Gambling problems and associated harms in United Kingdom Royal Air Force personnel

Amy Pritchard [a], Simon Dymond [a,b,*]

[a] School of Psychology, Swansea University, Singleton Campus, Swansea SA2 8PP, UK
[b] Department of Psychology, Reykjavík University, Menntavegur 1, Nauthólsvík, 101 Reykjavík, Iceland

ARTICLE INFO

ABSTRACT

International evidence indicates that currently serving and former military personnel may be at heightened vulnerability to problem gambling. The aim of the present study was to undertake the first survey of gambling experience and potential problems among serving United Kingdom Royal Air Force (RAF) personnel. Our objectives were to survey the frequency of gambling problems, types of gambling activities, examine mental health, alcohol use, and COVID-19-related associations with gambling, and identify potential risk factors for problem gambling among RAF personnel. A cross-sectional online survey was distributed to all serving RAF personnel in January 2021 and the final dataset consisted of $n = 2119$ responses. The Problem Gambling Severity Index (PGSI) identified gambling severity, the Patient Health Questionnaire (PHQ-9) assessed depression, the Generalized Anxiety Disorder assessment (GAD-7) measured anxiety, and alcohol use was assessed with the Alcohol Use Disorders Identification Test (AUDIT). Questions relating to COVID-19 asked whether the pandemic had impacted one's gambling, mental health, and alcohol use. Findings indicated that 12.5% of personnel reported gambling problems, which included 8.0% with PGSI scores indicating low-risk gambling (1–2), 2.9% with moderate-risk gambling scores (3–4), and 1.6% with scores indicating problem gambling ($\geq$8). Most personnel had no symptoms of depression or anxiety, and most experienced lower risk drinking levels. The likelihood of any gambling problem (PGSI $\geq$ 1) in RAF personnel was associated with age (18–24 years old), male gender, and Non-Commissioned ranks. Most participants reported a deterioration in their mental health due to COVID-19 and increased risky gambling. These findings indicate that gambling problems and associated harms are significant concerns for serving RAF personnel.

1. Introduction

Gambling is an addictive behaviour characterised by persistent maladaptive gambling with negative consequences such as financial hardship, emotional and psychological distress, and relationship problems (American Psychiatric Association, 2013). Self-reported gambling behaviours that may or may not meet subclinical thresholds are referred to as problem gambling (PG) or at-risk gambling (ARG) and capture a range of gambling-related harms (Currie et al., 2013; Wardle et al., 2019).

Current and ex-military personnel may exhibit heightened vulnerability to developing gambling problems (Etuk et al., 2020; Paterson et al., 2021). Cowlishaw et al. (2020) found that 7.7% of Australian Defence Force personnel reported at least some gambling problems following deployment, with 2.0% indicating PG (*Problem Gambling*

Severity Index (PGSI) scores $\geq$ 5) and 5.7% indicating ARG (PGSI 1–4). A USA-based study comparing currently serving and ex-military personnel with a civilian sample reported that those with military experience reported higher rates of moderate to severe PG (PGSI $\geq$ 3) – 31.97% compared to 16.97% reported by civilians - with the highest rates of PG observed among serving personnel (van der Maas & Nower, 2021). Similarly, an online survey of 337 serving personnel from the United Kingdom (UK), the USA, Australia, and New Zealand also revealed a higher proportion of gambling behaviours among respondents compared to the general population (Milton et al., 2020). The severity of specific gambling problems was not assessed in that study. In the UK, where gambling is technically forbidden on all armed forces sites, there are currently no published studies on gambling problems in serving military personnel. However, in a recent report prepared for the Royal Air Force (RAF) Benevolent Fund which reached more than 2,500

---

serving RAF personnel, it was found that 2% of respondents reported either a 'problem' or a 'major problem' with gambling and that rates increased to 5% when a 'slight problem' with gambling was included (Royal Air Force Benvolent Fund, 2019). Prevalence estimates of gambling severity were not undertaken in that study. Taken together, save for the UK, there is growing international evidence for increased PG risk among serving military personnel. The aim of the present study was to undertake the first formal survey of gambling experience, severity, and associated harm among a sample of serving UK military (RAF) personnel. The secondary aim was to investigate PG risk-factors and associations with in-service roles and any co-occurring mental health difficulties.

Military service is associated with increased risk of addictive behaviours and mental health difficulties. Pre-enlistment vulnerabilities such as childhood adversity, the rigorous selection process for the armed forces, and occupational risks like experiencing stressful and traumatic events in-service (Brooks & Greenberg, 2018; Iversen et al., 2007) may all predispose personnel to PG risk and related mental health conditions. It is long known that gambling problems frequently co-occur with common mental health disorders, such as, anxiety, depression, and alcohol misuse (Dowling et al., 2015), which are more common among serving military personnel compared to civilian populations (Goodwin et al., 2015; Thandi et al., 2015). In the UK, responsible consumption of alcohol is accepted in the armed forces. Goodwin et al. (2015) found that the prevalence of common mental health conditions in males aged 18–44 years in the armed forces was 18.2% compared to 9.2% for working men of the same age in the general population. Alcohol-related dependency also tends to be significantly higher in the military compared to the general population (Aguirre et al 2014). Rates of hazardous drinking have been reported at 34.8%, and harmful drinking at 9.6%, within the military (Irizar et al., 2021) compared to 16.6% of the general UK population who drank at hazardous levels and 3.1% at harmful or dependent levels (McManus et al., 2016). Higher levels of gambling involvement and problems have been identified among veterans with posttraumatic stress disorder (PTSD; Biddle et al., 2005; Dighton et al., 2018, 2021; Etuk et al., 2020; Lusk et al., 2017), substance use (Davis et al., 2017), or alcohol misuse (Steenbergh et al., 2008). Recently, among currently serving personnel, problem gambling was associated with a 9-fold increase in alcohol dependency, an almost 7-fold increase in probable major depression and PTSD, and a 5-fold increase in high psychological distress (Cowlishaw et al., 2020). Despite the co-occurrence of PG with mental health disorders commonly reported in military populations, little is known about these associations among currently serving personnel.

The impact of the COVID-19 pandemic on financial insecurity and related gambling among vulnerable groups like military personnel also remains to be determined (Auer et al., 2020; Hodgins & Stevens, 2021; Oksanen et al., 2018; Sharman et al., 2019; Sharman et al., 2021a; Sharman et al., 2021b). Data from the general population suggests that gambling has remained relatively stable, or in some cases, decreased during COVID-19; however, increases in gambling activity have also been noted (Hodgins & Stevens, 2021; Wardle et al., 2021). At-risk groups who increased their gambling during COVID-19 were vulnerable to alcohol misuse and engaged in high-risk gambling activities (Håkansson, 2020). Similarly, in younger age populations, those experiencing greater psychological distress and with greater pre-COVID problematic gambling were more likely to experience problematic gambling during periods of lockdown (Albertella et al., 2021). Clearly then, while the impact of the pandemic on gambling has varied across the general population, little is known about the impact among military personnel.

The aim of this study was to survey, for the first time, the nature and extent of gambling problems among currently serving members of the UK RAF and to identify risk-factors and predictors of gambling problems. Our specific objectives were (1) to survey the frequency of gambling problems among RAF personnel (using PGSI scores of 0 to

indicate non-problem gambling, 1–2 indicating low-risk gambling, 3–7 moderate-risk gambling, and 8 or higher as indicating problem gambling); (2) examine mental health, alcohol use, and COVID-19-related associations with gambling; and (3) identify potential risk factors which may heighten the vulnerability of RAF personnel to gambling-related harms.

2. Methods

2.1. Participants

A cross-sectional online survey of serving RAF personnel from across the UK was circulated on 19th January 2021 and made available for 5 weeks. To participate, participants had to be a currently serving member of the RAF and over 18 years old. In total, 2,805 responses were initially received. Ineligible and incomplete responses were removed to ensure data integrity (Pickering & Blaszczynski, 2021). Specifically, $n = 485$ opened the survey but did not complete the consent form, $n = 197$ did not meet the minimum threshold of completion of measures for inclusion in the study (i.e., minimum 41% completion), and $n = 4$ indicated they were under the age of 18. The final sample therefore consisted of $n = 2,119$, of which 2,046 were full (i.e., completed all questions) and 73 were partial responses (i.e., answered all the questions on some of the survey measures). Ethical approval was obtained from the Ministry of Defence Research Ethics Committee (Reference: 1051/MoDREC/20).

2.2. Materials

The online survey was hosted in Qualtrics and included questions relating to socio-demographic characteristics such as age, sex (i.e., 'please enter your sex as defined at birth: Male, female, intersex, prefer not to say, other'), gender (i.e., 'which of the following describes your gender today?: Male, female, non-binary, prefer to self-define, prefer not to say, other'), ethnicity, education level, dependent children, relationship status, housing status, rank, and type and length of RAF service. All socio-demographic characteristics were presented as categorical variables, including age and length of service, with start and endpoints based on Ministry of Defence categories. Further questions assessed gambling severity, mental health, alcohol use, and the impact of COVID-19.

The *Problem Gambling Severity Index* (PGSI) (Ferris & Wynne, 2001) is a nine-item measure of past year gambling. Response choices range from *never* (0) to *almost always* (3), with higher scores indicating PG. Scores of 0 indicate non-PG, 1–2 low risk gambling, 3–7 moderate risk gambling, and 8 or above as PG. For this study, Cronbach α = 0.94.

The *Patient Health Questionnaire-9* (PHQ-9) (Kroenke et al., 2001) is a nine-item measure of depressive symptoms during the past 2 weeks. Response options ranged from *not at all* (0) to *nearly every day* (4). Scores of 0–4 indicate no depression; 5–9 mild depression; 10–14 moderate depression; 15–19 moderately severe, and 20 + severe depression. For this study, Cronbach α = 0.89.

The *Generalised Anxiety Disorder-7* assessment (GAD-7) (Spitzer et al., 2006) is a seven-item measure of anxiety during the past 2 weeks. Responses are made on a scale from *not at all* (0) to *nearly every day* (3), with higher scores indicating greater anxiety levels. Scores of 5, 10, and 15 are the cut-off scores for mild, moderate, and severe anxiety, respectively. For this study, Cronbach α = 0.91.

The *Alcohol Use Disorders Identification Test* (AUDIT) (Babor et al., 2001) is a ten-item measure relating to the amount and frequency of alcohol intake, alcohol dependence and problems related to alcohol consumption within the past year. Response options range from *never* (0) to *daily or almost daily* (4). Higher scores indicate greater risk of alcohol dependency; 0–7 indicates lower risk, 8–15 increasing risk, 16–19 higher risk, and a score over 20 indicates possible dependency; the accepted cut-off point for potential hazardous alcohol intake is 8. For this study, Cronbach α = 0.79.

2.3. Procedure

Respondents were recruited to an online study of 'wellbeing and coping among serving RAF personnel'. Participants consented online, and were informed that their responses were confidential, non-identifiable and that they could withdraw participation at any time. Precautions were taken to ensure anonymity when completing the survey, including having 'prefer not to say' as an option for some sociodemographic variables (e.g., gender), ensuring automatically collected IP addresses were deleted, and storing raw data on a password-protected computer accessible only by the authors. Survey completion took between 10 and 20 min, depending on answers given and the survey skip pattern.

Following the sociodemographic questions, participants were asked to select gambling activities they had spent any money on within the last 12 months. These activities included, but were not limited to, betting on sports events, fruit or slot machines, scratch cards, the National Lottery Draw, and poker. If participants had engaged in any of these activities, they then completed the PGSI, PHQ-9, GAD-7, and AUDIT. Participants who indicated 'no' to the gambling activity questions were asked to confirm that they had not gambled in the past year, 'even very occasionally, perhaps to buy a lottery ticket, play on fruit machines, or play games or make bets for money with friends?' Participants completed the AUDIT if they had consumed alcohol in the past 12 months. All participants completed the demographic questions, PHQ-9, GAD-7, gambling activity questions, and COVID-19 specific questions (adapted to refer to UK lockdown restrictions introduced in March 2020; Price, 2020).

Following completion of the online survey, participants were given the opportunity to partake in a further, separate qualitative investigation (results not described here).

2.4. Statistical analysis

Incomplete responses that did not meet the quality control threshold were removed (25.5%). Logistic regression analyses determined the relationship between gambling behaviour, anxiety, depression, and alcohol use, with odds ratios (ORs) and 95% confidence intervals (CIs) reported alongside significance levels (p). Statistical analysis was conducted, with Bonferroni-correction applied, using SPSS version 28.

3. Results

3.1. Sociodemographic characteristics

Characteristics of the sample are shown in Table 1. Most personnel were male, with a mean age of 39.0 years ($SD = 10.6$), of white ethnicity, married, and educated to secondary or high-school equivalent or greater. Participants tended to have over 20 years length of service, were regular members of the RAF (i.e., full-time personnel based either in the UK or overseas), lived with family, and owned their own home. The most common ranks were Sergeant, Corporal, and Senior Aircraftman/Aircraftwoman.

Table 2 shows rates of gambling, mental health, and alcohol use. When asked the gambling check question, an additional 33 participants stated that they had gambled in the past year and hence completed the PGSI (Table 2). In total, 1,447 individuals completed the PGSI, with a mean score of 0.5 ($SD = 2.1$). Most of the sample who had gambled reported no problems ($n = 1266$, 87.5%), while $n = 116$ (8%) reported low-risk gambling, $n = 42$ (2.9%) reported moderate-risk gambling, and 1.6% ($n = 33$) reported PG risk (PGSI 8 +).

The PHQ-9 was completed by 2,119 individuals, with a mean score of 6.4 ($SD = 5.6$) and 2,109 individuals completed the GAD-7, with a mean score of 7.3 ($SD = 5.6$). Most RAF personnel had no symptoms of depression or anxiety, although 10% of the sample reported severe anxiety and 3.3% reported severe depression.

The mean AUDIT score was 6.2 ($SD = 4.9$). Of the 2,048 individuals

Table 1
Sociodemographic and military characteristics of the sample.

	RAF Personnel (n = 2,119)	
	n	%
Sex		
Male	1519	71.7
Female	574	27.1
Other	26	1.2
Gender		
Male	1516	71.5
Female	571	26.9
Other	32	1.5
Age		
18–24	217	10.2
25–34	526	24.8
35–44	700	33.0
45–54	519	24.5
55+	157	7.4
Ethnicity		
White-British	1992	94
White-Irish	13	0.6
Any other White background	25	1.2
Mixed – White/Black Caribbean/African/Asian	15	0.7
Any other Mixed background	7	0.3
Asian or Asian British – Indian	6	0.3
Any other Asian/Asian British background	5	0.2
Chinese	6	0.3
Prefer not to say	25	1.2
Other	15	0.7
Marital Status		
Single	332	15.7
In a relationship, married, civil partnership	1513	71.4
Co-habiting	154	7.3
Separated, divorced, or widowed	106	5.0
Other	20	0.6
Highest Qualification		
Secondary/High-school (AS/A level) or below	844	23.6
Higher Education (Cert of HE, Bachelors, Masters, Doctorate)	1275	60.4
Living Arrangement		
Live alone	446	21.0
Live with family	1599	75.5
Live with non-family	25	1.2
Other	49	2.3
Accommodation		
Service Families Accommodation	570	27.1
Single Living Accommodation	485	230
Owner (with mortgage or outright)	877	41.3
Other	173	8.4
Serving Role		
Regular	1816	85.7
Other (e.g., reservist), VERRS	303	14.3
Length of Service		
0–4	366	17.4
5–9	310	14.7
10–19	600	28.5
20+	829	39.4
Rank		
Aircraftman/Aircraftwoman	35	1.7
Leading Aircraftman/Aircraftwoman	23	1.1
Senior Aircraftman/Aircraftwoman	218	10.3
Senior Aircraftman/Aircraftwoman (Technician)	45	2.1
Lance Corporal	2	0.1
Corporal	309	14.6
Sergeant	341	16.1
Chief Technician	65	3.1
Flight Sergeant	162	7.6
Warrant Officer/RAF Master Aircrew	153	7.2
Officer Cadet	107	5.0
Pilot Officer	2	0.1
Flying Officer	56	2.6

(continued on next page)

Table 1 (*continued*)

	RAF Personnel (*n* = 2,119)	
	n	*%*
Flight Lieutenant	211	10.0
Squadron Leader	213	10.1
Wing Commander	133	6.3
Group Captain (and ranks above)	44	2.1

Note: VERRS – Volunteer ex-Regular Reserve.

Table 2

Gambling, mental health and alcohol use variables of the sample. The italicised numbers in the n column indicate the number of responses (respondents) available per measure.

	RAF Personnel	
	n	%
PGSI	*1447*	
Non-problem gambling (0)	1266	87.5
Low-risk gambling (1–2)	116	8.0
Moderate-risk gambling (3–7)	42	2.9
Problem gambling (8 +)	23	1.6
PHQ-9	*2119*	
No Depression (0–4)	970	45.8
Mild Depression (5–9)	639	30.2
Moderate Depression (10–14)	294	13.9
Moderately Severe Depression (15–19)	146	6.9
Severe Depression (20 +)	70	3.3
GAD-7	*2109*	
No Anxiety (0–4)	838	39.7
Mild Anxiety (5–9)	459	21.8
Moderate Anxiety (10–14)	602	28.5
Severe Anxiety (15 +)	210	10.0
AUDIT	*2048*	
Non-drinker	126	6.2
Lower Risk Drinking (0–7)	1340	65.4
Increasing Risk Drinking (8–15)	480	23.4
Higher Risk Drinking (16–19)	56	2.7
Possible Alcohol Dependence (20 +)	46	2.2

who completed the AUDIT, most experienced lower risk drinking (65.4. %), and 28.3% experienced harmful or hazardous drinking at varying levels of severity.

Participants were asked about the impact of COVID-19 on alcohol consumption; of the 1,919 who consumed alcohol, 43.5% reported that their intake stayed the same, 32.4% reported an increase, and 24.1% reported a decrease. As regards mental health, from the 2,106 responses received, 48.8% reported a deterioration in their mental health, 44.2% reported that their mental health had stayed the same, and 7.0% reported an improvement because of COVID-19.

Most participants had engaged in at least one gambling activity in the past year (*n* = 1,414; 67.9%). The rate of past year gambling participation is higher than that reported by the general (non-military) population (Public Health England, 2021).

Table 3 displays gambling activities for the whole sample and those with scores indicating PG (PGSI ≥ 8). The mean number of gambling activities was 2.26 (*SD* = 1.97). The most common gambling activities for all participants were the National Lottery, scratchcards or any other lottery, and online betting. Individuals with scores indicating PG gambled on more activities (6.72; *SD* = 4.21) and their six most common activities were playing the National Lottery, scratchcards, online gambling, virtual gambling machines, online betting, and online gambling, respectively

Of the participants who reported past year gambling, 37.9% stated that there had not been any change in their gambling due to COVID-19. Among the 23 individuals with scores indicating PG risk, 43.5% reported that they had signed up to one or more gambling apps or websites, 43.5% had increased the amount of time they spent gambling compared to previously, and 34.8% that they had increased the amount of money they had previously spent on gambling.

3.2. Covariate analysis

Logistic regression models were utilised to examine demographic risk factors for gambling problems. For this analysis, a binary measure of any gambling problems (PGSI ≥ 1) was identified as the dependent variable, which was regressed on social and military demographics and evaluated in the same model (Cowlishaw et al., 2020). The likelihood of any gambling problem in RAF personnel was strongly associated with age, gender, and rank (Table 4). That is, higher rates of any gambling problems were evident among male personnel aged 18–24 years old in

Table 3

Gambling activities of the sample by gambling severity (PGSI score).

Gambling Activity	Non-problem gambling (PGSI 0) (n=1266)		Low-risk gambling (PGSI 1-2) (n=116)		Moderate-risk gambling (PGSI 3-7) (n=42)		Problem gambling (PGSI 8+) (n=23)	
	n	%	n	%	n	%	n	%
Lottery	937	74.0	89	76.7	32	76.2	16	69.6
Scratch cards	337	26.6	53	45.7	23	54.8	15	65.2
Any other lottery	435	34.4	39	33.6	15	35.7	10	43.5
Football pools	28	2.2	15	12.9	4	9.5	5	21.7
Bingo	16	1.3	1	0.9	0	0	4	17.4
Fruit or slot machines	24	1.9	12	10.3	11	26.2	10	43.5
Virtual gambling machines	37	2.9	24	20.7	15	35.7	13	56.5
Casino table games	25	2.0	8	6.9	4	9.5	3	13.0
Poker	14	1.1	1	0.9	3	7.1	3	13.0
Online gambling	79	6.2	33	28.4	23	54.8	13	56.5
Online betting	242	19.1	61	52.6	19	45.2	12	52.2
Betting exchange	18	1.4	10	8.6	5	11.9	5	21.7
Horse racing	65	5.1	18	15.5	5	11.9	9	39.1
Dog racing	12	0.9	2	1.7	0	0	6	26.1
Sports betting	58	4.6	23	19.8	6	14.3	8	34.8
Other event betting	15	1.2	7	6.0	3	7.1	6	26.1
Spread betting	8	0.6	3	2.6	1	2.4	2	8.7
Private betting	57	4.5	12	10.3	7	16.7	6	26.1
Any other gambling	26	2.1	2	1.7	2	4.8	2	8.7
Total activities	2433		413		178		148	
Mean (SD)	1.92 (1.60)		3.56 (2.61)		4.23 (2.55)		6.7 (4.21)	

Table 4

Bivariate logistic regression models indicating predictors of any gambling problems (PGSI ≥ 1).

	Frequencies		Logistic Regression	
	n	%	*p*	OR (95% CI)
Gender				
Male	154	14.5	<.001*	2.23 (1.46–3.42)
Female	24	6.6	<.001*	0.42 (0.27–0.66)
Age (years)				
18–24	27	24.3	<.001*	2.47 (1.55–3.93)
25–34	56	15.5	.050	1.41 (1.00–1.98)
35–44	69	13.5	.387	1.15 (0.84–1.59)
45–55	24	6.9	<.001*	0.44 (0.28–0.69)
Ethnicity				
White	1216	96.3	.646	0.84 (0.39–1.80)
Mixed – White/Black Caribbean/ African/Asian/Other	47	3.7	646	1.20 (0.56–2.58)
Relationship Status				
Single	35	17.1	.034	1.55 (1.03–2.31)
In a relationship, married, civil-partnership	118	11.3	.033	0.70 (0.50–0.97)
Cohabiting	21	18.6	.044	1.68 (1.01–2.77)
Education Level				
A-Levels or below	96	16.5	<.001*	1.81 (1.33–2.48)
Further and Higher Education	85	9.8	<.001*	0.55 (0.40–0.76)
Living Arrangement				
Live alone	43	14.5	.250	1.24 (0.86–1.80)
Live with family	133	12.1	.354	0.85 (0.59–1.21)
Accommodation				
Service Families Accommodation	44	11.2	.348	0.84 (0.59–1.21)
Single Living Accommodation	51	15.5	.065	1.39 (0.98–1.97)
Owner (with mortgage or outright)	72	12.0	.577	0.91 (0.67–1.26)
Other	14	11.7	.764	0.92 (0.51–1.64)
Length of Service (Years)				
0–4	33	16.3	.092	1.42 (0.94–2.15)
5–9	33	16.2	.098	1.41 (0.94–2.13)
10–19	62	13.9	.332	1.18 (0.85–1.64)
20+	53	9.1	.001*	0.57 (0.41–0.80)
Rank				
Non-Commissioned Rank	157	15.4	<.001*	3.06 (1.96–4.77)
Commissioned Rank	24	5.6	<.001*	0.33 (0.21–0.51)

*Significant with Bonferroni corrected α of *p* = 0.002.

Non-Commissioned ranks. Education level and length of service also conferred risk of gambling problems, albeit at reduced rates.

The supplementary material reports findings of logistic regression models specifying mental health and alcohol use indicators as predictors of gambling severity (using PGSI categories of no-problems, a combined at-risk gambling category, and problem gambling, respectively, in line with existing analyses of this topic).

Multinomial logistic regression models were utilised to quantify the associations with gambling problem severity, mental health, and alcohol use. For these models, gambling problems were specified as dependent variables and the mental health (PHQ-9 ≥ 10, GAD-7 ≥ 10) and alcohol (AUDIT ≥ 8) variables were treated as explanatory. Gambling problems were specified using dummy variables comparing no gambling problems (PGSI 0) with low-risk gambling (PGSI 1–2), moderate-risk gambling (PGSI 3–4) and problem gambling (PGSI 8 +), respectively (Stone et al., 2015).

Regression analyses of gambling problems indicated associations with mental health predictors and alcohol use (Table 5). Compared to participants reporting no gambling problems, PG was associated with a more than a 10-fold increase in depression and a 19-fold increase in anxiety. The likelihood of experiencing PG was more than 4 times higher among participants reporting hazardous drinking.

4. Discussion

The present study represents the first investigation of risk factors for gambling problems in a large sample of currently serving UK military personnel using validated clinical measures. Until now, previous studies have been conducted mainly with samples of US and Australian personnel (Cowlishaw et al., 2020; Milton et al., 2020; van der Maas & Nower, 2021; Whiting et al., 2016), leading to a significant international research gap regarding the frequency and severity of gambling harms among service personnel from other jurisdictions operating under different legislative gambling environments. While acknowledging heterogeneity in the profiles of international military personnel and the organisational differences such as selection processes, types of operations and post-deployment environments (Vermetten et al., 2014), our findings do replicate estimated rates of problem gambling comparable to those previously identified.

Our main finding was that 12.5% of personnel reported gambling problems, which included 1.6% with scores indicating PG risk. The estimated rate mirrors other studies of problem gambling severity in currently serving military personnel conducted using the PGSI, but our findings report higher levels of ARG. Cowlishaw et al. (2020) found that 2% of 1,324 members of the ADF experienced PG and a further 7.7% reported at least one gambling related problem post-deployment. Furthermore, van der Maas and Nower (2021) reported that 31.97% of a US-based currently serving and ex-military sample had PGSI scores 3 + which is significantly higher than the 4.5% reported in this study. Our regression analysis identified significant predictors of vulnerability to gambling problems which were male gender, age 18–24 years, non-commissioned ranks, length of service, and education level. These findings are consistent with the growing international literature on gambling problems in currently serving military personnel (Calado & Griffiths, 2016; Cowlishaw et al., 2020). Problem gambling was however associated with symptoms of anxiety and depression. In this way, the sociodemographic variables of age, gender, and commissioned ranks may be protective factors in ameliorating gambling risk for many personnel; yet, mental health difficulties may exacerbate gambling problems during service.

Rates of harmful and hazardous/dependent drinking (23.4% and 4.9% respectively), were lower than those reported elsewhere (Irizar et al., 2021), but remain significantly higher than alcohol-related harms within the general population (McManus et al., 2016). Cowlishaw et al. (2020) reported 2.4% of their sample indicated alcohol dependency, which was comparable to the 2.2% reported in our findings; however, these authors reported almost double the levels of harmful drinking at 5.1% compared to 2.7% in our sample. This difference could be partly due to Cowlishaw et al.'s post-deployment sample, with evidence suggesting that increased alcohol use is associated with combat-area deployments (Bray et al., 2013).

Table 5
Multinomial logistic regression models specifying mental health and alcohol use indicators as predictors of gambling severity risk PGSI category.

	No Problems (PGSI = 0)		Low Risk (PGSI = 1–2)		Mediu Risk (PGSI = 3–7)		Problem Gambling (PGSI = 8 +)		Logistic Regression					
	(n = 1,266) (0)		(n = 116) (1)		(n = 42) (2)		(n = 23) (3)		(0) vs (1)		(0) vs (2)		(0) vs (3)	
	n	%	n	%	n	%	n	%	p	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)
Depression(PHQ-9 ≥ 10)	263	20.8	32	27.6	20	47.6	17	73.9	0.088	1.45 (0.95–2.23)	<0.001*	3.47 (1.86–6.45)	<0.001*	10.81 (4.22–27.68)
Anxiety(GAD-7 ≥ 10)	449	35.5	55	47.4	25	59.5	21	91.3	0.011*	1.64 (1.12–2.40)	0.002*	2.68 (1.43–5.01)	<0.001*	19.11 (4.46–81.86)
Alcohol(AUDIT ≥ 8)	339	27.1	52	46.4	20	48.8	13	61.9	<0.001*	2.33 (1.58–3.45)	0.003*	2.56 (1.37–4.79)	0.001*	4.37 (1.80–10.64)

Note: *Significant with Bonferroni corrected α of p = 0.017.

Self-reported rates of anxiety and depression were considerably higher in the present study than reported elsewhere. In a study exploring help-seeking among 1,448 currently serving and ex-personnel, Stevelink et al., (2019) found that 18.2% met probable diagnostic criteria for anxiety (a score of 10 + on GAD), compared to 38.5% in our sample. Stevelink et al. also reported that 7.8% of their sample were classified as having a depressive disorder (a PHQ-9 score of 15 +), which was lower than the 10.2% reported here. Elsewhere, Cowlishaw et al. (2020) reported estimated rates of 0.7%-2.0% for depression (PHQ-9 score of 10 +), compared to 24.1% of our sample. These mixed findings perhaps reflect the heterogenous nature of the samples (e.g., help-seeking, post-deployment), military service characteristics (e.g., length and type of service, veteran status, etc.) and the different clinical score cut-offs employed to measure depression. Overall, most of the current sample reported no symptoms of anxiety or depression, and lower risk drinking. However, for some personnel, military service may negatively impact their mental health and alcohol consumption (Stevelink et al., 2019) and warrants further monitoring.

The impact of COVID-19 on alcohol use, mental health, and gambling among RAF personnel revealed some concerns. While most personnel reported no change in their alcohol intake, most stated that their mental health had deteriorated during the pandemic. This accords with general population level surveys (Chandola et al., 2020; Gray et al., 2020) and indicates that population-wide interventions should be adapted for active service personnel. Regarding gambling, RAF personnel indicating PG risk spent more time and money on gambling and signed-up to new, online gambling opportunities during the pandemic. This mirrors findings in the general population (Gambling Commission, 2020), but to our knowledge, the present study represents the first assessment of the impact of COVID-19 on gambling and mental health among currently serving personnel. While the extant literature suggests the impacts on gambling are rather diverse (Hodgins & Stevens, 2021), our findings do accord with views that individuals with existing gambling problems are a vulnerable group. Moreover, occupational factors specific to the RAF such as multiple types of deployments interspersed with extensive periods of downtime could predispose personnel to greater risk of developing gambling problems. Longer-term studies will be necessary to assess the impact of COVID-19 on problematic gambling and the co-occurrence of mental health conditions or substitution behaviours (Xuereb et al., 2021) among serving RAF personnel.

4.1. Limitations

Although the results of this study are informative, the limitations require consideration. Data were collected during COVID-19 restrictions, which may have influenced reported rates of gambling and mental health outcomes. The survey utilised self-report measures rather than clinical interviews for mental health conditions which may limit

generalisability. Finally, the sample was drawn exlusively from RAF personnel and thus findings cannot be generalised to the wider UK armed forces. Future research is needed on the nature and extent of gambling problems within other branches of the armed forces.

4.2. Implications

At present, gambling is not assessed in UK pre-enlistment screening processes, during active service or upon discharge. Our findings incidate the need for increased recognition of, and screening for, potential gambling problems among currently serving personnel to ensure health professionals are alert to gambling-related harm (Cowlishaw et al., 2020). This may be particularly relevant among personnel who experience moderate to severe anxiety and depression, are younger, engaging in harmful drinking, and hold non-commissioned ranks given what we have found concerning their heightened vulnerability for PG. Screening may permit early-intervention, which may reduce the incidence of problem gambling and the impact of related harms. Our findings highlight the potential for focusing harm-reduction initiatives on identifiable at-risk groups. In addition, all branches of the military must ensure that confidential sources of support, independent of the service branch, are readily available and accessible. Doing so would help to overcome potential barriers to self-referral among this unique population, where disclosing a gambling problem may have consequences for security clearance and continued employment.

Author contributions

AP and SD designed and supervised the data collection. AP and SD wrote the first draft of the manuscript. AP conducted the statistical analysis. Both authors produced revised versions of the manuscript and approved the final paper.

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.

the Royal Air Force Benevolent Fund for their support of the study and assistance with recruitment. The study received ethical approval from the Ministry of Defence Research Ethics Committee (Reference: 1051/MoDREC/20).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2021.107200.

References

Aguirre, M., Greenberg, N., Sharpley, J., Simpson, R., & Wall, C. (2014). Alcohol consumption in the UK armed forces: Are we drinking too much? *Journal of the Royal Army Medical Corps, 160*(1), 72–73.

Albertella, L., Rotaru, K., Christensen, E., Lowe, A., Brierley, M.-E., Richardson, K., … Yücel, M. (2021). The influence of trait compulsivity and impulsivity on addictive and compulsive behaviors during COVID-19. *Frontiers in Psychiatry, 12*. https://doi.org/10.3389/fpsyt.2021.63458310.3389/fpsyt.2021.634583.s001

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (6th ed.). Washington, DC: American Psychiatric Association.

Auer, M., Malischnig, D., & Griffiths, M. D. (2020). Gambling before and during the COVID-19 pandemic among European regular sports bettors: An empirical study using behavioral tracking data. *International Journal of Mental Health and Addiction*, 1–8.

Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B., Monteiro, M.G. 2001. *The Alcohol Use Disorders Identification Test (AUDIT) Guidelines for use in primary care (2nd ed. (WHO Publication No. 01.6a))*. Geneva, Switzerland: World Health Organization.

Biddle, D., Hawthorne, G., Forbes, D., & Coman, G. (2005). Problem gambling in Australian PTSD treatment-seeking veterans. *Journal of Traumatic Stress, 18*(6), 759–767. https://doi.org/10.1002/(ISSN)1573-659810.1002/jts.v18:610.1002/jts.20084

Bray, R. M., Brown, J. M., & Williams, J. (2013). Trends in binge and heavy drinking, alcohol-related problems, and combat exposure in the US military. *Substance Use & Misuse, 48*(10), 799–810. https://doi.org/10.3109/10826084.2013.796990

Brooks, S. K., & Greenberg, N. (2018). Non-deployment factors affecting psychological wellbeing in military personnel: Literature review. *J Ment Health, 27*(1), 80–90. https://doi.org/10.1080/09638237.2016.1276536

Calado, F., & Griffiths, M. D. (2016). Problem gambling worldwide: An update and systematic review of empirical research (2000–2015). *Journal of Behavioral Addictions, 5*(4), 592–613. https://doi.org/10.1556/2006.5.2016.073

Chandola, T., Kumari, M., Booker, C. L., & Benzeval, M. (2020). The mental health impact of COVID-19 and lockdown-related stressors among adults in the UK. *Psychological Medicine*, 1–10. https://doi.org/10.1017/S0033291720005048

Cowlishaw, S., Metcalf, O., Lawrence-Wood, E., Little, J., Sbisa, A., Deans, C., … McFarlane, A. C. (2020). Gambling problems among military personnel after deployment. *Journal of Psychiatric Research, 131*, 47–53. https://doi.org/10.1016/j.jpsychires.2020.07.035

Currie, S. R., Hodgins, D. C., & Casey, D. M. (2013). Validity of the problem gambling severity index interpretive categories. *Journal of Gambling Studies, 29*(2), 311–327. https://doi.org/10.1007/s10899-012-9300-6

Davis, A. K., Bonar, E. E., Goldstick, J. E., Walton, M. A., Winters, J., & Chermack, S. T. (2017). Binge-drinking and non-partner aggression are associated with gambling among Veterans with recent substance use in VA outpatient treatment. *Addictive Behaviors, 74*, 27–32. https://doi.org/10.1016/j.addbeh.2017.05.022

Dighton, G., Wood, K., Armour, C., Fossey, M., Hogan, L., Kitchiner, N., Larcombe, J., Rogers, R.D., Dymond, S. 2021. Gambling problems among United Kingdom armed forces veterans: associations with gambling motivation and posttraumatic stress disorder. *Manuscript submitted for publication.*

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. https://doi.org/10.1556/2006.7.2018.25

Dowling, N. A., Cowlishaw, S., Jackson, A. C., Merkouris, S. S., Francis, K. L., & Christensen, D. R. (2015). Prevalence of psychiatric co-morbidity in treatment-seeking problem gamblers: A systematic review and meta-analysis. *Australian and New Zealand Journal of Psychiatry, 49*(6), 519–539. https://doi.org/10.1177/0004867415575774

Etuk, R., Shirk, S. D., Grubbs, J., & Kraus, S. W. (2020). Gambling problems in US military veterans. *Current Addiction Reports, 7*(2), 210–228. https://doi.org/10.1007/s40429-020-00310-2

Ferris, J., & Wynne, H. (2001). *The Canadian problem gambling index: Final report* (pp. 1–59). Ottawa, ON: Canadian Centre on Substance Abuse.

Gambling Commission. 2020. *COVID-19 and its impact on gambling: What we know so far.* https://www.gamblingcommission.gov.uk/newsaction-and-statistics/Statistics-and-research/Covid-19-research/Covid19-and-its-impact-ongambling-%E2%80%93-what-we-know-so-far.aspx.

Goodwin, L., Wessely, S., Hotopf, M., Jones, M., Greenberg, N., Rona, R. J., … Fear, N. T. (2015). Are common mental disorders more prevalent in the UK serving military compared to the general working population? *Psychological Medicine, 45*(9), 1881–1891. https://doi.org/10.1017/S0033291714002980

Gray, N. S., O'Connor, C., Knowles, J., Pink, J., Simkiss, N. J., Williams, S. D., & Snowden, R. J. (2020). The influence of the COVID-19 pandemic on mental well-being and psychological distress: Impact upon a single country. *Frontiers in Psychiatry, 11*, Article 594115. https://doi.org/10.3389/fpsyt.2020.594115

Håkansson, A. (2020). Changes in gambling behavior during the COVID-19 pandemic: A web survey study in Sweden. *International Journal of Environmental Research and Public Health, 17*(11), 4013. https://doi.org/10.3390/ijerph17114013

Hodgins, D. C., & Stevens, R. M. G. (2021). The impact of COVID-19 on gambling and gambling disorder: Emerging data. *Current Opinion in Psychiatry, 34*(4), 332–343. https://doi.org/10.1097/yco.0000000000000709

Irizar, P., Stevelink, S. A. M., Pernet, D., Gage, S. H., Greenberg, N., Wessely, S., … Fear, N. T. (2021). Probable post-traumatic stress disorder and harmful alcohol use among male members of the British Police Forces and the British Armed Forces: A comparative study. *European Journal of Psychotraumatology, 12*(1), 1891734. https://doi.org/10.1080/20008198.2021.1891734

Iversen, A. C., Fear, N. T., Simonoff, E., Hull, L., Horn, O., Greenberg, N., … Wessely, S. (2007). Influence of childhood adversity on health among male UK military personnel. *British Journal of Psychiatry, 191*(6), 506–511. https://doi.org/10.1192/bjp.bp.107.039818

Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*(9), 606–613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Lusk, J. D., Sadeh, N., Wolf, E. J., & Miller, M. W. (2017). Reckless self-destructive behavior and PTSD in veterans: The mediating role of new adverse events. *Journal of Traumatic Stress, 30*(3), 270–278. https://doi.org/10.1002/jts.22182

McManus, S., Bebbington, P.E., Jenkins, R., Brugha, T. 2016. *Mental Health and Wellbeing in England: the Adult Psychiatric Morbidity Survey 2014.* NHS digital.

Milton, A. C., La Monica, H., Dowling, M., Yee, H., Davenport, T., Braunstein, K., … Hickie, I. B. (2020). Gambling and the role of resilience in an international online sample of current and ex-serving military personnel as compared to the general population. *Journal of Gambling Studies, 36*(2), 477–498. https://doi.org/10.1007/s10899-019-09900-w

Oksanen, A., Savolainen, I., Sirola, A., & Kaakinen, M. (2018). Problem gambling and psychological distress: A cross-national perspective on the mediating effect of consumer debt and debt problems among emerging adults. *Harm Reduction Journal, 15*(1). https://doi.org/10.1186/s12954-018-0251-9

Paterson, M., Whitty, M., & Leslie, P. (2021). Exploring the prevalence of gambling harm among active-duty military personnel: A systematic scoping review. *Journal of Gambling Studies, 37*(2), 529–549. https://doi.org/10.1007/s10899-020-09951-4

Pickering, D., & Blaszczynski, A. (2021). Paid online convenience samples in gambling studies: Questionable data quality. *International Gambling Studies*, 1–21. https://doi.org/10.1080/14459795.2021.1884735

Price A. 2020. Online gambling in the midst of COVID-19: A nexus of mental health concerns, substance use and financial stress. *Int J Ment Health Addict*, 1–18. Advance online publication. 10.1007/s11469-020-00366-1.

Public Health England, 2021. Gambling-related harms evidence review: Quantitative analysis of gambling involvement and gambling-related harms among the general population in England. https://www.gov.uk/government/publications/gambling-related-harms-evidence-review.

Royal Air Force Benevolent Fund (2019). *Meeting the Needs of the Serving RAF Community.* https://www.rafbfsites/default/files/atoms/files/meeting_needs_report.pdf.

Sharman, S., Butler, K., & Roberts, A. (2019). Psychosocial risk factors in disordered gambling: A descriptive systematic overview of vulnerable populations. *Addictive Behaviors, 99*, 106071. https://doi.org/10.1016/j.addbeh.2019.106071

Sharman, S., Roberts, A., Bowden-Jones, H., & Strang, J. (2021a). Gambling in COVID-19 lockdown in the UK: Depression, stress, and anxiety. *Frontiers in Psychiatry, 12*, Article 621497. https://doi.org/10.3389/fpsyt.2021.621497

Sharman, S., Roberts, A., Bowden-Jones, H., & Strang, J. (2021b). Gambling and COVID-19: Initial findings from a UK Sample. *International Journal of Mental Health and Addiction*, 1–12.

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: The GAD-7. *Archives of Internal Medicine, 166*, 1092–1097. https://doi.org/10.1001/archinte.166.10.1092

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. https://doi.org/10.7205/MILMED.173.5.452

Stevelink, S. A. M., Jones, N., Jones, M., Dyball, D., Khera, C. K., Pernet, D., … Fear, N. T. (2019). Do serving and ex-serving personnel of the UK armed forces seek help for perceived stress, emotional or mental health problems? *The European Journal of Psychotraumatology, 10*(1), 1556552. https://doi.org/10.1080/20008198.2018.1556552

Stone, C. A., Romild, U., Abbott, M., Yeung, K., Billi, R., & Volberg, R. (2015). Effects of different screening and scoring thresholds on PGSI gambling risk segments. *International Journal of Mental Health and Addiction, 13*(1), 82–102. https://doi.org/10.1007/s11469-014-9515-0)

Thandi, G., Sundin, J., Dandeker, C., Jones, N., Greenberg, N., Wessely, S., & Fear, N. T. (2015). Risk-taking behaviours among UK military reservists. *Occupational Medicine, 65*(5), 413–416. https://doi.org/10.1093/occmed/kqv057

van der Maas, M., & Nower, L. (2021). Gambling and military service: Characteristics, comorbidity, and problem severity in an epidemiological sample. *Addictive Behaviors, 114*, 106725. https://doi.org/10.1016/j.addbeh.2020.106725

Vermetten, E., Greenberg, N., Boeschoten, M. A., Delahaije, R., Jetly, R., Castro, C. A., & McFarlane, A. C. (2014). Deployment-related mental health support: Comparative analysis of NATO and allied ISAF partners. *European Journal of Psychotraumatology, 5*(1), 23732.

Wardle, H., Donnachie, C., Critchlow, N., Brown, A., Bunn, C., Dobbie, F., … Hunt, K. (2021). The impact of the initial Covid-19 lockdown upon regular sports bettors in

Britain: Findings from a cross-sectional online study. *Addictive Behaviors, 118*, 106876. https://doi.org/10.1016/j.addbeh.2021.106876

Wardle, H., Reith, G., Langham, E., & Rogers, R. D. (2019). Gambling and public health: We need policy action to prevent harm. *BMJ, 365*. https://doi.org/10.1136/bmj.l1807

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.

Xuereb, S., Kim, H. Y., Clark, L., & Wohl, M. J. A. (2021). Substitution behaviors among people who gamble during COVID-19 precipitated casino closures. *International Gambling Studies*. https://doi.org/10.1080/14459795.2021.1903062