Addictive Behaviors xxx (xxxx) xxx Gambling and military Service: Characteristics, comorbidity, and problem severity in an epidemiological sample

Preprint *in* Addictive Behaviors · November 2020

DOI: 10.1016/j.addbeh.2020.106725

2 authors:

Mark van der Maas
Rutgers, The State University of New Jersey
49 PUBLICATIONS **274** CITATIONS
SEE PROFILE

Lia Nower
Rutgers, The State University of New Jersey
86 PUBLICATIONS **3,618** CITATIONS
SEE PROFILE

Addictive Behaviors xxx (xxxx) xxx

Contents lists available at ScienceDirect

Addictive Behaviors

journal homepage: www.elsevier.com/locate/addictbeh

Gambling and military Service: Characteristics, comorbidity, and problem severity in an epidemiological sample

Mark van der Maas *, Lia Nower

Center for Gambling Studies, School of Social Work, Rutgers, The State University of New Jersey, United States

ARTICLE INFO

Keywords:
Gambling
Military
Veterans
Suicidal ideation
Gender
Epidemiology

ABSTRACT

Active military members and veterans both show elevated risk of Gambling Disorder. However, research comparing these groups to civilians in epidemiological samples is sparse. There is also some research suggesting that there is a stronger association between military service and poor mental outcomes for women.

The current study applies bivariate analyses and generalized linear modelling predicting Problem Gambling Severity Index scores to a representative, complex survey sample of 2176 New Jersey adult residents.

The results show that problem gambling scores for past and current military service members were more than double that of the civilian participants after controlling for relevant demographic and behavioral characteristics. Additionally, the relationship between problem gambling scores and military service was significantly stronger for women than men. Bivariate analyses indicated that active military service members scored higher on the Problem Gambling Severity Index, indicated greater weekly participation in online gambling, lottery, electronic gambling machine, and sports betting, and nearly 20 times the rate of suicidal ideation compared with civilians. Additional regression analysis show that among military service members problem gambling scores were associated with suicidal ideation, tobacco use, and substance use problems.

The results are discussed in the context of a period of expansion of online gambling opportunities. Constrained options for leisure coupled with the high propensity for risk taking among military service members and the relative ease of concealing online gambling on base may expose military service members to disproportionately higher risk of Gambling Disorder.

1. Introduction

Gambling is a popular activity, with an estimated 73% of adults engaging in some type of gambling activity in the past year (NCPG, 2019). Gambling also brings with it the risk of developing a Gambling Disorder, characterized by a maladaptive pattern of gambling behavior that results in significant impairment or distress (DSM-5; American Psychiatric Association, 2013). There are many terms used to describe varying levels of distress as a result of gambling. Henceforth, "Gambling Disorder" will be used to describe an actual or probable diagnosis of a Gambling Disorder or equivalent category (e.g. pathological gambling or severe problem gambling), at risk for problem gambling will be used to describe one or more Gambling Disorder symptoms and moderate to severe problem gambling will be used to describe the experience of multiple Gambling Disorder symptoms and higher. The lifetime prevalence of Gambling Disorder has been estimated at 1% to 2% in nationally representative surveys of adults in the US (Rash, Weinstock, & Van Patten, 2016). While this proportion may seem low, there are certain characteristics that substantially increase the risk of developing gambling problems or disorder due to etiological factors such as trauma and child maltreatment (Ledgerwood & Petry, 2006; Blaszczynski & Nower, 2002; Haskell et al., 2010; National Survey on Gambling Attitudes and Gambling Experience NGAGE; Shultz, Shaw, McCormick, Allen, & Black, 2016) trauma (Ledgerwood & Petry, 2006), addictive and/or mental health disorders (Rask et al., 2016; Rodriguez-Monguio, Errea, & Volberg, 2017), persistent pain (Barry, Pilver, Hoff, & Potenza, 2013), emotional days regulation (Keough, Montreuil, & Derevensky, 2020), and impulsivity (Ioannidis, Hook, Wickham, Grant, & Chamberlain, 2019).

1.1. Prevalence of gambling and Gambling Disorder of veterans and active military

Active and former service members of the US military have long been

* Corresponding author.
E-mail address: mark.vandermaas@rutgers.edu (M. van der Maas).

https://doi.org/10.1016/j.addbeh.2020.106725
Received 24 June 2020; Received in revised form 7 October 2020; Accepted 28 October 2020
Available online 6 November 2020

identified as one such at-risk population. For example, a retrospective chart review for consecutive admissions to a Veterans Affairs medical center in 2000–2001 found that 64% of those who attempted suicide attributed their attempts to gambling-related harms (Kausch, 2003). A recent survey of veterans of Operations Iraqi Freedom, Enduring Freedom, and New Dawn reported a rate of being at-risk for problem gambling of 4.2% with risk being increased significantly in cases of higher post-deployment stress (Whiting et al., 2016). In a study of U.S. veterans in two cities, the estimated rate for moderate to severe problem gambling was 10.7%, significantly higher than the rate in the general population (Westermeyer, Canive, Thuras, Oakes, & Spring, 2013). International studies have likewise reported elevated rates of gambling problems. For example, results from the 2007 Adult Psychiatric Morbidity Survey in the United Kingdom found that moderate to severe problem gambling was approximately 7 times more prevalent among veterans when compared with selected non-veteran controls (Dighton, Roberts, Hoon, & Dymond, 2018). These elevated rates are particularly notable because there is little routine screening for Gambling Disorder in the military (Etuk, Shirk, Grubbs, & Kraus, 2020) and veterans with problems are reluctant to present for treatment (Shirk et al., 2018).

Compared to the research on problem gambling among veterans, there is less research on active military service members, though findings are similar. In a survey of 31,104 recruits in the US Air Force, Steenbergh, Whelan, Meyers, Klesges, and DeBon (2008) found that 10.4% of their sample gambled weekly or more frequently and 8.1% of the sample self-identified as problem gamblers, double the rate in the general population. A recent Massachusetts study found even higher rates; among veterans who had gambled in the past year, 16.2% were at risk for problem gambling (Freeman, Volberg, & Zorn, 2019). Similar to findings with veterans, results of a survey of outpatients from Naval Medical Center Portsmouth found that less than a third of those screened with Gambling Disorder reported a prior diagnosis, likely because of poor screening practices in the treatment of active service members (Weis & Manos, 2007).

1.2. Gambling among women service members

A majority of military studies have been conducted with men, though studies have found higher rates of moderate to severe problem gambling among women in the military (Westermeyer et al., 2013). For example, Westermeyer and colleagues (2013) found 3.6% of female veterans, compared to 2.2% of males, met criteria for Gambling Disorder. Similarly, in a multivariate regression analysis of a sample of 1,102,846 Veteran's Affairs service users, identifying as female increased odds of a Gambling Disorder diagnosis (Edens & Rosenheck, 2012).

However, a study of National Guard Members found that identifying as female was negatively associated with being at risk for problem gambling (Gallaway et al., 2019). Similarly, a comparison of veterans classified as recreational gamblers versus those at risk for problem gambling found no significant variation by gender (Freeman et al., 2019). These discrepancies in the literature underscore the need to clarify the relationship between military service and problem gambling across genders.

1.3. Gambling disorder and comorbidity among service members

In a recent review of military veterans research, Gambling Disorder has been associated with a range of indicators of poor mental health including major depressive disorder, PTSD, suicidal ideation and suicide attempts (Levy & Tracy, 2018). The same review noted strong support for the association between Gambling Disorder and substance use disorders among veterans, particularly for alcohol, cannabis, and cocaine misuse (Levy & Tracy, 2018).

A nationally representative sample of 3157 U.S. veterans found that more than a third of veterans gamble recreationally while 2.2% were at-risk for problem gambling (Stefanovics, Potenza, & Pietrzak, 2017). Gambling problems were associated with a higher risk for substance use, anxiety, and depressive disorders and a history of physical trauma or sexual trauma, particularly among ethnic minorities. In addition, younger age, self-identifying as Black, being retired, and trauma burden were significantly associated with gambling problems in the study suggesting that not only the lack of screening but also the lack of culturally-tailored screening and treatment for gambling problems may be particularly salient.

Some authors have suggested that problem gambling may be an outlet for stressful life events post deployment among veterans (Whiting et al., 2016), particularly those with poor stress-coping skills (Levy & Tracy, 2018). These findings parallel those of an early study, which related problem gambling to negative effects and poor coping skills among veterans who were unstably housed (Castellani, Wootton, Rugle, Wedgeworth, Prabucki, & Olson, 1996). Thus, those in the military who have the greatest needs may be at highest risks of developing a Gambling Disorder.

Studies have identified comorbidities between Gambling Disorder and mental health and/or substance use problems among active military service members. Findings from a longitudinal study, the Department Defense Health Behavior Survey (1980–2008), showed declines in cigarette use, relatively stable heavy alcohol use, decreases in illicit drug use and increases in prescription misuse over time. Increases were also observed for indicators of poor mental health such as PTSD and suicide attempts (Bray et al., 2010). Among active military personnel, rates of alcohol and tobacco use are found to the highest among low ranking positions (Kao, Schneider, & Hoffman, 2000), and problem gambling was related to high-risk behaviors such as binge drinking, riding with an intoxicated driver, and fighting (Steenbergh et al., 2008). Important differences in comorbidities also exist by gender. A medical record review of 1129 veterans of the conflicts in Iraq and Afghanistan that found that men were more likely to be screened for PTSD and obesity, and women, for depression and sexual trauma (Haskell et al., 2010).

1.4. Research objectives

Few studies of veterans or active duty military personnel examine gender and problem gambling within a representative, general population sample (Levy & Tracy, 2018). Therefore, the purpose of the current study was to examine gambling activities and related comorbidities in a epidemiological sample of New Jersey residents and to compare rates of problem gambling severity and it correlates by gender between military and civilian participants.

2. Methods

2.1. Design

Data for the study were derived from an epidemiological survey of 3634 adult residents of the state of New Jersey. The survey was designed to provide an accurate estimate of the nature and extent of gambling as well as the rate of problem gambling severity. The survey was restricted to those over the age of 18 and was conducted in English, and utilized a weighted, dual sampling frame of a random digit dial, computer assisted telephone interviews (n = 1500) and an online panel survey (n = 2134). Further detail on the sampling strategy can be found in the survey report Nower, Volberg, and Caler (2017). All statistical analyses accounted for complex survey design and dual sampling frame using the "survey" package for the R project for statistical computing (Lumley, 2020). The study subsample used in the analyses below excluded those who had not gambled in the last year and those who showed incomplete data on the study variables for a final study sample of 2176.

2.2. Measures

2.2.1. Gambling measures

The focal dependent variable of the study was problem gambling severity, assessed using the Problem Gambling Severity Index (PGSI) as developed by Ferris and Wynne (2001). The PGSI was developed for use in survey research and has been used in a number of epidemiological studies worldwide due to its ability to capture a range of severity in harm rather than a simple dichotomous separation of problem and non-problem gamblers. For descriptive tables, the PGSI was dichotomized with a score of three or higher indicating moderate to severe problem gambling. Frequent gambling was defined as weekly or more frequent participation in any gambling activity. Help seeking was captured by a yes or no response to the following question: "Have you sought help for gambling problems in the past 12 months?" To indicate past participation in online gambling, participants were asked whether or not they used an online platform to participate for each gambling activity included in the study. Finally, respondents were asked what proportion of their close friends and family members gamble too much, separating those who reported "none" from those who reporting any proportion.

2.2.2. Demographic measures

Military service was captured by participants' responses to the following question: 'Have you ever served on active duty in the U.S. Military, Military Reserves, or National Guard? Active duty does not include training for the Reserves or National Guard, but DOES include activation, for example, for the Persian Gulf War". Responses included "Yes, on active duty", "Yes, on active duty in the past", "No, training for the Reserves or National Guard only", "No, never served in the military", "Don't know", and "Refused". For descriptive tables and the regression analyses, the categories "Yes, on active duty" (n = 42), and "Yes, on active duty in the past" (n = 140) were combined, and the categories "No, training for the Reserves or National Guard only" (n = 44) and "No, never served in the military" (n = 1950) were combined to dichotomize the variable. Responses "Don't know" (n = 21) and "Refused" (n = 25) were removed from the study. Demographic variables included gender self-identification that allowed for the choice of "male" or "female." Age was captured as self-reported birth year and measured continuously in the regression for more robust analysis and presented categorically in tables for ease of presentation. Education was categorized into the following groups: high school or less, those with education beyond high up to a bachelor degree, and those with a completed graduate or professional degree. Ethnicity was derived from responses to the following question: "Which one or more of the following would you say is your race?" Multiple responses were allowed, however, due to low endorsement of multiple race identifiers the respondents first identification was used. Responses were simplified into the following categories: "White or Caucasian", "Black or African American", "Asian/Native Hawaiian or other Pacific Islander/Native American or Alaskan Native/Mixed race/Some other race," and "Hispanic or Latino." For marital status, responses were divided into "married or living with your partner," "divorced/separated/widowed," and "never been married." Household income was measured ordinally with the income groups listed in Table 1.

2.3. Analysis

PGSI scores are typically highly positively skewed, making modeling problem gambling as a continuous variable unreliable. To address this, the regression analysis of the current study design utilized Generalized Linear Modeling using a gamma distribution to better fit the error distribution of PGSI scores. Bivariate statistical comparisons were performed using Pearson x^2 tests.

3. Results

Table 1 describes characteristics of the study sample, classified by

Table 1
Sample characteristics as divided by past or current military service (active duty, veterans) (n = 2176).

		Civilians (n = 1994)		Military Service Members (n = 182)		X^2	p
		n	%	n	%		
PGSI3+	No	1666	83.6%	126	69.2%	21.864	<0.001
	Yes	328	16.4%	56	30.6%		
Sex	Male	943	47.3%	162	89.1%	108.200	<0.001
	Female	1051	52.7%	20	10.8%		
Age	18–24	180	9.0%	13	7.3%	15.496	<0.001
	25–34	396	19.9%	28	15.4%		
	35–44	447	22.4%	21	11.3%		
	45–55	420	21.1%	27	14.8%		
	55–64	269	13.5%	22	12.3%		
	65+	280	14.0%	71	38.8%		
Education	≤High school	421	21.1%	44	24.4%	1.933	0.145
	>high school or Bachelors' Degree	1199	60.1%	95	52.4%		
	Graduate or professional degree	374	18.8%	42	23.1%		
Race	White	1231	61.8%	112	61.4%	3.734	0.011
	Black	233	11.7%	26	14.0%		
	Asian/other	173	8.7%	3	1.7%		
	Hispanic	356	17.9%	41	22.7%		
Marital Status	Partnered (Married, Living together)	1230	61.7%	124	68.1%	12.189	<0.001
	Unpartnered (separated, widowed, divorced)	273	13.7%	40	22.2%		
	Single/Never Married	491	24.6%	17	9.6%		
Income	<15 k	95	4.8%	5	2.7%	0.748	0.631
	15,000–29,999	187	9.4%	14	7.6%		
	30,000–49,999	289	14.5%	23	12.7%		
	50,000–69,999	355	17.8%	43	23.4%		
	70,000–99,999	405	20.3%	37	20.4%		
	100,000–124,999	261	13.1%	25	13.7%		
	125–149,999	146	7.3%	13	7.4%		
	150 k+	257	12.9%	22	11.9%		

military service members (active duty and veterans) versus civilians. Military service categories were combined in order to allow for meaningful statistical comparisons across categories. In relation to the focal dependent variable for the study, problem gambling severity was greater among military service members as indicated by a significantly greater proportion of respondents classified as moderate to severe problem gambling on the PGSI. The rate among military service members was nearly twice that of those who had never served in the military (31.97% vs. 16.97%). Consistent with previous research, military service was much more common among men than women. Age also showed significant variation across military. Specifically, military service was over represented among those aged 65 and older and showed largely even distribution in the younger cohorts. There was no significant variation in educational attainment across military service. Those who identified as Asian or "other" ethnic group not listed were significantly underrepresented in military service. Marital status also showed significant variation by military service, with single respondents underrepresented among those with past or current military service. Finally, there was no significant variation in household income between those who have and have not served in the US military.

Table 2 provides insight on gambling preferences and behavior among active duty service members, veterans, and civilians. Overall, active duty service members were significantly more likely than veterans and/or civilians to gamble online and to prefer online gambling. Nearly 60% of active duty service members, compared to 9% of veterans and civilians, said they preferred online gambling and three times as many actually gambled online (74.19% versus 20.62%, veterans, and 24.90%, civilians). In addition, active duty service members gambled significantly more across all gambling activities when compared to either veterans or civilians in this study.

The groups were also compared across indicators of substance use and mental health (Table 3). Findings from bivariate analyses show that active duty military participants were overrepresented on each indicator. These differences were statistically significant according a chi-square test, adjusted for the complex survey structure. About 70% of active duty participants reported using tobacco, compared to just over 34% for veterans and 29% for non-military participants. In addition, a majority of active duty service members also report a substance use problem in the past 12 months (58.76%), compared to much lower rates among veterans (7.78%) and civilians (4.01%). Notably, the presence of mental health problems in the last 30 days was also nearly four times more common among active duty service members (61.02%) compared with veterans (12.83%) and civilian respondents (13.23%). However, the greatest disparities were in self-reported suicidal ideation in the past 12 months. A majority of active duty personnel (55.65%) reported seriously considering attempting suicide compared with 6.00% among veterans and only 2.40% among civilians.

Table 3
Substance use and mental health indicates across military status (n = 2176).

		Active Duty	Veterans	Civilians	X^2	*p*
Tobacco user (current)	No	13 (32.20%)	92 (65.87%)	1411 (70.76%)	29.937	<0.001
	Yes	28 (67.80%)	48 (34.13%)	583 (29.24%)		
Substance use problem (12 m)	No	17 (41.24%)	129 (92.22%)	1914 (95.99%)	246.820	<0.001
	Yes	25 (58.76%)	11 (7.78%)	80 (4.01%)		
Mental health (30 days)	No	16 (38.98%)	122 (87.17%)	1730 (86.77%)	77.489	<0.001
	Yes	26 (61.02%)	18 (12.83%)	264 (13.23%)		
Suicidal ideation (12 m)	No	19 (44.35%)	132 (94.00%)	1946 (97.60%)	332.670	<0.001
	Yes	23 (55.65%)	8(6.00%)	48 (2.40%)		

To further explore the issue of comorbidity among gambling severity, substance use and mental health, a generalized linear model was run to predict PGSI scores with a subsample of participant who were either active service members or veterans (n = 174). These categories were combined due to the low number of active duty members in the sample. The model controlled for sex and age. The results of the model (Table 4) demonstrate that all indicators had significant relationships with PGSI scores.

Generalized linear modeling was conducted to identify significant predictors of PGSI scores in military service (active duty, veterans) versus civilian participants (see Table 5, below). The combined military service category was used for the following analyses due to low numbers of active military service members. Model 1, including only military service predicting PGSI scores, found that military service was associated with significant increases in PGSI scores. Model 2 included demographic variables gender, age, marital status and race; gender had a

Table 4
Generalized linear modeling predicting problem gambling severity scores among active duty service members and veterans (n = 174).

	Estimate	Lower CI	Upper CI
(Intercept)	−73.954	−89.009	−58.898
Tobacco (current use)	0.908	0.687	1.128
Substance use problem (12 m)	1.170	0.865	1.475
Suicidal ideation (12 m)	0.454	0.091	0.816
Sex (female)	−0.430	−0.658	−0.201
Age	0.037	0.030	0.045

AIC = 12398.076.

Table 2
A comparison of gambling behaviors among those who have and have not served in the US military (n = 2176).

		Active Duty (n = 42)	Veterans (n = 140)	Civilians (n = 1994)	X^2	*p*
Online preference	No	17(40.34%)	127(90.78%)	1817(91.13%)	119.13	<0.001
	Yes	25(59.66%)	13(9.22%)	177(8.87%)		
Online participation	No	11(25.81%)	111(79.38%)	1497(75.10%)	54.31	<0.001
	Yes	31(74.19%)	29(20.62%)	497(24.90%)		
Close relationship with	No	17(40.08%)	116(82.71%)	1720(86.24%)	69.75	<0.001
	Yes	25(59.92%)	24(17.29%)	274(13.76%)		
Weekly Lotto	No	9(20.69%)	87(61.98%)	1494(74.93%)	70.65	<0.001
	Yes	33(79.31%)	53(38.02%)	500(25.07%)		
Weekly EGM	No	2251.29%)	133(94.80%)	1915(96.03%)	175.91	<0.001
	Yes	20(48.71%)	7(5.20%)	79(3.97%)		
Weekly Casino	No	17(39.87%)	133(95.12%)	1930(96.80%)	316.10	<0.001
	Yes	25(60.13%)	7(4.88%)	64(3.20%)		
Weekly Poker	No	16(38.08%)	130(92.99%)	1934(96.97%)	339.75	<0.001
	Yes	26(61.92%)	10(7.01%)	60(3.03%)		
Weekly Sports betting	No	16(38.08%)	125(89.23%)	1885(94.52%)	207.01	<0.001
	Yes	26(61.92%)	15(10.77%)	109(5.48%)		

Table 5
Full generalized linear model predicting Problem Gambling Severity Index scores.

	Model 1	Model 2	Model 3	Model 4
	Coef (LCI, UCI)	Coef (LCI, UCI)	Coef (LCI, UCI)	Coef (LCI, UCI)
AIC[a]	14857.408	13407.811	13325.113	13304.249
Intercept	**0.445 (0.339, 0.551)**	**−95.232 (−115.466, −74.999)**	**−99.393 (−117.126, −81.659)**	**−98.040 (−115.718, −80.356)**
Military	**0.904 (0.622, 1.186)**	**0.766 (0.437, 1.095)**	**0.754 (0.435, 1.073)**	**0.590 (0.245, 0.934)**
Sex (ref: Male)		**−0.412 (−0.655, −0.170)**	**−0.414 (−0.659, −0.170)**	**−0.463 (−0.712, −0.214)**
Birth year		**0.048 (0.038, 0.059)**	**0.051 (0.042, 0.060)**	**0.050 (0.041, 0.059)**
Race (ref: White)				
African American		**0.478 (0.132,0.824)**	0.339 (−0.013,0.690)	0.338 (−0.012,0.688)
Asian/Other		**0.563 (0.232, 0.894)**	**0.512 (0.173, 0.850)**	**0.508 (0.166, 0.850)**
Hispanic		**0.399 (0.095, 0.702)**	**0.393 (0.092, 0.694)**	**0.391 (0.088, 0.694)**
Marital Status (ref: Married/Partner)				
Unpartnered (separated, widowed, divorced)		−0.169 (−0.548, 0.211)	−0.215 (−0.640, 0.209)	−0.208 (−0.629, 0.214)
Single/Never Married		**−0.339 (−0.657, −0.022)**	**−0.411 (−0.723, −0.100)**	**−0.399 (−0.711, −0.087)**
Education (ref: ≤High school)				
>high school or Bachelor's Degree			−0.163 (−0.471, 0.145)	−0.172 (−0.479, 0.135)
Graduate or Professional Degree			0.214 (−0.165, 0.593)	0.193 (−0.187, 0.574)
Income linear			**−0.762 (−1.264, −0.261)**	**−0.762 (−1.263, −0.261)**
Income curvilinear			**−0.443 (−0.786, −0.100)**	**−0.442 (−0.784, −0.099)**
Interaction (Military * Sex)				**0.925 (0.272, 1.577)**

a = Akaike Information Criterion.
Bold indicates $p < 0.05$.

strong negative effect, with women reporting lower PGSI scores than men. Age also show a strong relationship with PGSI scores, with younger gamblers reporting higher PGSI scores. Respondents identifying as Black, Hispanic, or Asian or another ethnicity, reported higher PGSI scores that those identifying as White. The effects of military service, age and gender, remained relatively stable with the inclusion of ethnicity into the model. Model 3 introduced educational attainment and income to the model. The positive relationship between military status and PGSI scores remains significant and substantial.

As indicated in the final model (model 4) those who reported a bachelor's degree or some lesser amount of post-secondary education reported significantly lower PGSI scores that those with high school or less education. In contrast, PGSI scores among those with a graduate or professional degree were significantly lower than those with an educational attainment of high school or less. The household income variable shows significant linear and curvilinear negative effects with PGSI scores where the negative relationship is less evident across the lowest income groups (those earning less than $15,000 and those earning $15,000 to $30,000). The model also shows a relationship between marital status and PGSI scores, with single status significantly associated with lower PGSI scores. The effect of identifying as Black also became non-significant in this model, suggesting that for this group PGSI scores are, at least in part, mediated by socioeconomic resources. The significant association between military service and problem gambling severity remained after the introduction of controls (Model 5).

The final model explored an interaction between gender and military service to investigate whether the experience of armed forces service was associated with differences in PGSI scores for males and females. The interaction effect showed that the positive relationship between military service and PGSI was substantially stronger for women than for men. As displayed in Fig. 1, PGSI scores were higher for male than for female civilian participants (1.40 vs 0.60). However, among those with a history of military service, men scored substantially lower than women on average (2.20 vs. 3.95). The other relationships in the model remained relatively unchanged with the inclusion of the interaction term.

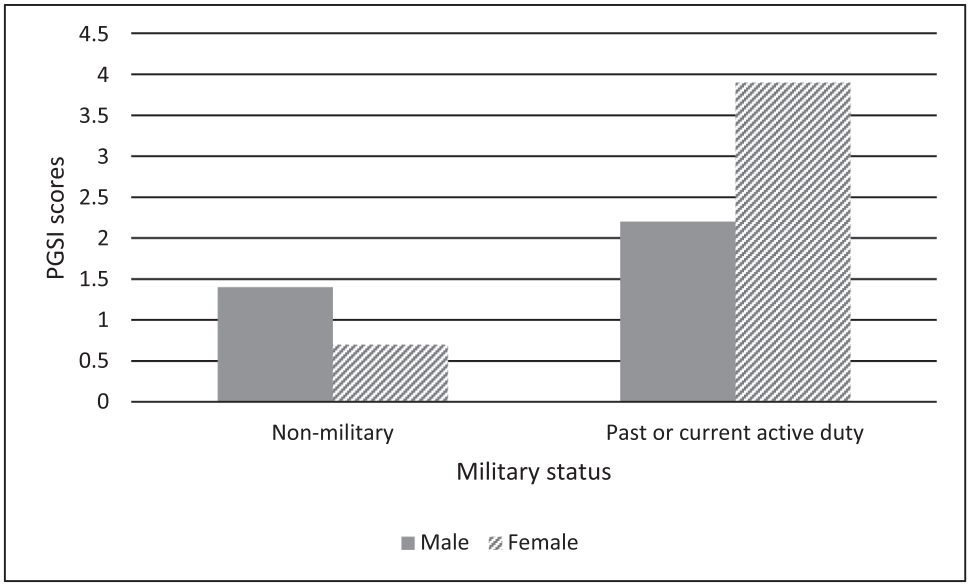

Fig. 1. Interaction between sex and military service in predicting Problem Gambling Severity Index scores for Model 4.

4. Discussion

Consistent with findings in prior studies, rates of moderate and severe problem gambling among military members in this epidemiological sample were more than double the rates for civilians (Steenbergh et al., 2008; Westermeyer et al., 2013). In addition, rates of gambling participation and online gambling in this study were significantly higher among military versus civilian participants. Notably, active military members reported the highest rates of moderate to severe problem gambling, even compared to veterans, and they were significantly more likely to prefer and patronize online gambling sites. In addition, active duty members gambled significantly more across all gambling activities compared to the other groups, suggesting that the well-documented additive effect of gambling frequency across forms would put this group particularly at risk for serious gambling-related harm.

Popular features of online gambling – the 24-hour availability of products, fast and uninterrupted speed of play, and relative secrecy of play – may be particularly suited to active military members who seek stress release and/or recreation in a venue that is private. Online gambling can also offer an appealing escape from dysphoric mood states to those who experience mental health symptoms or problems with substance use. Notably, however, a significant proportion of active duty respondents also reported seriously considering suicide, a negative consequence that is often associated with problem gambling and a possible indictor that individuals are using gambling to modulate mood, trauma or other mental health issues (Kausch, 2003).

Compared to civilians, being in the military, whether on active duty or as a veteran, was a significant predictor of higher problem gambling scores. Those with lower levels of educational attainment and lower household income as well as some minority ethnic groups were particularly at risk, although, for those identifying as Black, the risk was possibly limited to those with more limited economic resources. Also of import, while women showed lower problem gambling scores overall, women in the military reported significantly higher problem gambling scores than their male counterparts. This suggests that women in the military, an understudied group, may be most at risk for serious consequences from gambling but least likely to be identified through normal channels. This finding supports previous research finding higher rates of problem gambling among women in samples of military members (Edens & Rosenheck, 2012; Westermeyer, Canive, Garrard, Thuras, & Thompson, 2005).

The study is not without limitations. The study sample was drawn from residents of New Jersey, a state with one of the largest offerings of legalized gambling in the United States, which may limit the relevance of the current findings to other jurisdictions. In addition, the proportion of active military service members, relative to civilians in the sample, was small. The study adjusted for this by collapsing categories of active military service. While this is not ideal, elevated rates of all forms of weekly gambling examined, reported suicidal ideation, and substance use problems among veterans when compared with civilians provide some justification for this choice. Important distinctions were observed between veterans and active military members that would require replication with a larger sample. Finally, the study utilized self-report data which has well-known limitations such as response and sampling biases.

Despite these limitations, however, findings were drawn from a large, representative sample and provide new information regarding problem gambling and related variables in military service members compared to civilians. These findings have particular import for active duty service members, who reported alarmingly high levels of problem gambling, mental health and substance use problems, and suicidal ideation. In addition, women in the military have received little focus in the gambling literature but appear in this study to warrant further study.

Results from this study also provide preliminary direction for identification, prevention and treatment of military service members. The strong preference for online gambling – an activity that is always available and easily concealed – suggests that the military should be educated on screening for and addressing online gambling problems as soon as they are identified. Online gambling may be particularly attractive to active duty members given their increased propensity for risk taking coupled with increased restrictions in leisure options (Bray et al., 2010). In addition, counselors of military personnel should be trained in gambling counseling, ideally by receiving at least the 30 h of specialized training needed for certification as gambling counselors in most states. Finally, the popularity of gambling in its online form, combined with the other comorbid problems endorsed in the military sample, suggest that gambling should be included in any routine mental health and addiction services that are available to military members. Active duty military personnel who are experiencing mental health and substance use problems may initiate gambling as an avoidant stress coping strategy but engender significant financial harm. Those who have thoughts of suicide are at greatest risk. Further studies are needed to tailor interventions to the needs of racial and ethnic minorities and women, which are underserved groups in many areas but particularly in gambling prevention and treatment.

5. Conclusions

The current study found that veterans and active military service members have significantly higher problem gambling scores compare with the general population of New Jersey and that this difference was significantly more substantial for women than men. Additionally, the study found much higher rates of gambling participation among current military service members and that among service members, problem gambling scores were associated with higher rates of substance use and suicidal ideation. Given the current context of rapid expansion in gambling access, particularly online gambling, the findings here suggest that past and present military service members are at greater risk of developing a Gambling Disorder compared with the general population. In order to limit the harm of these trends, increased screening for Gambling Disorder and greater access to support for Gambling Disorder for with past or current military service is advisable.

CRediT authorship contribution statement

Mark Maas: Conceptualization, Writing - original draft, Methodology. **Lia Nower:** Conceptualization, Writing - review & editing, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders*. Arlington: American Psychiatric Publishing.

Barry, D. T., Pilver, C. E., Hoff, R. A., & Potenza, M. N. (2013). Pain interference, gambling problem severity, and psychiatric disorders among a nationally representative sample of adults. *Journal of Behavioral Addictions, 2*(3), 138–144.

Blaszczynski, Alex, & Nower, Lia (2002). A pathways model of problem and pathological gambling. *Addiction, 97*(5), 487–499.

Bray, R. M., Pemberton, M. R., Lane, M. E., Hourani, L. L., Mattiko, M. J., & Babeu, L. A. (2010). Substance use and mental health trends among US military active duty personnel: Key findings from the 2008 DoD Health Behavior Survey. *Military Medicine, 175*(6), 390–399.

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.

Dighton, G., Roberts, E., Hoon, A. E., & Dymond, S. (2018). Gambling problems and the impact of family in UK armed forces veterans. *Journal of Behavioral Addictions, 7*(2), 355–365.

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.

Etuk, R., Shirk, S. D., Grubbs, J., & Kraus, S. W. (2020). Gambling problems in US military veterans. *Current Addiction Reports*, 1–19.

Ferris, J. A., Wynne, H. J. (2001). The Canadian problem gambling index: Canadian Centre on Substance Abuse, Ottawa, ON.

Freeman, J. R., Volberg, R. A., & Zorn, M. (2019). Correlates of at-risk and problem gambling among veterans in Massachusetts. *Journal of Gambling Studies*, 1–15.

Gallaway, M. S., Fink, D. S., Sampson, L., Cohen, G. H., Tamburrino, M., Liberzon, I., … Galea, S. (2019). Prevalence and covariates of problematic gambling among a US military cohort. *Addictive Behaviors, 95*, 166–171.

Haskell, S. G., Gordon, K. S., Mattocks, K., Duggal, M., Erdos, J., Justice, A., & Brandt, C. A. (2010). Gender differences in rates of depression, PTSD, pain, obesity, and military sexual trauma among Connecticut war veterans of Iraq and Afghanistan. *Journal of Women's Health, 19*(2), 267–271.

Ioannidis, K., Hook, R., Wickham, K., Grant, J. E., & Chamberlain, S. R. (2019). Impulsivity in Gambling Disorder and problem gambling: A meta-analysis. *Neuropsychopharmacology, 44*(8), 1354–1361.

Kao, T.-C., Schneider, S. J., & Hoffman, K. J. (2000). Co-occurrence of alcohol, smokeless tobacco, cigarette, and illicit drug use by lower ranking military personnel. *Addictive Behaviors, 25*(2), 253–262.

Kausch, O. (2003). Suicide attempts among veterans seeking treatment for pathological gambling. *The Journal of Clinical Psychiatry*.

Ledgerwood, D. M., & Petry, N. M. (2006). Posttraumatic stress disorder symptoms in treatment-seeking pathological gamblers. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies, 19*(3), 411–416.

Levy, L., & Tracy, J. K. (2018). Gambling Disorder in veterans: A review of the literature and implications for future research. *Journal of Gambling Studies, 34*(4), 1205–1239.

Lumley T (2020). "survey: analysis of complex survey samples." R package version 4.0. Marchica, L. A.

Keough, M. T., Montreuil, T. C., & Derevensky, J. L. (2020). Emotion regulation interacts with gambling motives to predict problem gambling among emerging adults. *Addictive Behaviors, 106378*.

https://www.ncpgsurvey.org/, (2019–. (Accessed 20 September 2020).

Nower, L., Volberg, R. A., & Caler, K. R. (2017). *The prevalence of Online and land-based gambling in New Jersey*. New Brunswick, NJ: Center for Gambling Studies, Rutgers University.

Rash, C. J., Weinstock, J., & Van Patten, R. (2016). A review of Gambling Disorder and substance use disorders. *Substance Abuse and Rehabilitation, 7*, 3.

Rodriguez-Monguio, R., Errea, M., & Volberg, R. (2017). Comorbid pathological gambling, mental health, and substance use disorders: Health-care services provision by clinician specialty. *Journal of Behavioral Addictions, 6*(3), 406–415.

Shirk, S. D., Kelly, M. M., Kraus, S. W., Potenza, M. N., Pugh, K., Waltrous, C., … Drebing, C. E. (2018). Gambling-related cognitive distortions predict level of function among US veterans seeking treatment for Gambling Disorders. *The American Journal on Addictions, 27*(2), 108–115.

Shultz, S. K., Shaw, M., McCormick, B., Allen, J., & Black, D. W. (2016). Intergenerational childhood maltreatment in persons with DSM-IV pathological gambling and their first-degree relatives. *Journal of Gambling Studies, 32*(3), 877–887.

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 US veteran population: Prevalence, socio-demographics, and psychiatric comorbidities. *Journal of Gambling Studies, 33*(4), 1099–1120.

Weis, D. R., & Manos, G. H. (2007). Prevalence and epidemiology of pathological gambling at Naval Medical Center Portsmouth psychiatry clinic. *Military Medicine, 172*(7), 782–786.

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., 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.

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.