 98 gamblers from a younger cohort	85.2% white 93.3% male 51.9 \pm 11.3 years	To examine the comorbidities and other factors of elderly patients with GD and to compare them with a younger cohort	DSM-IV criteria and Gambler's Self-Report Inventory. GD only	The elderly were equally likely as the younger cohort to carry a psychiatric diagnosis, but the younger cohort showed significantly higher psychiatric severity. The elderly were less likely than the younger cohort to have attempted suicide in the past
Kausch (2003a)	Clinical sample; <i>n</i> = 113, retrospective chart review of veteran admissions to a VA gambling treatment program	85.2% white 91.2% male 48.8 \pm 9.8 years	To examine substance abuse patterns of veterans seeking treatment for GD	DSM-IV criteria, Gambler's Self-Report Inventory. GD only	66.4% of veterans reported a lifetime history of substance abuse or dependence. History of substance use/dependence was less common in older gamblers (> 60). Prior to admission (past year), 58.1% of veterans with a history of substance use/dependence actively used substances. In most gamblers, the onset of substance dependence preceded the onset of problem gambling
Shirk et al. (2018)	Clinical sample; 61 GD veterans seeking VA treatment	71% white 98.4% male 50.8 \pm 9.25 years	To investigate the clinical psychopathologies and comorbidities of veterans seeking treatment for GD	DSM-IV criteria, SOGS. GD only	41% of veterans showed a lifetime history of a mood disorder, and 29.5% presented a lifetime diagnosis of PTSD. 77% of

Table 3 (continued)

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Westermeyer et al. (2006)	Representative sample; <i>n</i> = 132 American Indian and Hispanic veterans who met lifetime criteria for GD	0% white 89.4% male 49.73 \pm 10.2 years	To determine 1-year remission rates from GD, along with factors associated with GD remission	DSM-III-R criteria via the Quick-Diagnostic Interview Schedule. GD only	veterans reported lifetime substance use, generally with tobacco (76.6%) and/or alcohol (68.9%) 70% of the sample met criteria for past-year GD while the remaining 30% was 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 variables and the absence of PTSD was associated with remission (10% remitters vs 33% non-remitters)
Westermeyer et al. (2008)	Representative sample; <i>n</i> = 557 American Indian veterans	0% white 85.6% men	To assess demographic and mental health characteristics of “non-problem” gamblers vs non-gamblers	DSM-III-R criteria via the Quick-Diagnostic Interview Schedule. Non-problem gamblers	Gamblers had greater lifetime rates of any Mood Disorder and PTSD. No significant difference was seen by gender or combat exposure but veterans who had experienced severe trauma were more likely to be gamblers in univariate analysis. However, this finding was no longer significant when included in a regression model. Tobacco dependence and antisocial personality disorder were significantly associated with gambling when analyzed with a regression model

*Demographics from the gambling veterans (*n* = 288)

GD, gambling disorder; PTSD, post-traumatic stress disorder; SOGS, South Oaks Gambling Screen

remission from GD (over the past year) were significantly less likely to have a current Axis I psychiatric diagnosis. The same research group again studied a representative sample of veterans, but now included only American Indian veterans [54]. However, this study differed from the previous in that the research team compared “non-problem” gamblers and non-gamblers and found that non-problem gamblers had greater lifetime rates of any mood disorder and PTSD.

PTSD and Trauma-Related Conditions

The relationship between PTSD and gambling behavior has become clearer in recent years, but more work remains to elucidate this relationship. Specifically, researchers found that gamblers were more likely to have a diagnosis of PTSD but no association was found between combat exposure and likelihood of gambling [54]. Similarly, in a study of a representative sample of veterans, researchers examined stressful life experience pre-, peri-, and post-deployment and found that veterans with PTSD were significantly more likely to engage in at-risk gambling behavior [15]. Specifically, this study

showed that the experience of post-deployment stressful life events and less social support increased the probability of at-risk gambling behavior. Finally, a retrospective chart review of veteran admissions to a VA gambling treatment program found that 64% of veterans reported a history of trauma (emotional, physical, or sexual abuse) that usually occurred during childhood [55]. They also found that gamblers with trauma backgrounds that included experienced physical and emotional abuse were more likely to attempt suicide.

PTSD co-occurs at high rates among US veterans receiving residential problem gambling treatment. For example, a recent set of studies [28, 56] included both an inpatient clinical sample of veterans with GD and an online convenience sample of non-veterans, as they explored the relationship between gambling beliefs, motivations, and their association with symptoms of PTSD. Results from these studies indicated that for both samples, symptoms of PTSD were related to more general cognitive distortions around gambling, including positive gambling expectancies (beliefs that gambling will improve one's affect, mood, or well-being). Additionally, PTSD was related to greater coping motivations for gambling (i.e., gambling to improve mood or reduce emotional distress). Moreover, both samples showed a positive relationship between positive gambling expectancies and coping motivations for gambling. Building off this previous study, these researchers used the same study design to further investigate symptoms of PTSD and how they might be related to specific situational vulnerabilities to gambling behaviors [48]. This study found that for both veterans with GD and non-veterans, symptoms of post-traumatic stress were uniquely related to gambling in response to negative affect, gambling in response to social pressure, and gambling due to a need for excitement. These latter two points are somewhat surprising, as gambling in response to a need for excitement or social pressure were not predicted as situations that individuals with PTSD would be especially vulnerable to gamble. However, these associations persisted, even when other potentially explanatory variables were held constant (i.e., trait impulsivity). Furthermore, they persisted in a non-veteran community sample, suggesting a consistent link between PTSD symptoms and gambling in response to a wide variety of situations. Further work is needed to uncover the mechanisms and directionality involved in the relationship between GD and PTSD among veterans.

Suicide Risk

An estimated 1-in-5 individuals with problem gambling will attempt suicide in their lifetime [57–59]. A similar pattern has emerged for US veterans as one study found that 39.5% of 114 veteran compulsive gamblers had previously attempted suicide [60]. Furthermore, another study by the same author [52] compared younger and older cohorts of treatment-seeking veterans with GD and revealed that older veterans

(age ≥ 60 years) were generally less likely to have attempted suicide at some point in the past. However, for recent suicide attempts in the last three years prior to gambling treatment admission, older veterans were more likely than the younger cohort to have attempted suicide. In a rare examination of suicide in a representative sample of veterans, researchers found that veterans who engaged in at-risk/problem gambling were significantly more likely to report a suicide attempt and suicidal ideation than recreational or non-gambling veterans [42]. Lastly, in a recent example, researchers revealed that in a clinical sample of veterans with GD and chronic pain, comorbid veterans were 1.9 times more likely to attempt suicide than veterans with a pain disorder alone [19•]. This result complements a previous work on chronic pain and GD, which suggested a positive association between moderate or severe pain interference and problematic/pathological gamblers in a sample of 41,897 adult Americans [61].

Taken together, these results raise considerable concerns about the increased risk for suicide that GD poses for military populations, but this association remains poorly understood. Considering the high rates of psychiatric disability associated with GD among veterans, greater attention is needed to routinely assess for suicidality and problem gambling severity among all active duty or veterans seeking healthcare.

Homelessness

Only two studies have investigated the relationship between homelessness and GD in veterans. An early study explored gambling problems in 154 formerly substance-abusing and homeless veterans six months after discharge from a treatment program [62]. Results from this study showed that veterans with gambling problems did not differ from other veterans in their current housing stability or employment. In a comparison of a national sample of homeless and non-homeless VA mental health users, researchers [63] discovered that in contrast to previous findings, GD was associated with homelessness and was a significant predictor of veteran homelessness (GD was the second strongest predictor after illicit drug use).

Table 4 provides an overview of studies exploring the factors of PTSD, trauma, homelessness, or suicide in gambling veterans.

Treatment for GD in Veterans

The present review found two studies on the treatment of GD in military veterans within its scope, although there were previous treatment articles conducted at an earlier date than the studies included in this review [64]. The lack of treatment studies for GD in military personnel is concerning, particularly when considering that many military members are apprehensive about the confidentiality of their decision to seek treatment for GD [33]. An additional concern is that

Table 4 Summary of studies examining suicide, PTSD and trauma-related conditions, and/or homelessness in gambling veterans

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Castellani et al. (1996)	Clinical sample; <i>n</i> = 154 formerly homeless, substance-abusing veterans 6 months after discharged from treatment	Not reported	To explore negative affect, gambling problems and coping skills in previously homeless, substance-abusing veterans	SOGS. GD only	Veterans with a gambling problem had significantly higher levels of negative affect and poorer coping, however their housing and employment stability did not differ from the other veterans
Edens et al. (2011)	Clinical sample, population-based; <i>n</i> = 1,120,424 veteran users of VA specialty mental health service during FY2009	25% white 91% male	To ascertain risk and protective factors for homelessness with comparisons of homeless and non-homeless VA mental health service users	Electronic medical recording for a clinical diagnosis of GD. GD only	The rate of past-year homelessness among veterans using VA mental health services was 9.7%. Illicit drug use was the strongest predictor of homelessness followed by GD. OEF/OIF veteran status was a protective factor against homelessness
Grubbs et al. (2018)	Representative and clinical sample; Representative: <i>n</i> = 589 adults via Amazon's Mechanical Turk Clinical: <i>n</i> = 332 veterans seeking residential VA treatment for GD	74.1% white 56.3% male 42.4 \pm 14 years	To assess how PTSD and post-traumatic stress may be related to specific gambling-related motives and cognitions	SOGS, Gambling Expectancies subscale of the Gambling-Related Cognitions Scale, Negative Emotions subscale of the Inventory of Gambling Situations, Coping subscale of the Gambling Motives Questionnaire. GD only	In both samples, symptoms of PTSD were related to positive gambling expectancies and coping motivations for gambling. Furthermore, in both samples positive gambling expectancies were associated with greater coping motivations for gambling
Grubbs and Chapman (2019)	Representative and clinical sample; Representative: <i>n</i> = 743 adults via Amazon's Mechanical Turk Clinical: <i>n</i> = 332 veterans seeking residential VA treatment for GD	73.9% white 55.8% male 41.5 \pm 13.9 years	To determine whether symptoms of post-traumatic stress might be related to specific situational vulnerabilities to gambling behaviors in a clinical GD sample and among recreational gamblers	SOGS, the Center for Addiction and Mental Health-Inventory of Gambling Situations, Inventory of Gambling Situations. GD, problem gamblers, and recreational gamblers	In both samples, symptoms of post-traumatic stress were uniquely related to gambling in response to negative affect, gambling in response to social pressure, and gambling due to a need for excitement. These effects remained after adjusting for substance use and trait impulsivity
Grubbs, Chapman and Shepherd (2019)	Representative and clinical sample; Representative: <i>n</i> = 589 adults via Amazon's Mechanical Turk Clinical: <i>n</i> = 332 veterans seeking residential VA treatment for GD	74.1% white 56.3% male 42.4 \pm 14 years	To examine how PTSD or symptoms of PTSD might be related to the expression and experience of gambling-related cognitions	SOGS, Gambling-Related Cognitions Scale. GD only	For both samples, individuals with PTSD or symptoms of PTSD were likely to report greater gambling-related cognitions. These findings were consistent even after gambling symptom severity and trait neuroticism were held constant
Kausch (2003b)	Clinical sample; <i>n</i> = 114, retrospective chart review of veteran admissions to a	86% white 92.2% male 48.9 \pm 9.7 years	To provide descriptive information about suicide attempts in veterans with GD, and to unveil	SOGS, DSM-IV criteria. GD only	39.5% of veterans reported that they had made a suicide attempt at some time in their lives. For

Table 4 (continued)

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
	VA gambling treatment program		underlying characteristics of suicide attempters		64% of attempters, they reported that their most recent attempt was gambling related. 58.8% of those with a history of drug dependence had a history of suicide attempts
Kausch, Ruge, and Rowland (2006)	Clinical sample; <i>n</i> = 111, retrospective chart review of veteran admissions to a VA gambling treatment program	85.6% white 91.9% male 48.9 \pm 9.8 years	To investigate the associations between trauma history, comorbid substance use and several other variables in a veteran GD sample	DSM-IV criteria, Gambler’s Self-Report Inventory. GD only	Most veterans (64%) reported a history of abuse (emotional, physical, or sexual trauma), which mostly occurred in childhood. Gamblers who experienced trauma (physical or emotional) were more likely to attempt suicide
Ronzitti et al. (2019)	Clinical sample; <i>n</i> = 242,859 veteran users of VA pain services between FY 2012–2014	89.7% male 56.58 \pm 0.3 years	To explore the relationships between gambling disorder, pain, and suicide attempts among veterans using VA pain-related services	ICD-9 codes extracted from the Corporate Data Warehouse. GD only	Severe pain score is negatively associated with gambling disorders. GD diagnosis was associated with suicide attempt in veterans who in the past year visited a VA for pain services
Whiting et al. (2016)	Representative sample; <i>n</i> = 738 veteran data from the Survey of the Experiences of Returning Veterans (SERV)	77.8% white 62.7% male 36 \pm 8.7 years	Examined pre-, peri-, and post-deployment factors associated with veteran problem gambling	Massachusetts Gambling Screen, DSM-IV criteria. Included GD, social, at-risk, and problem gamblers	Veterans with PTSD were significantly more likely to engage in at-risk gambling behavior. After adjusting for depression, the experience of post-deployment stressful life events and reduced social support increased the probability of at-risk gambling behavior

GD, gambling disorder; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; SOGS, South Oaks Gambling Screen

psychiatric disorders such as PTSD can co-occur at high rates among US veterans receiving residential problem gambling treatment [28, 56]. As such, the current strategies for treating GD in military members may be inadequate and should include plans to address likely psychiatric comorbidities and privacy concerns of US military members. Table 5 contains a summary of treatments of GD for veterans.

One study uniquely used a gambling treatment program that targeted 66 veterans’ gambling beliefs and attitudes [65]. The veterans that participated in this study showed significant improvement in gambling beliefs and attitudes at treatment end. In the only medication study found, the authors used disulfiram and naltrexone to treat 177 veterans with

comorbid alcohol dependence, and co-occurring psychiatric disorders [66]. In a subsample of the 177 veterans, the authors found that 45 veterans exhibited problem-gambling features and these 45 veterans displayed significantly less improvement over time in global psychiatric functioning. In general, treatment interventions (psychotherapy, pharmacotherapy) targeting GD and other co-occurring disorders (PTSD, alcohol use disorder) among veterans remain understudied.

Table 5 Summary of studies exploring gambling treatments for veterans

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Breen, Kruedelbach, and Walker (2001)	Clinical sample; <i>n</i> = 66 veterans admitted to a VA gambling treatment program	83% white 97% male 49.1 \pm 8.2 years	To examine the effect of a 28-day inpatient treatment program on gambling beliefs and attitudes	SOGS, Gambling Attitude and Beliefs Survey, DSM-IV criteria. GD only	Mean scores on the Gambling Attitudes and Beliefs Survey improved by treatment end
Grant et al. (2017)	Clinical sample; <i>n</i> = 254 veterans with alcohol dependence, and co-occurring psychiatric disorders admitted to one of three VA clinics for outpatient medication treatment. Included a subsample of <i>n</i> = 177 veterans with problem-gambling features.	70.1% white 96.6% male 47.3 \pm 8.7 years	To assess the influence of problem-gambling features on veteran treatment outcome for alcohol use disorder or co-occurring psychopathology assessed via DSM-IV criteria	Massachusetts Gambling Screen. GD and problem-gambling features (at-risk or problem gamblers)	45 of 177 veterans (25.4%) exhibited problem-gambling features. Veterans with problem-gambling features reported significantly less improvement over time in overall psychiatric functioning

GD, gambling disorder; SOGS, South Oaks Gambling Screen

Vietnam Era Twin Registry (Genetic and Environmental Factors)

The following series of studies use data from the Vietnam Era Twin Registry (VET-R), which is a large cohort of only male twin pairs (both monozygotic and dizygotic) born between 1939 and 1957. All cohort members served in the Vietnam era (1965–1975), and in 1992 participated in a structured psychiatric interview that assessed for psychiatric diagnoses. The VET-R is a valuable dataset in that it allows researchers to examine genetic and environmental contributions to psychiatric diagnoses (including GD) in a large military population.

In one of the earliest studies, the investigators found that inherited factors explain between 35% and 54% of the liability for developing GD symptoms ([67]. Results also indicated that 62% of liability for a clinical diagnosis of GD can be explained by genetics and shared environment (familial factors). Lin et al.'s [67] results were also supported by a subsequent study [68] which found that 48.9% and 57.5% of the total variance in risk of lifetime or past-year GD symptoms, respectively, were due to genetic factors.

Other studies from the VET-R have explored how genetic factors impact GD and its comorbidities. For example, one study found baseline PTSD symptoms were associated with a higher risk of developing problem gambling 10 years later [69]. Other researchers found high rates of co-occurring lifetime GD and major depression (MD) with 34% of the genetic variance for GD/MD also contributing to that of the other disorder [70]. A 2015 analysis found that GD and obsessive-compulsive spectrum disorders had a shared genetic variance of 19.4% [71] which is similar to the 12–20% genetic variance

shared between alcohol dependence and GD [72]. This research team also reported that 28% of the genetic variation in GD was accounted for by antisocial behavior disorders (ASPD, adult antisocial behaviors and childhood conduct disorder) [73]. Finally, several VET-R studies found that GD was associated with a host of attributes, including overall mental health, psychiatric disorders, and trauma history [25, 69, 74, 75•], with many of these associations still reaching significance after adjusting for covariates. For a complete summary of studies addressing genetic and environmental factors, see Table 6.

Discussion

Given recent funding priorities put forth by DOD and a steadily-but-slowly growing body of literature on gambling behaviors and problems in military and veteran populations, we sought to conduct a systematic review of gambling-related research in veteran and military populations. Despite the increased and apparent vulnerabilities US military populations present for the development of GD, little research exists to provide a clear clinical and practical understanding of the disorder within this population. A clear understanding of its etiology, comorbidities, protective and risk factors, and prognosis remains mostly unexplored. Our review does suggest, however, that US military veterans have higher rates (estimated ranges between 2.3 and 9.0%) of GD (including problem gambling/at-risk problem gambling) [13, 43] compared with their civilian counterparts (estimated ranges between 0.4 and 4.0%) and that GD in the military service member populations

Table 6 Summary of studies addressing genetic and environmental contributions to gambling disorder in veterans

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Eisen et al. (1998)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 6718	90.8% white 100% male 41.9 years	To estimate the familial contributions to GD	Diagnostic Interview Schedule Version III-Revised. GD and problem gamblers	Inherited factors explain between 35 and 54% of the liability for developing GD symptoms. 62% of liability for a clinical diagnosis of GD can be explained by genetics and shared environment (familial factors)
Potenza et al. (2005)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 7869	93.4% white 100% male 42 \pm 2.8 years	To estimate genetic and environmental contributions to GD and Major Depression (MD) based on DSM-III criteria. Also investigated the lifetime co-occurrence of GD and MD	Diagnostic Interview Schedule Version III-Revised. GD only	66% of the variance in GD and 41% of the variance in MD were due to genetic factors, and 34% of the variance in GD and 59% of the variance in MD were due to unique environmental factors. There was a significant correlation between the genetic aspects of GD and MD, with 34% of the genetic variance for GD/MD also contributing to that of the other disorder
Scherrer et al. (2005)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 1669	100% male	To model differences in the health-related quality of life (HRQoL) among non-problem gamblers, problem gamblers, and disordered gamblers	Diagnostic Interview Schedule Version III-Revised and a Diagnostic Interview Schedule based on DSM-IV criteria. GD, problem and non-problem gamblers	Negligible differences seen in the physical domains of the health survey between groups. In each mental health domain, disordered gamblers had lower HRQoL scores than problem gamblers, who in turn had lower scores than non-problem gamblers. The results suggest that genetics, substance use disorder and family environment account for differences between problem/disordered gambling and non-problem gambling
Scherrer et al. (2007a)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 1675	94% white 100% male 53.4 \pm 2.5 years	To investigate the relationship between psychiatric disorder history and genetic vulnerability to problem and disordered gambling	Diagnostic Interview Schedule Version III-Revised. GD and problem gamblers	After adjusting for genetic and family influence, prior history of problem and disordered gambling behavior was a strong predictor of current disordered gambling behavior. Increased risk of past-year gambling disorder significantly associated with: lifetime history of antisocial personality disorder, drug dependence, depression/dysthymia, PTSD and nicotine dependence
Scherrer et al. (2007b)	Representative sample; from the Vietnam Era Twin Registry; <i>n</i> = 1675	100% male	To estimate the strength of the association between exposure to lifetime traumatic events and gambling problems	Diagnostic Interview Schedule Version III-Revised and DSM-IV criteria. Unaffected, at-risk, problem gamblers, and GD	After adjusting for covariates, the following were associated with GD: child abuse, child neglect witnessing someone badly hurt or killed, and physical attack. Risk and severity of gambling problems increased with

Table 6 (continued)

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Scherrer et al. (2015)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 1675	100% male	To assess the genetic correlation and association among features of GD and obsessive-compulsive spectrum disorder (OC)	Diagnostic Interview Schedule Version III-Revised and DSM-V criteria for GD. GD and problem gamblers	number of lifetime traumatic events experienced GD and OC have a shared genetic variance of 19.4%, which implies genetic influence on co-occurrence. Genetic factors account for 37% and 64% of total variance in OC and GD respectively
Slutske et al. (2000)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 8169	94% white 100% male 42.4 \pm 2.8 years	To test for evidence of the continuity model of GD. To examine the causes of comorbidity between GD and alcohol dependence	Diagnostic Interview Schedule Version III-Revised. GD, problem and non-problem gamblers	64% of the variance for comorbidity of GD and alcohol dependence was accounted for by genetic factors. 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)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 7869	93.8% white 100% male 42.4 \pm 2.8 years	To study the association between GD and antisocial personality disorder (ASPD) and how the genetic and environmental factors contribute to the association	Diagnostic Interview Schedule Version III-Revised. Two groups, combined GD/problem gamblers and non-problem gamblers	Veterans with GD = 6.4 times more likely to have a lifetime diagnosis of ASPD. 28% of the genetic variation in GD was accounted for by antisocial behavior disorders (ASPD, adult antisocial behaviors and childhood conduct disorder)
Xian et al. (2007)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 1675	100% male 53 years	To address the contribution of environmental and genetic factors to lifetime GD symptoms (baseline) and past-year GD symptoms	Diagnostic Interview Schedule Version III-Revised. Combined group of GD/problem gamblers	48.9% of the total variance in risk of lifetime GD baseline symptoms was due to genetic factors. 57.5% of variance in risk of past-year GD symptoms was due to genetic factors. The remaining variance in current GD symptoms was attributed to unique environmental influences
Xian et al. (2008a)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 1354	90% white 100% male 53 years	To examine the association between cognitive distortions and GD	Diagnostic Interview Schedule Version III-Revised and National Opinion Research Center DSM-IV Screen for Gambling Problems. Low risk, at risk, problem and GD.	A positive association was found between cognitive distortion score and NODS gambling severity. This relationship was still significant even after controlling for genetic and shared environmental influence
Xian et al. (2008b)	Representative sample; subsample of participants <i>n</i> = 2720 from the Vietnam Era Twin Registry	93% white 100% male 43 years	To create latent classes based on GD criteria and to assess the association between other psychiatric disorders and these specific classes	Diagnostic Interview Schedule Version III-Revised. GD and problem gamblers	A four-class model provided the best data fit. Classes 1–3 comprised of increasing severity of problem gambling behavior and the number of diagnostic criteria endorsed with class 0 containing individuals who did not

Table 6 (continued)

Article	Sample (<i>n</i> and brief description)	Demographics (ethnicity, gender, mean age [\pm SD])	Study objective	Measure and severity of gambling patients	Results
Xian et al. (2014)	Representative sample from Vietnam Era Twin Registry; <i>n</i> = 7869	93.4% white 100% male 42 \pm 2.8 years	To investigate how genetic and environmental factors contribute to the co-occurrence of GD and drug abuse/dependence	Diagnostic Interview Schedule Version III-Revised. Combined group of GD/problem gamblers	gamble frequently. Members of Classes 2 and 3 were significantly more likely to experience psychiatric disorders than class 0, except for bipolar disorder for class 2 Genetic and non-shared environmental factors contributed to co-occurrence of problem/pathological gambling and drug abuse/dependence (cannabis and nicotine abuse/dependence). For stimulant (e.g., speed, cocaine) abuse/dependence, only genetic factors were significant contributors

GD, gambling disorder

often co-occurs with trauma-related conditions, substance use, and suicidality. Concerningly, there is a lack of published interventions tested in this unique population; and, like the general population, there appears to be a substantive genetic link to the development of the disorder and other psychiatric comorbidities [76]. Based on these factors, we have provided recommendations (see Table 7) on how to address missing gaps specific to problem gambling among US military populations.

With such limited research available, the apparent knowledge gaps are extensive as they pertain to problem gambling among US military populations. First, there is no clear, comprehensive understanding of the rates of problem gambling and GD among US military veterans. Prior work has provided some approximations of problem gambling among US veterans [42]; however, more research is needed to better understand how gambling severity evolves over the life course as well as differences across US military populations, particularly as a function of gender, ethnicity, and other cultural factors. It is likely that only in extreme cases of problem gambling are individuals diagnosed and referred to a mental health provider. Motivations for seeking gambling treatment among veterans are often the result of significant financial or legal factors [28]. To identify individuals with at-risk problem gambling (i.e., the beginning stages of the GD), we need to adopt standardized screening for problem gambling across healthcare settings that interact with military populations. The implementation of standardized screening for problem gambling could serve to detect those earlier in the course of the illness, thus reducing full onset of the GD, which in turn would prevent much of the

irrevocable psychological, medical, social, and financial problems associated with problem gambling [77]. Results from this systematic review suggest that the implementation of standardized screening for GD among organizations (DOD military bases, Veterans Affairs Medical Centers, universities with veteran student programming) that serve US veterans is strongly needed.

Second, our review suggests there are limitations with current studies specific to the design and samples used for assessing problem gambling/GD among veterans. With only a few exceptions, samples studied were convenience samples, often treatment-seeking, and designs were cross-sectional in nature. In addition, any comparisons made between diagnosed GD, problem gamblers, recreational gamblers, and non-gamblers amount to only a small fraction of studies. Slot machines are widely available on US military bases [78] which may play a role in the initial development of GD in military members [79]. Yet, these direct links remain untested. In the future, more exploration of the etiology of GD in military members and veterans is necessary, particularly as it pertains to understanding how gambling accessibility on military bases increases veterans' risk of developing GD. Ultimately, there are relatively few substantive examples of prospective research studies specifically investigating gambling behaviors and GD in veteran populations. Prospective studies of GD in US military members would assist researchers in unveiling the specific risk factors (e.g., trauma exposure, impulsivity, adverse childhood experiences) that might lead to the development of GD and in identifying potential protective factors that lower the chance of developing GD. Moreover, such research

Table 7 Knowledge gaps and concerns relating to GD in military veteran populations and approaches for addressing these issues

Current gaps	Future recommendations
Stigma of diagnosis	Currently, some active military members state that they do not undergo GD treatment for fear of discharge from the military or punishments from their superiors. These beliefs could persist as active military members transition into civilian life. Overall, policy changes and a larger emphasis on privacy for both active and veteran military members undergoing treatment could help with these issues. Other barriers to treatment for military members should also be investigated through large national representative samples of veterans.
Lack of rates, screening, and underdiagnosis	Inform clinicians and administrators that GD is a concern in veteran populations and encourage assessment of GD, possibly with a brief gambling screener. GD is often comorbid with many mental health disorders that veterans present with (i.e., mood disorders, PTSD, substance/alcohol abuse) and veterans that present with one of these common psychiatric disorders could be assessed for GD as well.
Gambling availability on military bases	More research is needed to understand the potential effects of allowing gambling games (e.g., slot machines) on military bases and to assess if this availability is related to the development or maintenance of GD in veterans.
Demographic differences	Age, race/ethnicity, and gender differences require further attention. For example, development of GD differs between men and women in the general population. With the growing number of women entering into military service and reporting greater psychiatric and substance use problems compared with the general public, investigating differences may inform prevention and interventions.
Non-US military veterans	A few studies have investigated the impact of GD on Non-US military veterans, but direct comparisons between US military and Non-US military veterans could examine cultural differences in veterans with GD. Such information could help inform both prevention and treatment approaches for military veterans.
Longitudinal data	New research using naturalistic longitudinal studies assessing the trajectory of GD are needed to help to identify risk and protective factors for the development of GD and measure the progression of GD symptoms over time among veterans.
Treatment effectiveness	Limited research has directly assessed treatment of GD specifically in veteran populations. As veterans are a unique population at higher risk than the general population for many psychiatric disorders, more research to assess effective treatments for this specific group is necessary. Future research should also include veterans with GD and comorbid psychiatric disorders as GD often co-occurs with other psychiatric disorders.

GD, gambling disorder

would also provide foundations for future policy initiatives in military and veteran populations designed to prevent the development of gambling problems before they appear.

Third, the majority of samples studied included white, male veterans. Although reflective of the armed services demographics overall, findings from the general population demonstrate that GD affects minorities differently and at greater rates and should also be considered within this subpopulation of US military veterans. This is particularly notable given that all branches of the military are increasingly diverse with regard to gender and racial composition [80]. In addition, the progression of problem gambling and GD differs between men and women in the general population [81], and although men make up the majority of US military veterans population, the percentage of women joining the US military service

continues to rise. Recent studies have also raised attention to GD among women veterans, which requires further exploration [19•]. This focus on gender differences is particularly notable given that recent studies of veterans in residential treatment for GD were comprised of 20% women, which suggests that either rates of GD or rates of treatment-seeking (or both) may be higher among women veterans [28, 56]. Lastly, evidence suggests that age may also play a role in how GD presents and its co-occurring risk factors (e.g., suicide); yet, despite the aging US veteran population, little is known about how gambling behaviors differ across the lifetime in veterans. With a large and aging US veteran population, further work examining the interplay between age and GD among veterans is sorely needed as prior work has suggested that problem

gambling occurs across the lifespan and is present among older adults [82].

Lastly, with only two extant treatment studies within the scope of this review, one psychosocial and one pharmacological, it is unclear how effective treatment within the general population will translate to the US veteran population. Because of the complex and unique histories and co-occurring disorders found among US military veterans, standard treatment protocols often need to be adapted to meet their specific needs. Given that, there is a great need to further investigate and develop effective treatments for this subpopulation and other at-risk groups [83].

As mentioned above, the US GAO (2017) reported a small number of active-duty service members were diagnosed with GD or were being treated for problem gambling. Yet, despite these low numbers, the GAO report suggests active screening for problem gambling given its association with its problematic preoccupation, financial problems, and an increased risk of suicide. In 2019, US Senators Warren and Daines introduced an updated Gambling Addiction Prevention (GAP) Act, which requires the DOD to develop policies and programs to prevent and treat problem gambling, provide education materials and programs, and to promote responsible gaming on military sites where gambling is available. In addition, within 180 days of the passage of the Act, it requires the DOD to update its regulations, instructions, and guidance to explicitly include gambling disorder. The exact nature of the screening, programs, and intervention have yet to be determined among US agencies that serve military populations. As such, this remains a significant barrier to care for veterans/active-duty personnel with GD.

As a natural corollary to the field's limitation and the DOD and VA policy changes proposed internally, future directions are clear. First, a systematic, prospective study specific to the study of problem gambling among US military veterans is needed to determine effective screeners for identifying those at risk and to better understand development of the disorder to help determine points for intervention. Second, investigation into the clinical comorbidities of problem gambling is also needed due to higher rates of psychiatric (e.g., PTSD) and substance use disorders (e.g., alcohol use disorder) and suicide among US veterans [42]. Likewise, further investigation is needed to determine the role of gambling in social and financial issues (e.g., homelessness). In addition, less is known about possible differences in specific characteristics regarding associated cognitive distortion and symptom severity of GD among this population is needed. A better understanding of gambling characteristics and co-occurring problems among this population will inevitably lead to improved interventions and treatment that appropriately target their unique needs, which leads to the next gap: demonstrated effective treatment. Our review found only two interventions for problem gambling among US veterans. Once problem gambling is

identified, demonstrated effective treatments need to be studied, developed, and tailored to this population to ensure it adequately addresses their specific needs and leads to recovery. Pharmacotherapy and psychotherapy interventions designed to treatment GD among US veterans are strongly needed to address missing gaps in care for this vulnerable subpopulation (see [76] for further discussion).

Despite the varying reports and studies of varying samples, design, and methodologies and the apparent knowledge gaps, as this review demonstrates, US military veterans are vulnerable to the development of problem gambling and GD. Unlike the general population, however, the extent of the problem and effective treatments for GD remain unknown and untested. Future research is needed to address many of the described missing gaps needed to enhance diagnosis and treatment outcomes for veterans with gambling problems.

Funding Information This project was supported by the International Center for Responsible Gaming. The content of this manuscript does not necessarily reflect the views of the funding agencies and reflects the views of the authors.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
- Of major importance

1. Grant JE, Kim SW. Quality of life in kleptomania and pathological gambling. *Compr Psychiatry*. 2005;46(1):34–7.
2. Anokhin AP, Grant JD, Mulligan RC, Heath AC. The genetics of impulsivity: evidence for the heritability of delay discounting. *Biol Psychiatry*. 2015;77(10):887–94.
3. Petry NM, Stinson FS, Grant BF. Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *J Clin Psychiatry*. 2005;66(5):564–74.
4. Shaffer HJ, Hall MN, Vander BJ. Estimating the prevalence of disordered gambling behavior in the United States and Canada: a research synthesis. *Am J Public Health*. 1999;89(9):1369–76.
5. Toce-Gerstein M, Gerstein DR, Volberg RA. The NODS-CLiP: a rapid screen for adult pathological and problem gambling. *J Gambl Stud*. 2009;25(4):541.
6. Welte JW, Barnes GM, Tidwell M-CO, Hoffman JH, Wieczorek WF. Gambling and problem gambling in the United States: changes between 1999 and 2013. *J Gambl Stud*. 2015;31(3):695–715.

7. Alegria AA, Petry NM, Hasin DS, Liu S-M, Grant BF, Blanco C. Disordered gambling among racial and ethnic groups in the US: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *CNS Spectrums*. 2009;14(3):132–43.
8. Barry DT, Stefanovics EA, Desai RA, Potenza MN. Gambling problem severity and psychiatric disorders among Hispanic and white adults: findings from a nationally representative sample. *J Psychiatr Res*. 2011;45(3):404–11.
9. Kong G, Smith PH, Pilver C, Hoff R, Potenza MN. Problem-gambling severity and psychiatric disorders among American-Indian/Alaska native adults. *J Psychiatr Res*. 2016;74:55–62.
10. Shirk SD, Kelly MM, Kraus SW, Potenza MN, Pugh K, Waltrous C, et al. Gambling-related cognitive distortions predict level of function among US veterans seeking treatment for gambling disorders. *Am J Addict*. 2018;27(2):108–15.
11. Welte JW, Barnes GM, Wieczorek WF, Tidwell M-CO, Parker JC. Risk factors for pathological gambling. *Addict Behav*. 2004;29(2):323–35.
12. VA.org. Title 38 of the Code of Federal Regulations. <https://va.org/what-is-a-veteran-the-legal-definition>. 2020. Accessed February 9, 2020 2020.
13. Galloway MS, Fink DS, Sampson L, Cohen GH, Tamburrino M, Liberzon I, et al. Prevalence and covariates of problematic gambling among a US military cohort. *Addict Behav*. 2019;95:166–71.
14. •• Westermeyer J, Canive J, Thuras P, Oakes M, Spring M. Pathological and problem gambling among veterans in clinical care: prevalence, demography, and clinical correlates. *Am J Addict*. 2013;22(3):218–25 **A clinical sample of veterans showed weighted lifetime rates of 1.9% and 8.8% for GD and problem gambling, respectively.**
15. Whiting SW, Potenza MN, Park CL, McKee SA, Mazure CM, Hoff RA. Investigating veterans' pre-, peri-, and post-deployment experiences as potential risk factors for problem gambling. *J Behav Addict*. 2016;5(2):213–20.
16. Morasco BJ, Pietrzak RH, Blanco C, Grant BF, Hasin D, Petry NM. Health problems and medical utilization associated with gambling disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychosom Med*. 2006;68(6):976–84.
17. Ronzitti S, Kraus SW, Hoff RA, Potenza MN. Stress moderates the relationships between problem-gambling severity and specific psychopathologies. *Psychiatry Res*. 2018;259:254–61.
18. Cowlshaw S, Hakes JK. Pathological and problem gambling in substance use treatment: results from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Am J Addict*. 2015;24(5):467–74.
19. •• Ronzitti S, Kraus SW, Decker SE, Ashrafioun L. Clinical characteristics of veterans with gambling disorders seeking pain treatment. *Addict Behav*. 2019;95:160–5 **This study found that in a clinical sample of veterans with GD and chronic pain were more likely to attempt suicide than veterans with a pain disorder alone.**
20. Ronzitti S, Kraus SW, Hoff RA, Clerici M, Potenza MN. Problem-gambling severity, suicidality and DSM-IV Axis II personality disorders. *Addict Behav*. 2018;82:142–50.
21. Desai RA, Potenza MN. Gender differences in the associations between past-year gambling problems and psychiatric disorders. *Soc Psychiatry Psychiatr Epidemiol*. 2008;43(3):173–83.
22. Brewer JA, Potenza MN, Desai RA. Differential associations between problem and pathological gambling and psychiatric disorders in individuals with and without alcohol abuse or dependence. *CNS Spectrums*. 2010;15(1):33–44.
23. Parhami I, Mojtabai R, Rosenthal RJ, Afifi TO, Fong TW. Gambling and the onset of comorbid mental disorders: a longitudinal study evaluating severity and specific symptoms. *J Psychiatr Pract*. 2014;20(3):207–19.
24. Kessler RC, Hwang I, LaBrie R, Petukhova M, Sampson NA, Winters KC, et al. DSM-IV pathological gambling in the National Comorbidity Survey Replication. *Psychol Med*. 2008;38(9):1351–60.
25. Scherrer JF, Xian H, Kapp JMK, Waterman B, Shah KR, Volberg R, et al. Association between exposure to childhood and lifetime traumatic events and lifetime pathological gambling in a twin cohort. *J Nerv Ment Dis*. 2007;195(1):72–8.
26. Najavits LM, Meyer T, Johnson KM, Korn D. Pathological gambling and posttraumatic stress disorder: a study of the co-morbidity versus each alone. *J Gambl Stud*. 2011;27(4):663–83.
27. Najavits LM. Treatment utilization of pathological gamblers with and without PTSD. *J Gambl Stud*. 2010;26(4):583–92.
28. Grubbs JB, Chapman H, Shepherd KA. Post-traumatic stress and gambling related cognitions: analyses in inpatient and online samples. *Addict Behav*. 2019;89:128–35.
29. Cunningham-Williams RM, Grucza RA, Cottler LB, Womack SB, Books SJ, Przybeck TR, et al. Prevalence and predictors of pathological gambling: results from the St. Louis personality, health and lifestyle (SLPHL) study. *J Psychiatr Res*. 2005;39(4):377–90.
30. Ledgerwood DM, Milosevic A. Clinical and personality characteristics associated with post traumatic stress disorder in problem and pathological gamblers recruited from the community. *J Gambl Stud*. 2015;31(2):501–12.
31. Slutske WS. Natural recovery and treatment-seeking in pathological gambling: results of two US national surveys. *Am J Psychiatr*. 2006;163(2):297–302.
32. Bernardi S, Petry NM, Martins SS, Hasin DS, Liu S, Grant BF, et al. Predictors of remission from problem and pathological gambling: Results from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). *Arch Behav Addict*. 2019. <https://doi.org/10.30435/ABA.01.2019.04>.
33. Kennedy CH, Cook JH, Poole DR, Brunson CL, Jones DE. Review of the first year of an overseas military gambling treatment program. *Mil Med*. 2005;170(8):683–7.
34. Congress U, editor. HR 5515-John S. McCain National Defense Authorization Act for Fiscal Year 2019. The US Congress; 2018.
35. Dighton G, Roberts E, Hoon AE, Dymond S. Gambling problems and the impact of family in UK armed forces veterans. *J Behav Addict*. 2018;7(2):355–65.
36. Levy L, Tracy JK. Gambling disorder in veterans: a review of the literature and implications for future research. *J Gambl Stud*. 2018;34(4):1205–39.
37. Lesieur HR, Blume SB. The South Oaks Gambling Screen (SOGS): a new instrument for the identification of pathological gamblers. *Am J Psychiatr*. 1987;144(9).
38. Association A, Association A. Diagnostic and statistical manual-text revision (DSM-IV-TR, 2000). American Psychiatric Association 2000.
39. Association AP. Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub; 2013.
40. •• Edens EL, Rosenheck RA. Rates and correlates of pathological gambling among VA mental health service users. *J Gambl Stud*. 2012;28(1):1–11 **This cross-sectional study found overall low rates of GD in military veterans. However, these findings may not represent the “true rates” for GD in military veterans, as current rate estimates of GD in military veterans have various issues.**
41. Hierholzer R, Vu H, Mallios R. Pathological gambling in combat veterans. *Fed Pract*. 2010;27(8–12):14–5.
42. Stefanovics EA, Potenza MN, Pietrzak RH. Gambling in a national US veteran population: prevalence, socio-demographics, and psychiatric comorbidities. *J Gambl Stud*. 2017;33(4):1099–120.
43. Eisen SA, Griffith KH, Xian H, Scherrer JF, Fischer ID, Chantarujikamong S, et al. Lifetime and 12-month prevalence of

- psychiatric disorders in 8,169 male Vietnam War era veterans. *Mil Med.* 2004;169(11):896–902.
44. Westermeyer J, Canive J, Garrard J, Thuras P, Thompson J. Lifetime prevalence of pathological gambling among American Indian and Hispanic American veterans. *Am J Public Health.* 2005;95(5):860–6.
 45. Freeman JR, Volberg RA, Zorn M. Correlates of at-risk and problem gambling among veterans in Massachusetts. *J Gambl Stud.* 2019;1–15 **This study estimated GD rates for both veterans and non-veterans. They found in the overall sample there was a problem gambling rate of 1.3%. In the veteran-only subsample, 2.8% were classified as problem gamblers.**
 46. Helmer DA, Chandler HK, Quigley KS, Blatt M, Teichman R, Lange G. Chronic widespread pain, mental health, and physical role function in OEF/OIF veterans. *Pain Med.* 2009;10(7):1174–82.
 47. Daghestani AN, Elenz E, Crayton JW. Pathological gambling in hospitalized substance abusing veterans. *J Clin Psychiatry.* 1996.
 48. Grubbs JB, Chapman H. Predicting gambling situations: the roles of impulsivity, substance use, and post-traumatic stress. *Substance Abuse: Res Treatment.* 2019;13:1178221819852641 **This cross-sectional study found that for both veterans with GD and non-veterans, symptoms of post-traumatic stress were uniquely related to gambling in response to negative affect, gambling in response to social pressure, and gambling due to a need for excitement.**
 49. Davis AK, Bonar EE, Goldstick JE, Walton MA, Winters J, Chermack ST. Binge-drinking and non-partner aggression are associated with gambling among veterans with recent substance use in VA outpatient treatment. *Addict Behav.* 2017;74:27–32.
 50. Kausch O. Patterns of substance abuse among treatment-seeking pathological gamblers. *J Subst Abus Treat.* 2003;25(4):263–70.
 51. Dickerson DL, O'Malley SS, Canive J, Thuras P, Westermeyer J. Nicotine dependence and psychiatric and substance use comorbidities in a sample of American Indian male veterans. *Drug Alcohol Depend.* 2009;99(1–3):169–75.
 52. Kausch O. Pathological gambling among elderly veterans. *J Geriatr Psychiatry Neurol.* 2004;17(1):13–9.
 53. Westermeyer J, Canive J, Thuras P, Kim SW, Crosby R, Thompson J, et al. Remission from pathological gambling among Hispanics and Native Americans. *Community Ment Health J.* 2006;42(6):537–53.
 54. Westermeyer J, Canive J, Thuras P, Thompson J, Kim SW, Crosby RD, et al. Mental health of non-gamblers versus “normal” gamblers among American Indian veterans: a community survey. *J Gambl Stud.* 2008;24(2):193–205.
 55. Kausch O, Rugle L, Rowland DY. Lifetime histories of trauma among pathological gamblers. *Am J Addict.* 2006;15(1):35–43.
 56. Grubbs JB, Chapman H, Milner L, Gutierrez IA, Bradley DF. Examining links between posttraumatic stress and gambling motives: the role of positive gambling expectancies. *Psychol Addict Behav.* 2018;32(7):821–31.
 57. Cox S, Lesieur HR, Rosenthal RJ, Volberg RA. Problem and pathological gambling in America: the national picture. National Council on Problem Gambling: Columbia; 1997.
 58. Ledgerwood DM, Steinberg MA, Wu R, Potenza MN. Self-reported gambling-related suicidality among gambling helpline callers. *Psychol Addict Behav.* 2005;19(2):175–83.
 59. Petry NM, Kiluk BD. Suicidal ideation and suicide attempts in treatment-seeking pathological gamblers. *J Nerv Ment Dis.* 2002;190(7):462–9.
 60. Kausch O. Suicide attempts among veterans seeking treatment for pathological gambling. *J Clin Psychiatry.* 2003.
 61. Barry DT, Pilver CE, Hoff RA, Potenza MN. Pain interference, gambling problem severity, and psychiatric disorders among a nationally representative sample of adults. *J Behav Addict.* 2013;2(3):138–44.
 62. Castellani B, Wootton E, Rugle L, Wedgeworth R, Prabucki K, Olson R. Homelessness, negative affect, and coping among veterans with gambling problems who misused substances. 1996.
 63. Edens EL, Kaspro W, Tsai J, Rosenheck RA. Association of substance use and VA service-connected disability benefits with risk of homelessness among veterans. *Am J Addict.* 2011;20(5):412–9.
 64. Russo AM, McCormick RA, Ramirez LF, Taber JJ. An outcome study of an inpatient treatment program for pathological gamblers. *Psychiatr Serv.* 1984;35(8):823–7.
 65. Breen RB, Kruegelbach NG, Walker HI. Cognitive changes in pathological gamblers following a 28-day inpatient program. *Psychol Addict Behav.* 2001;15(3):246–8.
 66. Grant JE, Potenza MN, Kraus SW, Petrakis IL. Naltrexone and disulfiram treatment response in veterans with alcohol dependence and co-occurring problem-gambling features. *J Clin Psychiatry.* 2017;78(9):e1299–e306.
 67. Lin SAEN, Lyons MJ, Scherrer JF, Griffith K, True WR, Goldberg J, et al. Familial influences on gambling behavior: an analysis of 3359 twin pairs. *Addiction.* 1998;93(9):1375–84.
 68. Xian H, Scherrer JF, Slutske WS, Shah KR, Volberg R, Eisen SA. Genetic and environmental contributions to pathological gambling symptoms in a 10-year follow-up. *Twin Res Human Genet.* 2007;10(1):174–9.
 69. Scherrer JF, Slutske WS, Xian H, Waterman B, Shah KR, Volberg R, et al. Factors associated with pathological gambling at 10-year follow-up in a national sample of middle-aged men. *Addiction.* 2007;102(6):970–8.
 70. Potenza MN, Xian H, Shah K, Scherrer JF, Eisen SA. Shared genetic contributions to pathological gambling and major depression in men. *Arch Gen Psychiatry.* 2005;62(9):1015–21.
 71. Scherrer JF, Xian H, Slutske WS, Eisen SA, Potenza MN. Associations between obsessive-compulsive classes and pathological gambling in a national cohort of male twins. *JAMA Psychiatry.* 2015;72(4):342–9.
 72. Slutske WS, Eisen S, Xian H, True WR, Lyons MJ, Goldberg J, Tsuang M. Common genetic vulnerability for pathological gambling and alcohol dependence in men. *Arch Gen Psychiatry.* 2000;57(7):666–73.
 73. Slutske WS, Eisen S, Xian H, True WR, Lyons MJ, Goldberg J, et al. A twin study of the association between pathological gambling and antisocial personality disorder. *J Abnorm Psychol.* 2001;110(2):297–308.
 74. Scherrer JF, Xian H, Shah KR, Volberg R, Slutske W, Eisen SA. Effect of genes, environment, and lifetime co-occurring disorders on health-related quality of life in problem and pathological gamblers. *Arch Gen Psychiatry.* 2005;62(6):677–83.
 75. Xian H, Shah KR, Potenza MN, Volberg R, Chantarujikapong S, True WR, et al. A latent class analysis of DSM-III-R pathological gambling criteria in middle-aged men: association with psychiatric disorders. *J Addict Med.* 2008;2(2):85 **This article found that around half of the total variance in risk of lifetime or past year GD symptoms was due to genetic factors.**
 76. Kraus SW, Etuk R, Potenza MN. Current pharmacotherapy for gambling disorder: a systematic review. *Expert Opin Pharmacother.* 2020:1–10.
 77. Dowling NA, Merkouris SS, Manning V, Volberg R, Lee SJ, Rodda SN, et al. Screening for problem gambling within mental health services: a comparison of the classification accuracy of brief instruments. *Addiction.* 2018;113(6):1088–104.

78. Barlowe K. Slot machines at US Army bases generate \$100 million. 2020. <https://www.casino.org/news/slot-machines-at-us-army-bases-generate-100-million/>. Accessed February 9, 2020 2020.
79. Hall TC. Compulsive Gambling. The VVA Veteran Online. 2013. https://vvetteran.org/33-3/33-3_ptsd.html. Accessed February 9, 2020 2020.
80. Parker K, Cilluffo A, Stepler R. Facts about the US military and its changing demographics. Pew Research Center.
81. Petry NM, Stinson FS, Grant BF. Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions.[CME]. *J Clin Psychiatry*. 2005;66(5):1,478–574.
82. Wiebe JM, Cox BJ. Problem and probable pathological gambling among older adults assessed by the SOGS-R. *J Gambl Stud*. 2005;21(2):205–21.
83. Kraus SW, Etuk R, Potenza MN. Current pharmacotherapy for gambling disorder: a systematic review. *Expert Opin Pharmacother*. in press. <https://doi.org/10.1080/14656566.2019.1702969>.

Key Points

- Increasing evidence suggests that US military veterans (“a person who served in the active military, naval, or air service and who was discharged or released under conditions other than dishonorable”) are vulnerable to developing problem gambling habits.
- Research on gambling disorder (GD) in veterans has been limited in terms of treatment, intervention, and consistent GD rate estimates.
- Systematic screening for problem gambling/GD in military populations should be implemented in the future.

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