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Gambling problems among United Kingdom armed forces veterans: Associations with gambling motivation and posttraumatic stress disorder

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ABSTRACT

Military service, mental health, and gambling activities and motivations as predictors of problem gambling in a sample of UK AF veterans. Age-and-gender matched veterans (n = 1,037) and non-veterans (n = 1,148) completed an online survey of problem gambling, gambling motivation, mental health (depression and anxiety), and posttraumatic stress disorder (PTSD). Past year problem gambling rates were higher in veterans compared to non-veterans. Veteran status predicted increased problem gambling risk. The relationship between problem gambling and gambling to cope with distress was significantly stronger among veterans. Veterans experiencing PTSD and complex PTSD (C-PTSD) were at increased risk of problem gambling. Overall, the present, findings contribute further international evidence that veterans are a population vulnerable to problem gambling. Veterans with PTSD or C-PTSD are most at-risk and may engage in problematic gambling to escape/avoid distress. Routine screening for gambling problems should be undertaken with current and former military personnel, and further research is needed on the interplay between gambling motivation and veterans' mental health.

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Introduction

Gambling is an addictive behavior characterized by recurrent, problematic patterns of gambling leading to significant harm across several life domains (American Psychiatric Association, 2013). Gambling problems often fall along a continuum from clinically significant levels of severity ranging from what is termed, 'problem gambling', to sub-clinical, problematic behaviors involving some degree of harm referred to as 'low-risk', 'moderate-risk', or 'at-risk gambling' (Wardle et al., 2019).

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Increasing evidence highlights vulnerable populations at heightened risk of gambling problems, such as currently serving military personnel (Cowlishaw et al., 2020; Van der Maas & Nower, 2021) and Armed Forces (AF) veterans (Etuk et al., 2020; Sharman et al., 2019). International rates of lifetime problem gambling in veterans from jurisdictions with different gambling environments, such as the United States of America (USA), United Kingdom (UK), and Australia range between 2% and 29%, considerably higher than the general population (Etuk et al., 2020; Levy & Tracy, 2018; Paterson et al., 2021; Van der Maas & Nower, 2021). Analysis of a large national household survey dataset (the *Adult Psychiatric Morbidity Survey 2007*) from the UK identified that community-dwelling veterans were up to 8 times more likely to experience problem gambling than non-veterans (Dighton et al., 2018; Roberts et al., 2019). This relationship was not explained by differences in mental health conditions, substance use, or financial management.

While the availability of differing opportunities to gamble is likely to impact estimated rates of problem gambling, such problems frequently co-occur with common mental health disorders that disproportionately affect veterans relative to non-veterans (Ahern et al., 2015; Freeman et al., 2020). Despite this, research on the associations between the heightened prevalence of gambling problems and mental health disorders in veterans is limited (Etuk et al., 2020; Levy & Tracy, 2018). Gambling problems are associated with depression and anxiety, with 41% of veterans seeking treatment for gambling also reporting a lifetime history of mood disorders (Shirk et al., 2018). Indicators from a longitudinal study of data from the US Department of Defense Health Behavior Survey (1980–2008) revealed increased rates of poor mental health and suicide attempts in active service personnel (Bray et al., 2010). Moreover, gambling is related to substance misuse in veterans, with 79% of veterans attending treatment for substance misuse reporting 'cravings' to gamble and 27% reporting life problems due to their gambling (Davis et al., 2017). In a US-based sample of veterans seeking treatment for gambling problems, 66.4% reported substance use or dependence across their lifetime (Kausch, 2003). Although the association between the two is well known, the causal direction between substance use and gambling in veterans has been minimally analyzed. Thus, the associations and interactions between mental health, substance use, and gambling among veterans warrant further investigation (Etuk et al., 2020; Levy & Tracy, 2018).

The relationship between trauma and gambling problems in veterans is similarly unclear. Although gamblers among the general population may be more likely to have a diagnosis of posttraumatic stress disorder (PTSD; Moore & Grubbs, 2021), Westermeyer et al. (2018) found no association between gambling severity and combat exposure. Recent research identified salient associations between a history of physical or sexual trauma and severity of gambling in a large sample of veterans (Stefanovics et al., 2017). Given the changing nature of military involvement, differences between UK and US AF in levels of combat engagement in recent conflicts (Hoge et al., 2014) and culture and organization (Hotopf et al., 2016) leading to wide variances in PTSD rates in samples of veterans between the two countries, analysis of the association between PTSD and gambling among UK AF veterans is pertinent. Moreover, evidence suggests that International Classification of Diseases (ICD)-11 complex PTSD (C-PTSD) is more common than PTSD among UK help-seeking veterans (Murphy et al., 2021). The ICD-11 diagnostic criteria for PTSD include reexperiencing trauma, engaging in avoidance,

and a current sense of threat. To meet criteria for potential C-PTSD, additional disturbances in self-organization within related symptom clusters of affective dysregulation, negative self-concept, and disturbances in relationships must be evident (Brewin et al., 2017; Wolf et al., 2015). Veterans screened for symptoms indicating potential C-PTSD are more likely to experience greater levels of childhood adversity prior to enrollment and increased bullying during service, as well as elevated levels of comorbid mental health difficulties and greater social isolation on leaving the services. The respective impact of PTSD and C-PTSD risk factors and their comorbidity on vulnerability to problem gambling among veterans, however, remains underexamined.

Identifying the factors motivating veterans' gambling is crucial in understanding the co-occurrence of mental health difficulties (Stewart et al., 2016). Gambling may be motivated by factors, such as to practice or learn the game, to feel competent at an objective, to experience excitement, to socialize with peers and others, to feel important, to win money, and to continue to gamble with no objective (Chantal et al., 1994). Understanding gambling motivation may aid in determining the persistence and resulting severity of gambling related problems among veterans (Grubbs et al., 2018). Drawn from research on operant conditioning, studies employing versions of the Gambling Functional Assessment (GFA; Dixon et al., 2018; Miller et al., 2009; Weatherly et al., 2014, 2011) found different motives in the maintenance of gambling. These include social attention (e.g. interacting with peers) and accessing tangible rewards (e.g. vouchers or competitions) that capture the social and nonsocial positive reinforcement motivations, while sensory experiences (e.g. enjoying the lights and sounds, or feeling an emotional rush), and psychological/physical escape (e.g. leaving/distracting from a difficult work/home environment) capture the negative reinforcement motivations of gambling. Crucially, negative reinforcement is thought to represent the function most likely to maintain problem gambling (Dixon et al., 2018). To date, no study has investigated gambling motivation in veterans.

Interestingly, gambling motivated as a form of escape/avoidance-based coping mechanism is highlighted through findings linking PTSD and gambling (Grubbs et al., 2018; Moore & Grubbs, 2021). Coping motivations for gambling and positive gambling outcome expectations are elevated in those experiencing PTSD symptoms, both in treatment-seeking samples and online convenience samples (Grubbs et al., 2019). While little is currently known about the possible factors maintaining gambling in veterans, how individuals respond to stress is a significant factor in the gambling behavior of the general population (Buchanan et al., 2020). Gambling is often used as a coping mechanism to deal with stress, yet the consequences of problematic gambling may also come to act as stressors, leading to a feedback loop accentuated by stress-induced loss-chasing that may become exacerbated by a blunted physiological reaction to stress as the behavior becomes established (Buchanan et al., 2020). Moreover, family experience and living arrangements contribute to early exposure and provide a motive to escape through gambling (Allami et al., 2021; Subramaniam et al., 2017), with veterans with family members engaged in gambling having higher likelihood of increased gambling (Freeman et al., 2020).

At present, little is known about the prevalence of gambling problems among UK veterans. The preliminary findings of Dighton et al. (2018) and Roberts et al. (2019) involved small numbers of veterans living in England and utilized data obtained over 15 years ago. As such, a contemporary survey is required that addresses these limitations and reflects both the changing nature of being a member of the AF and the evolving, increasingly online, gambling landscape. The aim of this paper is to describe the findings of a survey designed to investigate sociodemographic, military service, mental health, and gambling activities and motivation variables as predictors of problem gambling among a large sample of UK veterans.

Materials and method

Participants and ethics

For the veterans' sample, participants were recruited primarily online to the 'UK AF Veterans' Health and Gambling Study' using digital marketing-based methods (e.g. targeted adverts on Facebook). Recruitment e-mails were also circulated by National Health Service (NHS) veterans' services and charities. Prolific, an online research participation platform, was used to target an age- and gender matched non-veteran sample on completion of recruitment for the veteran sample. In total, 5,147 responses were received to the online survey (2,535 veterans and 2,612 non-veterans). To ensure data integrity, quality control measures were applied to screen for and remove the following responses from the veteran sample: (a) opened the survey but did not complete any of the measures (11.1%); (b) did not complete the consent form (3.4%); (c) did not meet the threshold of completion of measures to be included in the dataset (19%); (d) did not provide legitimate military service credentials (23.3%); (e) did not meet the inclusion criteria of being at least 18 years old and having served in the UK Armed Forces (2.1%). For the non-veteran sample, the following screening measures were applied: (a) opened the survey but did not complete any of the measures (23.4%); (b) did not complete the consent form (1.9%); (c) did not meet the threshold of completion of measures to be included in the dataset (3.2%); (d) did not provide a legitimate UK postcode, completed the survey outside the UK, or provided inconsistent or questionable responses (24.7%). The final sample consisted of 2,185 responses (n = 1,037 veterans and n = 1,148 non-veterans). Veterans and non-veterans were a minimum of 18 years old and not currently serving in the UK AF. The non-veteran sample was limited to those who were domiciled within the UK; however, veterans who provided a valid service number but had emigrated since leaving the AF were included (1% of the veteran sample). All participants were reimbursed with a £20 shopping voucher on completion of the study.

The study protocol was reviewed by Wales NHS Research Ethics Committee 6 and obtained favorable HRA and Health and Care Research Wales (HCRW) approval (REC reference 19/WA/0134) and was conducted in accordance with STROBE guidelines. All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Measures

The UK AF Veterans' Health and Gambling Study is an age- and gender-matched cross-sectional online survey of UK veterans no longer serving in the military and those who have never served in the military (non-veterans). As well as sociodemographic characteristics, primary outcome variables included gambling severity and motivation, mental health (anxiety, depression, PTSD, and C-PSTD, and alcohol and nicotine use.

Sociodemographic variables

Respondents were asked their sex (as defined at birth), gender (i.e. male, female, non-binary, prefer to self-define/not to say, other), age, ethnicity (i.e. White-British/Irish, Any other white background, Mixed – White and Black Caribbean/Black African/Asian, Any other mixed background, Asian or Asian British – Indian/Pakistani/Bangladeshi, Any other Asian/Asian British background, Black or Black British – Caribbean/African, Any other Black/Black British background, Chinese, Prefer not to say, Any other), relationship status (i.e. single, in a relationship, co-habiting, never married, married-first and only marriage/second or later marriage, separated, divorced, widowed, other), highest qualification (e.g. no formal qualifications, General Certificate of Secondary Education (GCSE), Advanced Subsidiary (AS)/Advanced (A) Levels, bachelor's degree), accommodation type (e.g. owner-occupier, privately rented flat or house, sheltered housing, rehabilitation/long-stay psychiatric ward, homeless), and who they lived with (i.e. alone, children under 18/over 18, spouse/partner, other family, parent(s), non-family, other).

Military demographic variables

Veterans provided their service number and further details about their military service including years served, branch (e.g. Royal Navy, Royal Marines, Army, Royal Air Force, Merchant Navy) and trade in service, type of discharge (e.g. medical, at own request, and end of engagement), rank at discharge, number of deployments, deployment length, and deployment locations. Locations were selected from a list of 37 deployments (see Supplementary Materials) including Northern Ireland, the Falkland Islands, Gulf War (1990–1991), Afghanistan (2001–2014), Iraq (2003–2011), Iran–Iraq conflict (1977), and non-combat and low combat United Nations/NATO peacekeeping missions (e.g. Somalia, Bosnia). Respondents could select more than one deployment location and indicate other locations using a self-completion textbox.

Gambling participation and activities

Respondents were asked whether they had participated in one or more of 19 gambling activities within the past year (Wardle et al., 2007; see Supplementary Materials). If participants had gambled, they proceeded to the gambling severity and motivation measures. If not, they proceeded directly to the mental health measures.

Gambling severity and motivation variables

The *Problem Gambling Severity Index* (PGSI; Ferris & Wynne, 2001) comprises nine items measuring problematic gambling. Respondents use a 4-point scale to rate how often in the past year they had experienced a particular behavior (e.g. '*Have you bet more than you could really afford to lose*?'), from '*Never*' (0) to '*Almost Always*' (3). Scores are summed, with 0 indicative of *non-problem gambling*, scores of 1–2 classified as *low-risk gambling*, scores between 3 and 7 are indicative of *moderate-risk gambling*, and scores of 8 or above indicate *problem gambling*.

The *Gambling Functional Assessment – Revised* (GFA-R; Weatherly et al., 2014) is a 16-item measure of gambling motivations. Respondents use a 7-point scale to rate how often, from '*Never*' (0) to '*Always*' (6) a particular experience motivates their gambling (e.g. '*I gamble when I feel stressed or anxious.*'). The scores are summed and two subscales, or 'motivations,' for gambling derived: positive reinforcement and negative reinforcement.

Mental health variables

The *Patient Health Questionnaire* (PHQ-9; Kroenke et al., 2001) was used to screen for depression. Comprised of nine items, respondents use a 4-point scale to categorize how often over the last 2 weeks they have experienced a certain statement related to symptoms of depression (e.g. '*Little interest or pleasure in doing things*') ranging from 0 ('*not at* all') to 3 ('*nearly every day*'). The scores are summed and threshold scores of 0–4 indicate none or mild depression, 5 is considered minimal depression, ≥10 is considered moderate, ≥15 is considered moderately severe, and ≥20 indicates severe depression, respectively.

The *Generalized Anxiety Disorder assessment* (GAD-7; Spitzer et al., 2006) is a 7-item inventory for the screening of generalized anxiety disorder. Respondents use the same scale as the PHQ-9 to score how often over the last 2 weeks they feel they have experienced a certain statement related to symptoms of generalized anxiety disorder (e.g. '*Not being able to stop or control worrying.*'). The scores are summed, with scores of 0–4 indicating none/normal levels of anxiety, 5–9 is considered mild, 10–14 is considered moderate, and 15–21 is considered severe anxiety.

The *International Trauma Questionnaire* (ITQ; Cloitre et al., 2018) is an eighteen-item measure for the diagnosis of post-traumatic stress disorder (PTSD) and complex PTSD (C-PTSD) based on ICD-11. The ITQ is comprised of four sections, with the first two sections determining probable PTSD, and the second two sections, identifying Disturbances in Self-Organization (DSO). In the first section, respondents report how much they experienced any of six problems within the past month (e.g. '*Feeling jumpy or easily startled*'). Pairs of questions in this section relate to three PTSD symptom clusters: reexperiencing in the here and now, avoidance, and sense of current threat. The second section asks whether the above problem has affected any of three domains of life (e.g. "*Affected your work or ability to work*?). The questions in this section relate to functional impairment from PTSD. The third section asks how a respondent 'typically' feels, thinks about themselves, or how they might relate to others in six statements (e.g. '*I feel like a failure*'). Pairs of questions

in this section relate to symptoms from three DSO clusters: affective dysregulation, negative self-concept, and disturbances in relationships. The final section asks how the emotions identified in the third section may have affected three domains of the respondent's life (e.g. '*Created concern or distress about your relationships or social life*'). The questions in this section relate to functional impairment from DSO. Respondents use a 5-point Likert-scale to indicate their responses to questions in all sections, from 0 ('*Not at all*') to 4 ('*Extremely*'). For a diagnosis of PTSD, respondents must score above the threshold (greater than or equal to 2) for each PTSD symptom cluster, and above this threshold on the PTSD functional impairment section. For a diagnosis of C-PTSD, respondents must score above the threshold (greater than or equal to 2) for each DSO symptom cluster, and above this threshold on the DSO functional impairment section in addition to meeting the diagnosis criteria for PTSD. Respondents can receive either a potential diagnosis of PTSD or C-PTSD, not both.

Alcohol use and nicotine dependence

The *Alcohol Use Disorders Identification Test* (AUDIT; Babor et al., 2001) is a 10-item screening tool for harmful alcohol consumption. Respondents use 5-point scales to rate their drinking behavior in three-axes: how often (e.g. '*How often do you have a drink containing alcohol*?': 'Never' to '4+ times per week.'), how much (e.g. '*How many units of alcohol do you drink on a typical day when you are drinking*?': '0–2' to '10+'), and their personal perceptions of their own drinking behavior (e.g. '*How often during the last year have you had a feeling of guilt or remorse after drinking*?': 'Never' to 'Daily or almost daily'). The final two questions ask whether someone has ever been injured as a direct result of the respondent's drinking and whether someone has been concerned about the respondent's drinking habits. Respondents use a 3-point Likert scale ranging from 'No' to 'Yes, but not in the last year', and 'Yes, during the last year'.

The *Fagerström Test for Nicotine Dependence* (FTND; Heatherton et al., 1991) is a six-item measure of the quantity of cigarette consumption, the compulsion to use, and dependence. Four of these questions are binary 'yes' or 'no' questions (e.g. '*Do you smoke more frequently during the first hours after waking than during the rest of the day*?'), with one multiple-choice question (e.g. '*How many cigarettes per day do you smoke?')* rated from 1 (*10 or less)* to 4 (*31 or more*) and another (e.g. *'How soon after waking do you smoke your first cigarette*?') rated from 1 (*within 5 minutes*) to 3 (*31–60 minutes*). The items are summed for total score of 0–10, with higher scores indicating greater nicotine dependency.

Data analysis

Associations between veteran status and outcome variables were calculated using chi-square tests of association, unadjusted odds ratios were calculated for significant associations, and differences between groups analyzed using parametric analysis (i.e. t-tests and one-way ANOVA).

Stepwise multiple linear regressions were utilized to predict gambling severity as measured by continuous PGSI score. Four models were developed either based on factors known to influence the development of problem gambling (Dixon et al., 2018; Etuk et al., 2020; Moore & Grubbs, 202; Sharman et al., 2019; Weatherly et al., 2011, 2014) or about which little information is currently known among veterans. The first model utilized sociodemographic characteristics, the second military demographics, the third mental health variables, and the fourth gambling activities and motivation variables. Continuously scored variables were entered as ordinal variables to compensate for non-transformable non-normality. These ordinal variables models were included as binary dummy variables of each category (Rosenberg et al., 2013). Multicollinearity of variables was examined by inspection of variance inflation factors (VIF); these all remained below 2 indicating that variables were not closely correlated for regression analysis.

Skewness and kurtosis of the PGSI data was within accepted threshold tolerances for normal univariate distribution (± 2; George & Mallery, 2010; Hair et al., 2010; Kline, 2011). For the full sample, skewness was identified as 1.297 (SE = .058) with a kurtosis of 0.642 (SE = .117); for the veteran subsample, continuous PGSI score skewness was calculated as 0.574 (SE = .079) with a kurtosis of −0.840 (SE = 0.159).

Results

Sociodemographics

As shown in Table 1, the sociodemographic characteristics of the veteran cohort are consistent with the profile of the UK AF veteran population (Ministry of Defence, 2019). Most veterans were male (93.5%), with a mean age of 46.69 (*SD* = 13.21), white-British, married, resided in England, and in paid employment. Veterans tended to be educated to GCSE-level A*-C or above and living with family. Most of both samples were not in receipt of benefits, yet the proportion of veterans who were (45.8%) was more than twice that of non-veterans (23.5%). Overall, the samples were adequately matched for age and gender, but did inadvertently differ by country of residence, ethnicity, marital status, employment, qualifications, household arrangement, accommodation, and benefits.

Military demographics

Table 2 shows military demographic characteristics of the veterans' sample. Most veterans had served in the Army, for between 5 and 9 years, had two or more operational deployments (see Supplementary Materials), and left at the end of their engagement period, 12 or more years ago.

Gambling

Table 3 displays gambling activities, severity, and motivations for both samples. Veterans were over 4 times more likely to have gambled in the past year ($p < .001$) and did so on more activities ($p < .001$) than non-veterans. Of the sample, 43.1% of veterans and 6.5%

Table 1. Sociodemographic characteristics of the veterans' and non-veterans' samples.

	Veterans (n = 1,037)		Non-veterans (n = 1,148)			
	n	%	*n*	%	*p*	
Gender						
Male	970	93.5	1054	91.8	.123	.278
Female	64	6.2	91	7.9	.111	
Other	3	0.3	3	0.3	.901	
Age						
18–29	63	6.1	73	6.4	.788	1.00
30–39	346	33.4	383	33.4	.986	
40–49	201	19.4	221	19.3	.929	
50–59	222	21.4	246	21.4	1.00	
60–69	155	15.0	171	14.9	.966	
70–79	40	3.9	45	3.9	.943	
80+	9	0.9	9	0.8	.827	
Country						
England	805	77.6	965	84.1	<.001‡	<.001‡
Wales	127	12.2	76	6.6	<.001‡	
Scotland	67	6.5	84	7.3	.431	
Northern Ireland	28	2.7	23	2.0	.282	
Other	10	1.0	0	0.0	.001‡	
Ethnicity						
White British	960	92.6	1020	88.9	.003‡	
Other	77	7.4	128	11.1		
Marital Status						
Single	103	9.9	243	21.2	<.001‡	<.001‡
In a relationship	95	9.2	160	13.9	.001‡	
Co-habiting	47	4.5	138	12.0	<.001‡	
Married	510	49.2	440	38.3	<.001‡	
Married 2nd+	166	16.0	87	7.6	<.001‡	
Separated	25	2.4	22	1.9	.426	
Divorced	70	6.8	45	3.9	.003‡	
Widowed	21	2.0	13	1.1	.092	
Employment						
Unemployed, not actively seeking	14	1.4	24	2.1	.186	.010†
Unemployed, actively seeking	55	5.5	63	5.3	.849	
In training/education	24	2.3	15	1.3	.076	
In sheltered work	9	0.9	0	0.0	.002‡	
In paid employment	704	67.9	810	70.6	.177	
Not working due to long term illness	64	6.2	51	4.4	.071	
Looking after home/family	20	1.9	21	1.8	.864	
Retired	147	14.2	164	14.3	.941	
Highest Qualification [a]						
No formal qualification	63	6.1	24	2.1	<.001‡	<.001‡
Entry certificate	34	3.3	16	1.4	.003‡	
GCSE D-G	153	14.8	83	7.2	<.001‡	
GCSE A*-C	311	30.0	156	13.6	<.001‡	
AS/A level	153	14.8	199	17.3	.101	
Certificate of HE	125	12.1	87	7.6	<.001‡	
Bachelor's degree	116	11.2	355	30.9	<.001‡	
Master's degree	78	7.5	189	16.5	<.001‡	
Doctorate	4	0.4	39	3.4	<.001‡	
Household Arrangement						
Live alone	180	17.4	201	17.5	.926	.008‡
Live with family	844	81.4	910	79.3	.214	
Live with non-family	13	1.3	37	3.2	.002‡	
Accommodation						

(*Continued*)

Table 1. (Continued).

	Veterans (n = 1,037)		Non-veterans (n = 1,148)			
	n	%	n	%	p	
Domestic/family	130	12.5	146	12.7	.898	<.001‡
Owner	493	47.5	637	55.1	<.001‡	
Privately rented	211	20.3	250	21.8	.413	
Rented from local authority	163	15.7	106	9.2	<.001‡	
Community/supported living	37	3.6	6	0.5	<.001‡	
Homeless	3	0.3	0	0.0	.068	
Other	0	0.0	3	0.3	.099	
Benefits						
Yes	475	45.8	269	23.5	<.001‡	
No	562	54.2	877	76.5		

[a]Qualification categories describe qualifications based on the English educational qualification system of equivalent level of attainment and may not be the qualification the respondent holds. p = Significance of Pearson's χ^2 test. † Indicates significance where $p < 0.05$. ‡ Indicates significance where $p < 0.01$

Table 2. Military demographic characteristics of the veterans' sample.

	Veterans (n = 1,037)	
	n	%
Service (includes reserves)		
Army	671	64.7
Royal Navy/Royal Marines/Royal Fleet Auxiliary	220	21.2
Royal Air Force (RAF)	142	13.7
Rank at discharge		
Commissioned Officer	78	7.5
NCO/Other ranks	835	80.5
Length of service		
0–4 years (early leavers)	245	23.6
5–9 years	413	39.8
10–19 years	193	18.6
20+ years	182	17.6
Discharge status		
Medical discharge	96	9.3
Premature Voluntary Release (PVR)	329	31.7
End of engagement	391	37.7
Administrative	47	4.5
Compulsory	56	5.4
Redundancy	58	5.6
Other	27	2.6
Years since leaving service		
0–8 years	220	21.2
9–13 years	277	26.7
14–24 years	257	24.8
25+ years	252	24.3
Location of deployment [a]		
Falkland Islands	177	17.1
Gulf War	88	8.5
Northern Ireland	352	33.9
Bosnia and Kosovo	170	16.4
Afghanistan	163	15.7
Iraq (Op TELIC)	151	14.6
Other [b]	447	43.1
None	164	15.8

Notes: [a]Respondents were able to select more than one deployment location. [b]Includes minor conflicts or international non-combat theater deployments.

Table 3. Gambling activities, severity, and motivation for veterans and non-veterans who had participated in gambling activities within the past year.

	Veterans (n = 949; 91.5%)		Non-veterans (n = 815; 71%)		p	OR (95%CIs)
	n	%	n	%		
Gambling Activity						
National Lottery	601	63.3	580	71.2	<.001‡	
Scratch cards	384	40.5	272	33.4	.002‡	
Any other lottery	336	35.4	154	18.9	<.001‡	
Football pools	191	20.1	51	6.3	<.001‡	
Bingo	157	16.5	29	3.6	<.001‡	
Fruit or slot machines	283	29.8	83	10.2	<.001‡	
Virtual gambling machines	205	21.6	70	8.6	<.001‡	
Casino table games	174	18.3	36	4.4	<.001‡	
Poker	119	12.5	21	2.6	<.001‡	
Online gambling (e.g. casino games)	247	26.0	189	23.2	.168	
Online betting	257	27.1	322	39.5	<.001‡	
Betting exchange	122	12.9	122	15.0	.200	
Horse racing	255	26.9	112	13.9	<.001‡	
Dog racing	129	13.6	27	3.3	<.001‡	
Sports betting	200	21.1	110	13.5	<.001‡	
Other event betting	107	11.3	43	5.3	<.001‡	
Spread betting	96	10.1	27	3.3	<.001‡	
Private betting	180	19.0	52	6.4	<.001‡	
Any other gambling	23	2.4	17	2.4	.635	
Total activities						
Mean (SD)	4.28 (3.14)		2.85 (2.33)		<.001‡	
Gambling Severity						
Non-problem gambling (PGSI score 0)	357	37.7	546	67.0	<.001‡	0.30 (0.25–0.36)
Low-risk gambling (PGSI score 1–2)	80	8.4	125	15.3	<.001‡	0.51 (0.38–0.69)
Moderate-risk gambling (PGSI score 3–7)	102	10.8	91	11.2	.791	0.96 (0.71–1.30)
Problem gambling (PGSI score ≥ 8)	408	43.1	53	6.5	<.001‡	10.88 (8.01–14.79)
Gambling Motivation						
Positive Reinforcement	569	60.0	241	29.6	<.001‡	0.28 (0.23 – .0.34)
Negative Reinforcement	326	34.4	54	6.6	<.001‡	7.37 (5.43–10.02)

Notes: p = Significance of Pearson's χ^2 test, except for total activities where the significance of a t-test is presented. † Indicates significance where $p < 0.05$. ‡ Indicates significance where $p < 0.01$

of non-veterans experienced problem gambling. Veterans were over 10 times more likely to be distinguished by problem gambling than non-veterans ($p < .001$). Veterans' gambling was over 7 times more likely to be motivated by negative reinforcement ($p < .001$) compared to non-veterans.

Mental health

Table 4 displays the prevalence of mental health variables. The single largest proportion of both veterans and non-veterans reported no symptoms of depression (30.4% and 55%, respectively) or anxiety (38.7% and 64.9%, respectively) and most did not reach the threshold for diagnosis of PTSD. However, veterans were more than 4 times more likely to have a diagnosis of likely PTSD and almost 7 times more likely than non-veterans to

Table 4. Comparison of mental health outcome variables between veterans and non-veterans.

	Veterans		Non-veterans				
	n	%	n	%	*p*		OR (95% CI)
Depression	*1002*		*1145*				
No Depression	305	30.4	630	55.0	<.001‡	<.001‡	0.36 (0.30–0.43)
Mild	269	26.8	274	23.9	.121		1.17 (0.96–1.42)
Moderate	271	27.0	116	10.1	<.001‡		3.30 (2.59–4.17)
Moderately Severe	72	7.2	87	7.6	.716		0.94 (0.68–1.30)
Severe	85	8.5	38	3.3	<.001‡		2.70 (1.82–4.00)
Anxiety	*1002*		*1145*				
No Anxiety	388	38.7	743	64.9	<.001‡	<.001‡	0.34 (0.29–0.41)
Mild	354	35.3	224	19.6	<.001‡		2.25 (1.85–2.73)
Moderate	167	16.7	106	9.3	<.001‡		1.96 (1.51–2.54)
Severe	93	9.3	72	6.3	.009‡		1.53 (1.11–2.10)
Posttraumatic Stress Disorder	*852*		*1148*				
No Diagnosis	552	64.8	1064	92.7	<.001‡	<.001‡	0.15 (0.11–0.19)
Likely PTSD	73	8.6	26	2.3	<.001‡		4.04 (2.56–6.39)
Likely C-PTSD	227	26.6	58	5.1	<.001‡		6.83 (5.03–9.26)
Alcohol Use	*967*		*1138*				
nondrinker	112	11.6	170	14.9	.024	<.001‡	0.75 (0.58–0.96)
Lower Risk	239	24.7	598	52.5	<.001‡		0.30 (0.25–0.36)
Increasing Risk	332	34.3	271	23.8	<.001‡		1.67 (1.38–2.02)
Higher Risk	144	14.9	38	3.3	<.001‡		5.07 (3.50–7.32)
Possible Alcohol Dependence	140	14.5	61	5.4	<.001‡		2.99 (2.18–4.09)
Nicotine Dependence	*965*		*1137*				
Nonsmoker	587	60.8	976	85.8	<.001‡	<.001‡	0.26 (0.21–0.32)
Very Low	1	0.1	1	0.1	.908		1.18 (0.07–18.86)
Low	39	4.0	57	5.0	.287		0.80 (0.53–1.21)
Medium	143	14.8	40	3.5	<.001‡		4.77 (3.32–6.85)
High	162	16.8	58	5.1	<.001‡		3.75 (2.74–5.13)
Very High	34	3.5	6	0.5	<.001‡		6.88 (2.88–16.47)

Notes: Sample respondent totals reported for each measure. *p* = Significance of Pearson's χ2 test. OR: unadjusted Odds Ratio. 95% CI: Upper and lower bound 95% confidence intervals. † Indicates significance where p < 0.05. ‡ Indicates significance where p < 0.01.

have a diagnosis of C-PTSD. Most non-veterans experienced lower risk drinking while most veterans experienced increasingly hazardous drinking levels. Veterans and non-veterans were generally nonsmokers.

Predictors of gambling severity

Analysis, using four stepwise multiple regression models, was conducted using clustered factor blocks of sociodemographics, military demographics, mental health, and gambling activities and motivations.

Nine significant predictors of veterans' PGSI scores (F (9,937) = 42.26, p < .001) from the sociodemographic variables were included in the first model (Table 5). The multiple correlation for these nine predictors was R = .54, accounting for 28.9% of PGSI score variance. Age was the strongest predictor, accounting for 21.0% of the variance (ΔR^2 = .210, F (1,945) = 251.02, p < .001). Additionally, being of White-British ethnicity (ΔR2 = .009), achieving a Doctorate as one's highest qualification (ΔR^2 = .004) and, living with non-family members (ΔR^2 = .003) were negative predictors of continuous PGSI score (i.e. protective factors). Conversely, positive predictors of continuous PGSI score

Table 5. Stepwise multiple linear regression models for clustered theoretical predictors of veterans' continuous PGSI scores.

	Sociodemographics				Military Demographics				Mental Health				Gambling			
Model Summary																
R	.54				.59				.59				.73			
R^2	.29				.35				.35				.54			
Adjusted R^2	.28				.34				.34				.54			
p	<.001				<.001				<.001				<.001			
Significant Predictors	B	*β*	*t*	*p*	B	*β*	*t*	*p*	B	*β*	*t*	*p*	B	*β*	*t*	*p*
(Constant)	*15.72*		*16.42*	*<.001*	*7.86*		*18.81*	*<.001*	*8.69*		*17.29*	*<.001*	*.046*		*0.15*	*<.001*
Age	−0.20	−.40	−13.83	<.001												
Ethnicity	−2.55	−.11	−3.77	<.001												
Benefits	2.41	.19	6.71	<.001												
Relationship Status (Married)	1.11	.09	3.02	.003												
Highest Qualification (Doctorate)	−6.35	−.07	−2.33	.020												
Accommodation (Private Rent)	0.97	.06	2.14	.033												
Accommodation (Supported Living)	4.23	.12	4.27	<.001												
Live with Non-Family	−3.92	−.06	−2.24	.025												
Length of Service (20+ Years)					−6.70	−.40	−12.84	<.001								
Length of Service (10–19 Years)					−2.75	−.16	−5.44	<.001								
Length of Service (0–4 Years)					1.86	.13	4.09	<.001								
Years Since Discharge (25+ Years)					−2.80	−.19	−6.35	<.001								
Years Since Discharge (9–13 Years)					2.76	.20	6.69	<.001								
Branch (Royal Navy)					1.04	.07	2.46	.014								
Not Deployed					−1.57	−.09	−3.14	.002								
Discharge (Other)					−4.17	−.11	−3.82	<.001								
Discharge (At Own Request)					−1.07	−.08	−2.65	.008								
Discharge (Medical)					−1.46	−.07	−2.41	.016								
PHQ-9 (No Depression)									−3.18	−.23	−6.18	<.001				
GAD-7 (Mild Anxiety)									1.02	.08	2.22	.026				
GAD-7 (Severe Anxiety)									−2.07	−.09	−2.83	.005				
AUDIT (Lower Risk Drinking)									−1.35	−.09	−2.83	.005				
AUDIT (Higher Risk Drinking)									2.08	.11	3.56	<.001				
AUDIT (Possible Alcohol Dependence)									3.10	.18	5.56	<.001				
ITQ PTSD (No PTSD)									−3.85	−.29	−8.55	<.001				
Number of Gambling Activities													0.72	.35	14.97	<.001
GFA-R (Negative Reinforcement)													7.86	.59	20.00	<.001
GFA-R (Positive Reinforcement)													0.83	.06	2.25	.025

(i.e. risk factors) included the respondent being in receipt of benefits (ΔR^2 = .041), living in supported accommodation (ΔR^2 = .008), being married (ΔR^2 = .006) and living in privately rented accommodation (ΔR^2 = .003).

In the second model, eleven significant predictors (F (11,902) = 44.27, p < .001) were included (Table 5). In combination, these predictors had a multiple correlation of R = .59, which accounted for 35.1% of the variance within PGSI scores. Serving for longer than 20 years was the strongest predictor of PGSI score, accounting for 12.5% of variance (ΔR^2 = .125, F (1,912) = 129.92, p < .001). Additionally, serving for between 10 and 19 years (ΔR^2 = .044), being discharged 25+ years ago (ΔR^2 = .034), discharge due to a reason listed as 'other' (ΔR^2 = .009), not being deployed during their career (ΔR^2 = .008), being discharged at their own request (ΔR2 = .003), and being medically discharged (ΔR2 = .004) were negative predictors of PGSI score (i.e. protective factors). Positive predictors of PGSI score (i.e. risk factors) were being discharged 9–13 years ago (ΔR^2 = .103), serving for between 0 and 4 years (ΔR^2 = .009), and serving in the Royal Navy (ΔR^2 = .005).

The third model evaluated the role of mental health variables to predict veterans' PGSI scores. Entered stepwise, seven significant predictors (F (7,770) = 59.08, p < .001) were included (Table 5) that accounted for 35.9% of the variability in PGSI scores with a multiple correlation of R = .59. The strongest predictor was having no symptoms of depression within the last 2 weeks and accounted for 19.9% of the variance in PGSI score (ΔR^2 = .199, F (1,776) = 193.28, p < .001). Additionally, no likely PTSD diagnosis (ΔR^2 = .080), severe anxiety (ΔR^2 = .015) and lower risk drinking (ΔR^2 = .008) comprised the negative predictors (i.e. protective factors) of PGSI score in this model. The positive predictors were possible alcohol dependence (ΔR^2 = .026), higher risk drinking (ΔR^2 = .018), and mild anxiety (ΔR^2 = .004).

The final model analyzed the role of gambling activities and motivations in predicting veterans' PGSI scores. Three significant, positive predictors (F (3,943) = 364.79, p < .001) were included (Table 5), accounting for 53.7% of variance within PGSI scores with a multiple correlation of R = .73. The strongest predictor was gambling due to negative reinforcement, accounting for 40.8% of PGSI score variance (ΔR^2 = .408, F (1,945) = 651.48, p < .001), followed by number of gambling activities (ΔR^2 = .127) and gambling due to positive reinforcement (ΔR^2 = .002), respectively.

Discussion

This study represents the first survey of gambling risk factors among a large sample of community-dwelling UK AF veterans. Consistent with findings from both the UK (Dighton et al., 2018; Roberts et al., 2019) and internationally (Etuk et al., 2020; Levy & Tracy, 2018), we found that UK veterans were at increased risk of problem gambling. Veterans gambled on more activities than their non-veterans, and their gambling was motivated by negative reinforcement (escape from or avoidance of distress). In line with previous findings, veterans experienced numerous symptoms of depression, anxiety, risky alcohol use, nicotine dependence at higher levels, and increased indications of PTSD and C-PTSD diagnoses compared to non-veterans (Biddle et al., 2005; Goodwin

et al., 2015; Murphy et al., 2021). Our regression analysis identified that veteran status was a significant predictor of increased PGSI score along with gambling due to negative reinforcement. Length of service and years since discharge also predicted a decrease in gambling severity. These findings indicate that longer service in the AF may be a protective factor; however, negative mental health outcomes may exacerbate gambling problems soon after leaving the AF, with gambling being further motivated by a need to escape or avoid distress.

Our most striking finding was that 43.1% of the veterans' sample experienced problem gambling and were 10 times more likely to do so than non-veterans. The estimated rate and odds ratio are significantly higher than other studies of problem gambling severity in veterans conducted using the PGSI. For instance, a previous study of n = 1324 members of the Australian Defense Force deployed between 2010 and 2012 found that 2% experienced problem gambling (PGSI > 5) and that 7.7% reported at least some gambling-related problems post-deployment (Cowlishaw et al., 2020). Notably, greater difficulties were most pronounced in early service leavers serving in the Army as noncommissioned officers (NCOs)/ Other Ranks. Our findings partially mirror these, with length of service a key predictor of harm among most of our veterans who had served in the UK Army in NCO roles, albeit with substantially higher distinguishing rates of problem gambling. Comparing our findings on problem gambling to the extant literature, Biddle et al. (2005) noted rates of 28% and Grant et al. (2017) rates of 25.9% among help-seeking samples of veterans receiving treatment for alcohol dependence and co-occurring psychiatric disorders, respectively. The present findings indicate high, previously undetected estimated rates of problem gambling in UK veterans (Dighton et al., 2018; Roberts et al., 2019).

It was notable that 8.6% veterans in the current study met criteria for likely PTSD, with 26.6% indicating probable C-PTSD. These findings are lower than the rates reported in help-seeking UK samples (n = 96, 54.3%; Murphy et al., 2021). Evidence suggests that C-PTSD is more common in veterans than PTSD (Murphy et al., 2019, 2020, 2021; Stevelink et al., 2018) and, although research focussing on comorbidites is limited, the association between C-PTSD and poor treatment outcomes for veterans is relatively well understood (Kitchiner et al., 2019; Murphy et al., 2019; Phelps et al., 2018). Complex emotional responses, such as guilt and shame, are closely related to the disorder of self-organization component of C-PTSD (Goodwin et al., 2015) that also overlaps with problem gambling, with shame motivating coping by negative reinforcement in gambling (Schlagintweit et al., 2017). Our findings do, however, indicate, for the first time, the co-occurrence of problem gambling and C-PTSD in veterans.

The motivation to gamble due to negative reinforcement was the strongest predictor of increased PGSI score in the veteran sample. Indeed, veterans who gambled were over 7 times more likely to be motivated to do so due to avoidance or escape from distress. This unique finding parallels the elevated levels of alcohol misuse that is considered a potential negative coping strategy in veterans (Goodwin et al., 2015). In interviews on coping with trauma in the military, Williamson et al. (2019) noted that some veterans indicated that 'avoidance' was the most accessible coping strategy; avoidance is core to the symptomatology of PTSD. Taken together,

these findings highlight increased scores on mental health variables and high rates of probable C-PTSD in the veterans' sample, suggesting that gambling may become a maladaptive, avoidant coping mechanism for veterans.

Identifying the motivations or functions of gambling has novel implications for clinical treatment of gambling problems. Although the present study adopted a broadly two-factor approach as revealed by the GFA-R and found that problem gambling among veterans was significantly motivated by the moderation or amelioration of heightened stress (i.e. negative reinforcement), it is unlikely that there are just two distinct functions of gambling-related problems (i.e. positive or negative reinforcement) and that a four-factor model may have greater clinical utility. As Dixon et al. (2018) describe, these four-factors of 'social attention (e.g. enjoyment of interacting with peers), psychological/physical escape (e.g. ability to forget about stress at home, leave a troubled work environment), access to tangible rewards (e.g. money, comps, and vouchers), and sensory (e.g. feeling a rush or buzz)' (p. 177) account for topographies of reinforcement-maintained gambling behavior, yet a complete assessment also necessitates identification of relevant antecedent conditions (i.e. those life events that precede or prompt occurrence of the different functions at different times). Such a functional analytic approach is consistent with the goals of case conceptualization where individuals are interviewed about the triggers to their gambling or the antecedents that may prompt relapse if they are in recovery. Determining both the antecedents and motivations (i.e. consequences) of gambling may aid in the development of individualized treatment plans and assist with cross-validation of self-report-based assessment interviews with functional assessment outcomes measured by the recently developed four-factor GFA-II (Dixon et al., 2018). The potential utility of this functional approach warrants further investigation with vulnerable populations like veterans. Doing so may lead to greater synthesis with established treatments from behavioral psychology for negatively reinforced behavior (Miltenberger, 2005), perhaps as adjunct treatments for gambling problems identified through prior functional assessment (Hofmann & Hayes, 2019; Hurl et al., 2016).

Our findings indicate that screening for potential gambling problems should be conducted by the UK AF as it is with military personnel in the USA (Etuk et al., 2020; Levy & Tracy, 2018; Milton et al., 2019). At present, gambling is not assessed in pre-enlistment screening processes or during active service and discharge procedures. Doing so in preexisting surveys, such as the AF Continuous Attitudes Survey would establish parity of care for gambling-related harm with, for instance, substance use disorders among personnel who are at heightened vulnerability for problem gambling.

Limitations

The present study was conducted almost entirely online (78.3% of veterans and 100% of non-veterans were recruited in this way), with recruitment primarily carried out through targeted paid content on social media for a survey of 'veterans' health and gambling'. While potential study sampling effects and the risk of self-selection bias cannot therefore be ruled out (Angus et al., 2021), we employed recommended methods for increasing data quality such as participant screening, removing duplicate and non-sensical responses, presenting content-knowledge questions (e.g. providing a service number that was correctly structured and within date bounds), and IP address geolocation and monitoring (Pickering &

Blaszczynski, 2021). Collecting data online may have inadvertently excluded older veterans, those without access to the internet, and the homeless. The range and complexity of the measures obtained online may have benefitted from the inclusion of attention-checks and controls to reduce response set and/or prompt truthful answers from respondents. The samples differed on 8 of the 10 demographic characteristics examined that are known to be associated with increased risk of gambling problems (Allami et al., 2021). Moreover, some data were collected during COVID-19 national lockdowns. Additional stress related to the pandemic may have facilitated problematic, risky behaviors (Albertella et al., 2021) and influenced reporting. Further cross-cultural comparative research should examine the impact of the different gambling legislative environments on reported estimates of gambling problems in veterans. Finally, the study used self-report measures rather than clinical interviews for mental health conditions, which may limit generalizability.

Conclusions

The present study provides the first gambling-focussed source of data in UK AF veterans with an age- and gender-matched comparison group of non-veterans. We found that problem gambling is significantly higher in UK veterans, is a likely coping mechanism for mental health conditions, and driven by a need to avoid or escape distress. In veterans, problem gambling co-occurred with, for the first time, C-PTSD. Screening for problem gambling should be undertaken to provide improved treatment and support.

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Data availability statement

The data described in this article are openly available in the Open Science Framework at https://osf.io/km8wx/

Open scholarship

This article has earned the Center for Open Science badge for Open Data. The data are openly accessible at https://osf.io/km8wx/.

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