Exploring problem gambling, loneliness and lifetime suicidal behaviours: a cross-sectional study using the Adult Psychiatric Morbidity Survey 2007

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Disclosures

The research questions for Reports 1 and 3 were developed and set by the Advisory Board for Safer Gambling and the project was commissioned by GambleAware, via a competitive tender process. The research question for Report 2 was agreed with GambleAware.

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Introduction

Gambling is now a recognised public health concern, and there is a growing need to better understand the social-environmental determinants of gambling-related harms. Our first report based on the Adult Psychiatric Morbidity Survey, APMS 2007, produced the first national estimates for England of the extent of suicidal thoughts and attempts among problem gamblers living in the community and of the extent of problem gambling among those who have experienced thoughts of suicide or attempted suicide in the past year. Problem gamblers were more likely than non-problem gamblers to either have had suicidal thoughts (19.2% vs 4.1%) or to have attempted suicide (4.7% vs 0.6%) in the past year.

Loneliness, defined as the subjective perception of a lack of contact with other people, is associated with premature mortality, mental ill-health, and increased use of health services. We aimed to explore the extent to which loneliness may be associated with gambling and suicidal thoughts, non-suicidal self-harm (NSSH), self-harm and suicide attempts.

Method

We conducted a cross sectional study using the APMS 2007 with descriptive statistics. Four multivariable binary logistic regression analyses were conducted with lifetime suicidal thoughts, self-harm, NSSH or suicide attempts separately as the dependent variable and gambling as the independent variable to examine their associations. A hierarchical regression analysis was performed, entering blocks of variables sequentially: loneliness; core demographics; individual level factors such as marital status; mental disorders; perceived social support; household factors and social capital.

Results

Among the 6941 respondents, there were 41 participants meeting the criteria for problem gamblers (0.7%), 172 (2.5%) at-risk gamblers and 6,728 (96.8%) non-gamblers or gamblers who did not report experiencing any *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition (DSM) symptoms (a DSM score of 0). We reported weighted sample sizes and percentages so as to be representative of the general population. Compared to non-gamblers or gamblers with a DSM of zero and at-risk gamblers, problem gamblers were more likely to feel lonely from other people (3.0% for non-gamblers/ DSM=0, 3.3% of at-risk gamblers and 10.1% of problem-gamblers feel 'very much' lonely). Problem gamblers had higher levels of lifetime suicidal thoughts (42.2% vs. 17.5%), NSSH (22.4% vs. 5.0%) and suicide attempts (27.0% vs. 5.4%) than non-gamblers.

Overall, in the fully adjusted models problem gambling remained significantly associated with lifetime suicide attempt (OR 3.3). Subjective loneliness appeared consistently to be an important factor across all the models, as did physical health, smoking, alcohol and substance misuse, and mental health (CMD, psychosis, ADHD but not ASD trait). In the fully adjusted model we found females have a higher risk of lifetime suicide attempts compared to males (OR: 3.7, 95% CI: 1.1-12.7).

Discussion

Our results suggest that whilst the association between suicide attempts and problem gambling may be mediated through perceived loneliness, the association persists independent of it. It may be that addressing loneliness also reduces the risk of suicide attempts in some problem gamblers. Addressing loneliness is an emerging field and evidence-based interventions for loneliness are yet to be fully evaluated.

Any health care or other service provider, including the gambling industry, or community or user group likely to be in contact with gamblers should be aware of the risk of suicidal behaviours and should have appropriate policies and safeguarding procedures in place. Training of staff in suicide awareness, appropriate responses and signposting is essential. Our results also indicate a need to raise awareness amongst professional staff conducting psychosocial assessments for those attending healthcare services with self-harm and suicidal behaviours to ask about gambling behaviours and perceived loneliness.

The Adult Psychiatric Morbidity Survey 2014 did not include questions related to gambling. Given the rapid development of industry practice since 2007, it is important to view any associations found in this context with caution.

Conclusion

Our results, while highly preliminary, suggest an association between problem gambling, suicidal behaviours and perceived loneliness that warrants further investigation in more up-to-date datasets with larger sample sizes.

1. Introduction

Aims and objectives

Gambling has increasingly gained recognition as a public health concern (Rogers et al., 2019; Wardle et al., 2019), and there is a growing need to better understand the social-environmental determinants of gambling-related harms and their prevalence. Our first report (Wardle et al., 2019) produced the first national estimates for England of the extent of suicidal thoughts and attempts among problem gamblers living in the community and of the extent of problem gambling among those who have experienced thoughts of suicide or attempted suicide in the past year. Problem gamblers were more likely than non-problem gamblers to either have had suicidal thoughts (19.2% vs 4.1%, respectively) or to have attempted suicide (4.7% vs 0.6%, respectively) in the past year. But while this study was based on representative survey data (Adult Psychiatric Morbidity Survey, APMS 2007), more up to date in-depth and longitudinal research is required. The Adult Psychiatric Morbidity Survey 2014 did not include questions related to gambling. Given the rapid development of industry practice since 2007, it is important to view any associations found in this context with caution.

Loneliness, defined as the subjective perception of a lack of contact with other people, is associated with premature mortality, physical and mental ill-health, worse cognitive function and increased use of health services (Hawkley and Cacioppo, 2010; Elovainio et al., 2017; Dreyer et al., 2018). Living alone has been consistently linked with risks of self-harm and suicide but loneliness may partly explain this association. This is a complex but increasingly studied area of research (Hawkley and Cacioppo, 2010; Elovainio et al., 2017; Dreyer et al., 2018). Using data from the APMS 2007, a previous study has demonstrated robust association between loneliness and suicidal behaviours in the general adult population after controlling for the effects of common mental disorders (CMDs) and other sociodemographic factors (Stickley & Koyanagi, 2016). Gambling, however, was not included in their analyses. Another study using the same dataset revealed a strong association between suicidality and problem gambling when the effects of mental health, physical health and other sociodemographic factors had been controlled for (Cowlishaw & Kessler, 2016). In that study the effect of loneliness was not considered as a potential risk factor.

Gambling can have numerous adverse consequences resulting in financial distress and debt, relationship breakdown and social isolation and impairments to physical and mental health and wellbeing. Charting the nature and extent of the association between loneliness, suicide, and gambling is important for identifying determinants of, and vulnerability factors for, the range of gambling

harms and therefore for the design and targeting of interventions. In view of the current literature, a comprehensive analysis on the existing APMS 2007 dataset to examine the associations among problem gambling, loneliness and suicidal behaviours seem justified.

In this report we aim to explore the extent to which perceived loneliness or social isolation may be associated or related to gambling and suicidal thoughts, non-suicidal self-harm (NSSH), self-harm and suicide attempts.

This second report should ideally be read in conjunction with the first report (Wardle et al., 2019).

2. Methods

This report presents a secondary analysis of a Department of Health and Social Care (DHSC) survey: the Adult Psychiatric Morbidity Survey (APMS) 2007 (McManus et al. 2009). The survey included a series of questions about gambling, loneliness and social capital and self-harming thoughts and behaviours. This report builds on an initial analysis and report of problem gambling and self-harm/ suicidal behaviours carried out as part of this same work programme.

2.1 Data Source

The 2007 Adult Psychiatric Morbidity Survey (APMS) is a nationally representative survey of the English population aged ≥ 16 years living in private households. Details of the survey have been described previously (Jenkins et al., 2009; McManus, et al., 2009) In brief, the survey was conducted by the National Centre for Social Research and Leicester University between October 2006 and December 2007 using a multistage stratified probability sampling design. The sampling frame consisted of the small user Postcode Address File with the postcode sectors as the primary sampling units (PSU). PSUs were stratified by region (health authority) and socioeconomic status and randomly sampled from strata based on the probability proportional to size.

13,171 addresses were considered eligible for interview and one person (aged ≥16 years) from each address was randomly selected to participate. Responses from participants were obtained from computer-assisted face-to-face interviews and computer-assisted self-report responses. Overall the response rate was 57% (7,461 participants out of 13,171) and data were excluded from proxy respondents, resulting in the final sample size of 7,403. Sampling weights were constructed to account for non-response and the probability of being selected in order that the sample was representative of the English household population. Details of the weighting scheme were outlined in the survey report (McManus et al., 2009). In this study we present weighted bases, counts and percentages, unless otherwise specified.

People living in communal or institutional establishments (such as large residential care homes and offender institutions), in temporary housing (such as hostels or bed and breakfasts) or sleeping rough were not within the scope of the survey. While rates of self-harming behaviours may be elevated in these populations (Jenkins et al. 2005), they are estimated to comprise less than 2% of the total population; their exclusion should not impact on the overall rate (ONS 2015).

2.2 Ethical approval

Ethical approval of the APMS 2007 survey was obtained from the Royal Free Hospital and Medical School Research Ethics Committee. The survey was conducted in accordance with relevant guidelines and regulations. Ethical approval for the present re-analysis of the APMS 2007 dataset was obtained from the Research Ethics Sub-Committee of the Swansea University Medical School (approval reference number 2019-0010).

2.3 Measures
Dependent variables
Suicidal thoughts, non-suicidal self-harm (NSSH), self-harm and suicide attempts

The 5th Diagnostic and Statistical Manual of Mental Disorders includes non-suicidal self-injury (NSSI) and suicidal behaviour disorder (SBD) as conditions for further study. While intentionality can be difficult to establish (Kapur et al. 2013), an attempt to separate suicide attempts from non-suicidal self-harm (NSSH) has also been the approach adopted on APMS. APMS participants were asked in the face-to-face section of the interview the following questions about suicidal thoughts, suicide attempts, and self-harm without suicidal intent:

- Have you ever thought of taking your life, even though you would not actually do it?"
- Have you ever made an attempt to take your life by taking an overdose of tablets or in some other way?"
- Have you ever deliberately harmed yourself in any way but not with the intention of killing yourself?"

These were based on the work of others (Paykel et al., 1974; Salmons & Harrington, 1984) and formed part of the revised *Clinical Interview Schedule* (CIS-R) (Lewis et al., 1992).

A positive response was followed up with a question on whether this last occurred in the last week, last year or longer ago. The same questions were also asked in the self-completed interview but based on lifetime experience.

Since the overall proportion of respondents giving a positive response was higher when combining both data collection methods, we derived four binary variables for lifetime suicidal thoughts, NSSH, self-harm (attempts and NSSH combined) and suicide attempts to indicate any positive responses on the respective face-to-face CIS-R or self-completed item.

In the descriptive analysis, we also explored the responses to two questions from the CIS-R to assess suicidal ideation in the broad sense (Singleton & Lewis, 2003).

- Have you ever felt that life was not worth living?
- Have you ever wished that you were dead?"

Independent variables

Gambling

Gambling was assessed using a questionnaire based on the ten *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition (DSM-IV) diagnostic criteria for pathological gambling (Cowlishaw & Kessler, 2016; Wardle et al., 2012). An initial question was asked on whether any money had been spent on gambling in the past year. Examples of gambling activities were provided and included:

- Buying lottery tickets or scratch cards for yourself
- Playing games or making bets for money on the internet (online gambling)
- Playing football pools, bingo or fruit machines
- Playing games or making bets with friends for money
- Betting on races and/or with a bookmaker
- Table games in a casino

Participants responding 'yes' (65.3% out of 7,403) were routed to the problem gambling screen. Those responding 'no' were asked a check question about whether they had gambled just occasionally in the past year, perhaps to buy a lottery ticket or scratch card. An additional 6% of respondents were identified as past year gamblers using this method, and were also routed to the problem gambling screen.

The ten-item problem gambling screen was used to identify gamblers in the past year who were experiencing problems with their gambling behaviour at the time of the interview. APMS 2007 had a modified version of the DSM-IV-Multiple Response screen used in *British Gambling Prevalence Survey* (BGPS) 2007. The problem gambling questions on APMS were asked of those who had gambled in the past 12 months. However, they were phrased in the present tense and likely reflect the prevalence of current symptoms rather than symptoms present in the past year.

The number of endorsed DSM-IV criteria were summed to generate a score. Participants are assigned a score if they had given a yes or no response to least half of the items (4% of respondents were excluded). Those who had not gambled in the past year were given a score of zero.

We then adopted the widely used DSM-based classification strategy (Carrà, Crocamo, & Bebbington, 2017; Cowlishaw & Kessler, 2016; Jacob, Haro, & Koyanagi, 2018a, 2018b; Rai et al., 2014) to categorise respondents as non-gamblers (those with a DSM score of zero (score 0)), at-risk (score 1-2), or problem gamblers (score ≥ 3). DSM-IV recommends that people should be considered positive for pathological gambling if they meet five or more of the diagnostic criteria.

We categorised other independent variables into blocks to reflect sociodemographics, individual-level characteristics, loneliness, household and other social characteristics:

Core sociodemographics

Core sociodemographics contain the categorical variables: **sex** (male and female); **age** (16-34, 34-54 and ≥ 55 years); **ethnic origin** (White British and others); and **area deprivation**. We used the variable QIMD (Quintiles Index of Multiple Deprivation) in the survey as a measure of area deprivation, which was based on the 2004 Overall Index of Multiple Deprivation (DCLG-Department for Communities & Local Government, 2004). It is a measure of multiple deprivation for small areas from seven domains, including income, employment, health and disability, education, skills and training, barriers to housing and services, crime and disorder and living environment. The index was divided into quintiles, with the 5th quintile (Q5) demarcating the fifth most deprived areas.

Individual-level factors

Individual-level factors contained categorical variables regarding: **marital status** (three groups: single, widowed/divorced/separated and married/cohabitating): **highest education level** (three groups: no qualification, A-level/GCSE/foreign/other and degree/ teaching /HND/nursing); and **employment** (three groups: unemployed, economically inactive and employed).

Additionally, we included the following variables as individual-level factors:

Financial debt: We constructed a dichotomous variable to represent whether an individual experienced any financial difficulty in the past year with paying rent, utilities (gas, electricity and water), goods bought on hire purchase, mortgage repayments, tax (council/road), credit card payments, mail order payments, telephone, loans, TV license, social fund loan or child support/maintenance.

Physical health condition was assessed by questions on the presence of 20 physical health conditions that have been diagnosed by a doctor or other health

professional in the past year. These conditions included cancer, diabetes, epilepsy, migraine, cataracts/eyesight problems, ear/hearing problems, stroke, heart attack/angina, high blood pressure, bronchitis/emphysema, asthma, allergies, stomach ulcer or other digestive problems, liver problems, bowel/colon problems, bladder problems/incontinence, arthritis, bone/back/joint/muscle problems, infectious disease, and skin problems. The number of health conditions was summed to obtain the total number as a continuous variable.

Smoking: Participants were asked on their smoking activity during their lifetime and the responses were classified into four groups as described previously (McManus et al., 2016): never smokers, ex-smokers (quitted), current smoker smoking on average < 15, and those smoking ≥ 15 cigarettes per day.

Alcohol misuse in relation to the past year was assessed from responses to the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993). We constructed a binary variable to identify individuals with hazardous or harmful use of alcohol, based on the AUDIT score ≥ 8.

Substance misuse: We examined participants' responses on the Diagnostic Interview Schedule (Malgady, Rogler, & Tryon, 1992) on whether they had used cannabis, amphetamines, crack, cocaine, ecstasy, tranquillisers, opiates or volatile substances in the past year. A binary variable was used to indicate substance misuse for the participants who responded to the use of any of these drugs.

Mental health:
Any common mental disorder (Any CMD)- Symptoms of six CMDs including depressive episode, mixed anxiety and depression, generalized anxiety disorder, panic disorder, phobia, and obsessive-compulsive disorder were assessed using the revised *Clinical Interview Schedule* (CIS-R). The CIS-R covers the presence of non-psychotic symptoms in the week prior to interview with its outputs as a continuous scale reflecting overall severity of CMD psychopathology (Lewis et al., 1992). A diagnostic algorithm was then used to generate ICD-10 diagnoses (McManus et al., 2009). In this study, we created a dichotomised variable to indicate participants who were identified with any of the six CMDs.

Probable psychoses- In the APMS 2007 survey, case identification of psychosis consisted of two phases. The first phase was a screening process using the Psychosis Screening Questionnaire (PSQ) (Bebbington & Nayani, 1995) as well as other criteria suggesting a psychotic episode, e.g., use of antipsychotic medication, receipt of a diagnosis and a stay in a psychiatric ward or hospital in the past year. Phase two was to interview selected screened individuals based on

the Schedules for Clinical Assessment in Neuropsychiatry (SCAN) (World Health Organization, 1992), conducted by clinically trained research interviewers. In the present study, a binary variable was used to indicate probable psychoses for individuals who had positive response in SCAN, together with individuals who were not interviewed with SCAN but met at least two of the phase-one psychosis screening criteria (McManus et al., 2009).

Autistic traits- were assessed by a two-phase process (Brugha et al., 2009). Phase one (screening) consisted of a self-reported structured questionnaire (autism-spectrum quotient, AQ-20) designed to capture lifetime signs of autistic spectrum disorder (ASD). A score between zero and twenty was generated based on the responses to AQ-20, with the higher score associated with increasing likelihood of having ASD. The second phase involved interviews conducted by clinically trained research interviewers to the selected screened respondents at phase one using the Autism Diagnostic Observation Schedule Module 4. Due to the very small sample size of identifying ASD (19 individuals) using responses from phase two (Brugha et al., 2009), we used the score from AQ-20 at phase one as a proxy for autistic traits in the present study.

Attention-deficit/hyperactivity disorder (ADHD)- ADHD symptoms were examined via the Adult ADHD Self-Report Scale (ASRS) screener (Kessler et al., 2007). This consisted of six face-to-face questions about inattention (four items) and hyperactivity (two items) in the previous six months. A five-point response scale ("never" – scored 0 to "very often" – scored 4) was used to rate the frequency of these characteristics. In this study, we used a binary variable that adopted the four-item threshold for identifying individuals who may need clinical assessment of ADHD, as recommended by others (Fayyad et al., 2007).

Perceived Loneliness
Feel lonely and isolated from people: Loneliness was primarily assessed by one item from the Social Functioning Questionnaire (SFQ) (Tyrer et al., 2005). Participants were asked to assess with a four-category response (very much, sometimes, not often and not at all) the extent to which they had felt "lonely and isolated from other people" in the previous two weeks.

Perceived Social Support
Perceived social support refers to an individual's perceptions of support, reciprocity, sharing and trust from their social networks, which are central to people's welfare (Poortinga, 2006). We used seven variables to reflect the level of social support the participants perceived from family and friends at the date of survey assessment. Participants were asked to select one of three responses (not true, partly true and certainly true) to the following statements about their family and friends:
1) "**do things to make me happy**",

2) "**make me feel loved**",
3) "**can be relied on no matter what happens**",
4) "**would see that I am taken care of if I needed to be**",
5) "**accept me just as I am**",
6) "**make me feel an important part of their lives**" and
7) "**give me support and encouragement**".

Number of people they feel close to: We included a continuous variable by summing the numbers of 1) adults living with the respondent they feel close to, 2) relatives who do not live with the respondent they feel close to and 3) friends described as close or good friends as a measure of perceived social support at the date of survey assessment (Brugha et al., 2003; Cowlishaw & Kessler, 2016).

Household factors

We included continuous variables within the household factors: **household size**, **number of children in house < 15** years and number of children respondent is natural parent of (**number of biological children**).

We also examined **living arrangements** (alone, spouse or partner and other) using data from the household questionnaire. Participants were asked how many people lived in their household. If there was more than one person, the participant was asked how these people were related to them. If any member of the household was a spouse or partner, participants were classified as living with spouse or partner. The other category included both relatives and unrelated people.

Social capital

Social capital relates to the extent and intensity of associational links and qualitative aspects of the levels of trust or reciprocity to and from the neighbourhood/community (Araya et al., 2006). In this study, social capital was assessed by asking participants to what degree they agreed to the following six statements about the area where they currently lived:

- "I feel like I **belong around here**",
- "I **trust people around here**",
- "I **enjoy living around here**",
- "I think of the area **around here** as a **real home** not just a place",
- "I **feel safe around here** in the day time" and
- "Given the opportunity I would like to **move away from here**".

These questions have been used to investigate individual perception of social cohesion and trust in their environment (Araya et al., 2006). Participants' responses were measured in a five-point likert scale ranging from strongly agree to strongly disagree. For the present analysis, we created three-category

variables by combing the strongly agree and agree categories as well as combining strongly disagree and disagree categories. Six variables were created corresponding to the six items.

2.4 Statistical analyses

Sample weighting and the complex study design (clustering by PSU and strata) were considered in all statistical analyses to obtain nationally representative estimates. Missing data were minimal and were excluded from analyses. The level of statistical significance was set at $p < 0.05$ and all analyses were performed with Stata version 15.1 (Stata Corp LP, College Station, Texas).

We reported descriptive statistics as prevalence (percentage) with 95% confidence intervals (CIs) of the sample characteristics stratified by gambling, suicidal thoughts, non-suicidal self-harm, self-harm, and suicide attempts. Cross-tabulations with chi-squared tests of association were carried out to test for differences in sample characteristics. Continuous variables were transformed into categorical variables in the cross-tabulations. Variables including number of physical health conditions, number of children in household < 16 years and number of biological children were transformed into three-group categorical variables containing a group with zeros and two groups from dichotomising non-zero values by median split. Household size was also categorised into three groups – a group with ones and two other groups from dichotomising all values > 1 by median split. The variable for the number of people felt close was divided into tertiles and scores on autistic traits were divided into two groups at the threshold of 10.

Four multivariable binary logistic regression analyses were conducted with lifetime suicidal thoughts, self-harm, NSSH or suicide attempts separately as the dependent variable and gambling as the independent variable to examine their associations. In order to investigate how the associations were affected by the inclusion of different control variables, a hierarchical analysis was performed by entering different blocks of variables sequentially in the regression analyses (Figure 1). All variables were included in the models as categorical variables except the following variables, which were treated as continuous variables: the number of physical health conditions, number of children in household < 16 years, number of biological children, household size, number of people feel close to and autistic traits. Wald tests were performed to evaluate the difference between nested models. We conducted diagnostic checks on multicollinearity by calculating the variance inflation factors (VIF) of all independent variables (Mansfield & Helms, 1982). We report odds ratios (OR), 95% CI and p-values associated significant fully adjusted models.

Block of factors	Variables	Model										
		0	1	2	3	4	5	6	7	8	9	10
Gambling	Gambling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Loneliness	Feel lonely and isolated from people		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Core sociodemographics	Sex			✓	✓	✓	✓	✓	✓	✓	✓	✓
	Age											
	Ethnic origin											
	Area deprivation											
Individual level factors	Marital status				✓	✓	✓	✓	✓	✓	✓	✓
	Highest education level											
	Employment											
	Debt											
	Physical health condition											
	Smoking											
	Alcohol misuse											
	Substance misuse											
CMD	Any CMD					✓	✓	✓	✓	✓	✓	✓
Probable psychosis	Probable psychoses						✓	✓	✓	✓	✓	✓
ASD trait	Autistic traits							✓	✓	✓	✓	✓
ADHD	ADHD								✓	✓	✓	✓
Perceived social support	Do things to make me happy									✓	✓	✓
	Make me feel loved											
	Can be relied on no matter what happens											
	Would see that I am taken care of if I needed to be											
	Accept me just as I am											
	Make me feel an important part of their lives											
	Give me support and encouragement											
	Number of people they feel close to											
Household factors	Household size										✓	✓
	Number of children in house < 16 years											
	Number of biological children											
Social capital	Belong around here											✓
	Trust people around here											
	Enjoy living around here											
	Around here as a real home											
	feel safe around here											
	Move away from here											

Figure 1. Summary of modelling development for factors associated with lifetime suicidal thoughts, self-harm, NSSH or suicide attempts and gambling.

3. Results

3.1 Profile of problem and at-risk gamblers

Among the respondents in the APMS 2007 survey, there were 41 responders meeting the criteria for problem gamblers (0.7% out of 6,941 responders, 462 individuals did not respond to the relevant questions), 172 (2.5%) at-risk gamblers, and 6,728 (96.8%) non-gamblers or gamblers who did not report experiencing any of the DSM symptoms presented (a DSM score of 0). We report weighted sample sizes and percentages throughout the results so as to be representative of the general population. Accordingly, 0.7% of adults were classified as problem gamblers (a DSM score of 3 or more). A further 2.5% were classified as at-risk gamblers (a DSM score of 1 or 2) and 96.8% were either non-gamblers or gamblers who did not report experiencing any of the DSM symptoms presented (DSM score of 0). The profile of problem and at-risk gamblers was reported previously in Report 1[6]. Table 1 shows problem gamblers and at-risk gamblers   by a wide range of core characteristics and circumstances. Table 1 indicates that there were 48 problem gamblers in the sample; this is because counts presented here are weighted.

Table 1. Core sample characteristics – gambling. Weighted counts are shown.

			Non-gambler (DSM = 0)		At-risk gambler (DSM = 1-2)		Problem gambler (DSM ≥ 3)	
			Weighted counts	%	Weighted counts	%	Weighted counts	%
		Total	6,723	96.8	177	2.5	48	0.7
Core sociodemographics	sex	male	3,223	95.1	127	3.7	41	1.2
		female	3,500	98.4	50	1.4	7	0.2
	age	16-34 years	2,031	95.5	73	3.4	23	1.1
		34-54 years	2,401	97.2	52	2.1	18	0.7
		≥ 55 years	2,291	97.5	52	2.2	7	0.3
	ethnicity	White British	5,715	96.9	142	2.4	39	0.7
		others	983	95.7	34	3.4	9	0.9
	area deprivation	Q1	1,299	97.8	25	1.9	5	0.4
		Q2	1,496	97.6	33	2.2	3	0.2
		Q3	1,330	96.6	37	2.7	10	0.7
		Q4	1,274	96.0	40	3.0	13	1.0
		Q5 (most deprived)	1,324	95.7	42	3.0	17	1.3
Individual-level factors	marital status	single	1,519	95.2	61	3.8	15	1.0
		widowed / divorced / separated	956	96.5	27	2.7	8	0.8
		married / cohabitating	4,248	97.4	89	2.0	26	0.6
	highest education level	no qualification	1,703	95.4	69	3.9	14	0.8
		A-level / GCSE / foreign / other	3,020	96.9	70	2.3	25	0.8
		degree / teaching / HND / nursing	1,876	97.6	37	1.9	8	0.4
	employment	unemployed	187	96.4	4	2.0	3	1.6
		economically inactive	2,475	97.3	55	2.2	12	0.5
		employed	4,061	96.4	117	2.8	33	0.8
	debt	no	6,150	97.1	152	2.4	32	0.5
		yes	525	93.2	22	4.0	16	2.8
	no. of phy health conditions	0	1,314	96.6	34	2.5	12	0.9
		1-2	3,056	96.6	83	2.6	24	0.8
		≥ 3	2,352	97.0	59	2.4	13	0.5
	smoking	never	2,371	97.6	44	1.8	15	0.6
		quitted	2,849	97.2	68	2.3	15	0.5
		smoke < 15 cig. per day	922	95.3	40	4.2	5	0.6
		smoke ≥ 15 cig. per day	581	94.0	24	3.9	13	2.1
	alcohol misuse	AUDIT score < 8	5,140	97.7	98	1.9	25	0.5
		AUDIT score ≥ 8	1,583	93.9	79	4.7	24	1.4
	substance misuse	no	6,115	97.1	148	2.3	35	0.6
		yes	597	93.5	29	4.5	13	2.0
Mental health	any CMD	no	5,664	97.2	134	2.3	26	0.5
		yes	1,059	94.3	42	3.8	22	2.0
	psychoses	no	6,697	96.8	176	2.5	47	0.7
		yes	26	91.6	1	2.5	2	6.0
	ASD trait	< 10	6,103	97.1	152	2.4	30	0.5
		≥ 10	620	93.5	25	3.8	18	2.7
	ADHD	no	6,198	97.2	145	2.3	36	0.6
		yes	522	92.3	31	5.5	13	2.2

3.2 Profile of gambling and loneliness

We explored the survey sample responses related to perceived loneliness and social isolation by gambling (Table 2).

Compared to non-gamblers or gamblers with a DSM score of zero and at-risk gamblers, problem gamblers were more likely to feel lonely and isolated from other people (3.0% for non-gamblers/ DSM=0, 3.3% of at-risk gamblers and 10.1% of problem gamblers feel 'very much' lonely; 16.8% for non-gamblers, 29.1% of at-risk gamblers and 43.6% of problem-gamblers feel 'sometimes lonely').

Problem gamblers also appeared to have smaller networks of people they felt close to compared to non-gamblers (≥ 15 people they felt close to: 31.9% of non-gamblers/DSM=0 vs. 17.6% problem gamblers). They were also less likely to perceive that family and friends gave them encouragement and support (89.3% non-gamblers/DSM=0 vs. 79.4% problem gamblers).

Table 2. Sample characteristics – gambling and loneliness.

			Non-gambler / DSM=0		At-risk gamblers		Problem gamblers	
			Weighted counts	%	Weighted counts	%	Weighted counts	%
Loneliness	feel lonely and isolated from other people	very much	202	3.0	6	3.3	5	10.1
		sometimes	1,127	16.8	51	29.1	21	43.6
		not often	1,115	16.6	23	12.8	8	16.5
		not at all	4,276	63.6	97	54.8	14	29.8
Perceived social support	family & friends do things to make me happy	not true	109	1.6	2	1.2	1	2.5
		partly true	922	13.8	43	24.6	11	22.4
		certainly true	5,665	84.6	131	74.2	36	75.1
	family & friends make me feel loved	not true	74	1.1	1	0.8	0	0.0
		partly true	630	9.4	27	15.3	8	17.5
		certainly true	5,989	89.5	148	83.9	40	82.5
	family & friends can be relied on no matter what happens	not true	83	1.2	1	0.6	0	0.0
		partly true	584	8.7	26	14.5	7	13.6
		certainly true	6,027	90.0	150	84.9	42	86.4
	family & friends would see that I am taken care of if I needed to be	not true	60	0.9	2	1.1	0	0.0
		partly true	477	7.1	20	11.5	6	12.9
		certainly true	6,154	92.0	154	87.4	42	87.1
	family & friends accept me just the way I am	not true	48	0.7	0	0.0	0	0.0
		partly true	408	6.1	17	9.7	6	11.7
		certainly true	6,239	93.2	159	90.3	42	88.3
	family & friends make me feel an important part of their lives	not true	98	1.5	2	1.0	0	0.9
		partly true	748	11.2	34	19.1	7	15.4
		certainly true	5,846	87.4	141	79.9	40	83.8
	family & friends give me support and encouragement	not true	77	1.2	3	1.8	1	2.5
		partly true	640	9.6	29	16.6	9	18.1
		certainly true	5,979	89.3	143	81.6	38	79.4
	no. of people feel close	0-8	2,374	35.4	61	34.3	21	43.8
		9-14	2,194	32.7	61	34.8	19	38.6
		≥ 15	2,138	31.9	55	30.9	8	17.6

3.3 Profile of gambling, household factors and social capital

In addition to individual-level factors such as perceived loneliness, we investigated household- and social-level characteristics and gambling (Table 3).

The difference in the percentage of respondents living alone in the non-gamblers/ DSM score of zero group compared to those who were problem gamblers (15.3% vs. 19.7%, respectively) was not statistically significant. We also observed statistically significant differences in the proportions of non-gamblers compared to problem gamblers to have spouse or partner (71.05% vs. 60.4%) and who have no children in their household (72.0% vs 82.3%, respectively).

For social capital at a community level, however, we found that a smaller percentage of problem gamblers agreed that they felt they belonged around the community, trusted the people around the community, enjoyed living around the community, thought of the area around as a real home, as well as, felt safe around their community. On the other hand, problem gamblers were more likely to say they would like to move away from the community given opportunity compared with non-gamblers.

Table 3. Sample characteristics – gambling, household factors and social capital.

			Non-gamblers		At-risk gamblers		Problem gamblers	
			Weighted counts	%	Weighted counts	%	Weighted counts	%
Household factors	household size	1	1,031	15.3	34	19.0	10	19.7
		2-3	4,010	59.6	96	54.4	29	58.8
		≥ 4	1,682	25.0	47	26.6	10	21.6
	living arrangement	alone	1,031	15.3	34	19.0	10	19.7
		spouse or partner	4,775	71.0	109	61.5	29	60.4
		others	915	13.6	34	19.5	10	20.0
	no. of children in household < 16 years	0	4,843	72.0	125	71.0	40	82.3
		1-2	1,569	23.3	48	27.0	4	9.1
		≥ 3	311	4.6	3	1.9	4	8.6
	no. of biological children	0	2,193	32.6	76	43.2	21	43.8
		1-2	3,045	45.3	62	35.1	20	40.8
		≥ 3	1,485	22.1	38	21.7	7	15.4
Social capital	belong around here	strongly/agree	5,169	77.1	125	71.0	29	63.7
		neutral	934	13.9	22	12.3	11	24.8
		strongly/disagree	599	8.9	30	16.7	5	11.5
	trust people around here	strongly/agree	4,780	71.4	106	60.5	23	47.0
		neutral	1,072	16.0	33	18.7	11	22.7
		strongly/disagree	844	12.6	37	20.8	15	30.4
	enjoying living around here	strongly/agree	5,743	85.7	139	78.6	39	80.4
		neutral	442	6.6	14	7.7	3	7.0
		strongly/disagree	517	7.7	24	13.7	6	12.6
	real home around here	strongly/agree	5,312	79.3	130	73.6	34	73.9
		neutral	642	9.6	20	11.2	10	22.4
		strongly/disagree	742	11.1	27	15.2	2	3.7
	feel safe around here	strongly/agree	6,266	93.5	156	88.6	40	84.0
		neutral	207	3.1	11	6.5	5	9.9
		strongly/disagree	228	3.4	9	4.9	3	6.1
	move away from here	strongly/agree	2,366	35.3	78	44.8	23	47.6
		neutral	805	12.0	26	14.9	3	6.1

| | strongly/disagree | 3,523 | 52.6 | 71 | 40.3 | 22 | 46.3 |

3.4 Profile of lifetime suicidal thoughts, NSSH and suicide attempts

In our first report we demonstrated that, in the past year, problem gamblers had elevated rates of suicidal thoughts, attempts and non-suicidal self-harm. In the past year, 20.9% of problem gamblers had felt that life was not worth living, 17.1% had wished they were dead and 19.2% had thought about suicide. Equivalent estimates among those with a DSM score of 0 were 6.0%, 4.7% and 4.1%, respectively. While rates of suicidal thoughts, attempts and self-harm were clearly elevated in problem gambling, the profile for at-risk gamblers was very similar to that for the rest of the population. 4.7% of problem gamblers reported attempting suicide compared with 0.6% of those with a DSM score of 0 and 1.2% among at-risk gamblers. Over a fifth of problem gamblers (22.4%) had self-harmed without suicidal intent at some point in their life, compared with one in twenty (5.2%) in the population as a whole.

In order to explore the association between gambling, suicidal thoughts, NSSH, self-harm and suicide attempts, we needed an increased sample size. We therefore analysed these variables across lifetime experience (Table 4). Since some individuals were more likely to respond to the self-completed questions than face- to- face interview, we used a combined sample where relevant.

Table 4. Proportion of suicidal thoughts, NSSH and suicide attempts- whole sample.

Question	Question type	Weighted Total	Lifetime Weighted counts	%	Past year Weighted counts	%
Felt life was not worth living	face-to-face	7381	1356	18.4	457	6.2
Wished to be dead	face-to-face	7380	1064	14.4	356	4.8
Thought of taking own life (Suicidal thoughts)	face-to-face	7,381	1,014	13.8	318	4.3
	self-completed	7,316	1,221	16.7	-	-
	combined	7,392	1,333	18.0	-	-
Non suicidal self-harm (nssh)	face-to-face	7,381	253	3.4	-	-
	self-completed	7,326	358	4.9	-	-
	combined	7,392	387	5.2	-	-
Made an attempt to take own life (Suicide attempts)	face-to-face	7,385	353	4.8	49	0.7
	self-completed	7,322	412	5.6	-	-
	combined	7,392	440	5.9	-	-

3.5 Lifetime suicidal thoughts, NSSH and suicide attempts by gambling

Problem gamblers had higher levels of lifetime suicidal thoughts (42.2% vs. 17.5%), NSSH (22.4% vs. 5.0%) and suicide attempts (27.0% vs. 5.4%) than non-gamblers (Table 5).

Table 5. Suicidal thoughts, non-suicidal self-harm and suicide attempts and gambling.

			Weighted counts	%
Suicidal thoughts	Lifetime (face-to-face)	Non-gambler	885	13.2
		At-risk gambler	28	15.6
		Problem gambler	20	40.3
	Lifetime (self-completed)	Non-gambler	1,075	16.1
		At-risk gambler	37	21.2
		Problem gambler	18	37.5
	Lifetime (combined)	Non-gambler	1,169	17.5
		At-risk gambler	40	22.7
		Problem gambler	20	42.2
Non-suicidal self-harm	Lifetime (face-to-face)	Non-gambler	214	3.2
		At-risk gambler	5	2.6
		Problem gambler	8	16.2
	Lifetime (self-completed)	Non-gambler	311	4.6
		At-risk gambler	5	2.6
		Problem gambler	9	18.0
	Lifetime (combined)	Non-gambler	332	5.0
		At-risk gambler	7	3.8
		Problem gambler	11	22.4
Suicide attempts	Lifetime (face-to-face)	Non-gambler	291	4.3
		At-risk gambler	13	7.4
		Problem gambler	12	25.8
	Lifetime (self-completed)	Non-gambler	345	5.2
		At-risk gambler	17	9.8
		Problem gambler	13	27.0
	Lifetime (combined)	Non-gambler	362	5.4
		At-risk gambler	18	10.4
		Problem gambler	13	27.0

3.6 Factors associated with gambling and lifetime suicidal thoughts/ NSSH and suicide attempts

As a first step we analysed the effect of loneliness by counting and cross-tabulating the responses from the question regarding feeling lonely and isolated from other people for respondents who had lifetime suicidal thoughts/NSSH and suicide attempts stratified by non-gamblers, at-risk and problem gamblers (Figure 2).

We observed increases in the proportion of respondents feeling very much lonely and having lifetime suicidal thoughts/NSSH or suicide attempts. In the problem-gambling group, we found an even higher proportion of individuals who felt 'very much' lonely and who had self-harmed (either NSSH or self-harm in general). We also found that more problem-gamblers, who only 'sometimes' or 'not often' felt lonely, had lifetime suicidal thoughts/NSSH and suicide attempts.

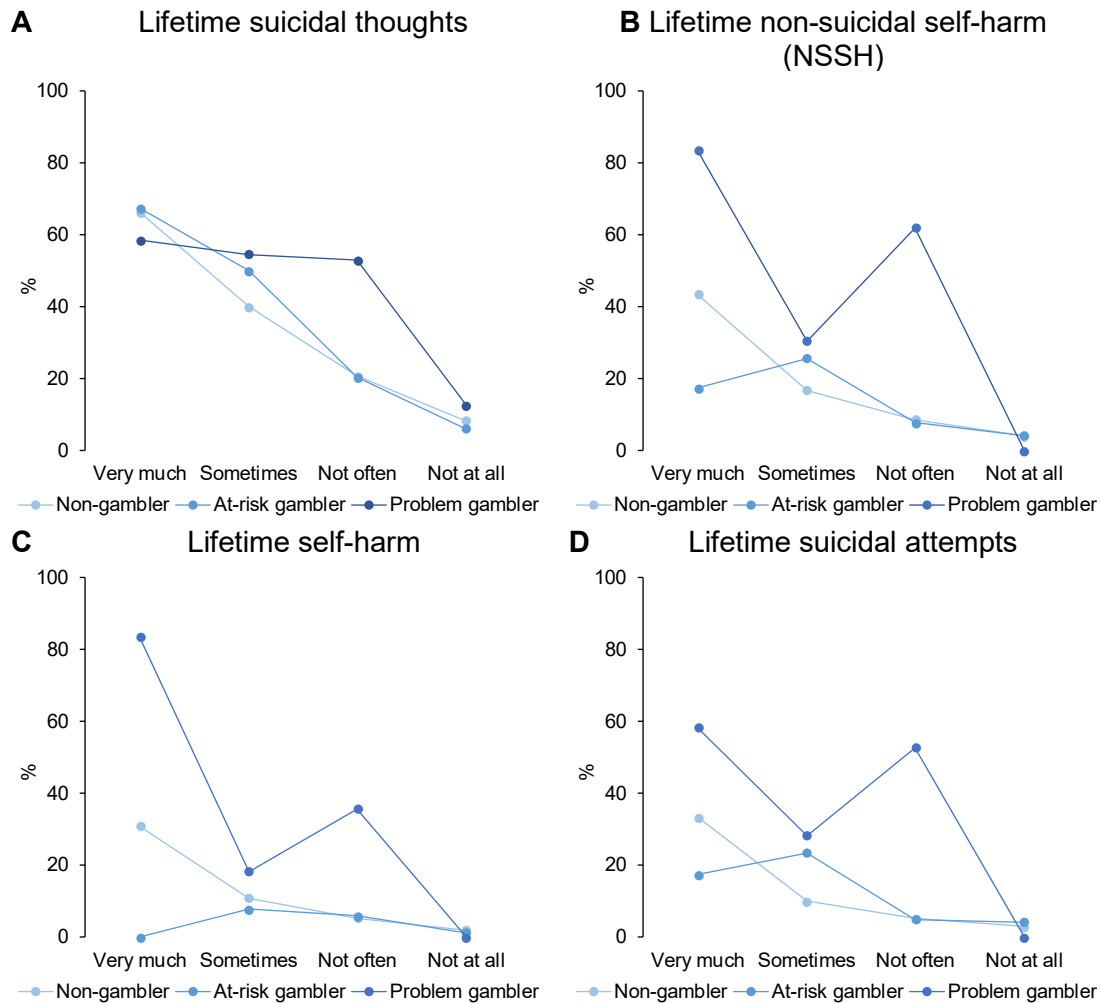

*Figure 2. Association of gambling and lifetime suicidal thoughts (**A**), NSSH (**B**), self-harm (**C**) and suicide attempts (**D**) stratified by response of question "feel lonely and isolated from other people". Weighted counts*

Table 6. Schematic representation of fully-adjusted logistic regression model for suicidal thoughts, NSSH, self-harm and suicide attempts. Red ticks denote statistically significant variables.

Factors		Suicidal thoughts	Non-suicidal self-harm	Self-harm	Suicide attempts
Gambling					✓ (problem gambler)
Loneliness		✓	✓	✓	✓
Demographics & other personal factors	Sex				✓ (female)
	Age	✓ (34-54 years)	✓ (16-54 years)	✓ (16-34 years)	
	Ethnic origin	✓ (White British)	✓ (White British)	✓ (White British)	✓ (White British)
	Area deprivation				
	Marital status				
	Education level				
	Employment				
	Financial debt		✓		
	Physical health	✓		✓	✓
	Smoking	✓	✓	✓	✓
	Alcohol misuse	✓	✓	✓	✓
	Substance misuse	✓	✓	✓	
Mental health	Common mental disorders	✓	✓	✓	✓
	Psychosis	✓	✓	✓	✓
ASD trait					
ADHD		✓	✓	✓	✓
Perceived social support	Do things to make me happy				
	Make me feel loved				
	Can be relied on no matter what happens				
	Would see that I am taken care of if I needed to be				
	Accept me just as I am	✓			
	Make me feel an important part of their lives				
	Give me support and encouragement				
	Number of people they feel close to				
Household factors			✓ (more children < 16 years in household)		
Social capital	Not feeling belong around				
	Not trusting people around	✓			
	Not enjoying living around	✓	✓		
	Not feeling around as real home				
	Not feeling safe around		✓	✓	✓
	Moving away	✓		✓	

compared to other two groups. These associations suggest that both perceived loneliness and gambling might be associated with suicidal thoughts, attempts and self-harm. As can be seen in our first report, a whole range of different factors are associated with both gambling and suicidal thoughts or suicide attempts in the past year. Previous research has suggested that the association between problem gambling and suicidal thoughts or suicide attempts is mediated by other common experiences, such as co-existing (or pre-existing) substance abuse or mental health problems (Barnard et al., 2014). In this section, we present findings from multivariate logistic regression models which enable us to control for loneliness and the potential presence of the mentioned conditions and common experience which may be influencing this association. We also included measures of household level factors and social capital.

Table 6 summarises the models exploring gambling, suicidal thoughts/NSSH, self-harm and suicide attempts and loneliness. By adding individual and social factor/ other covariates to the models, we observed a gradual attenuation of the effect of problem gambling on having suicidal thoughts, NSSH, self-harm and suicide attempts (Table 7). Problem gambling was no longer a statistically significant factor for suicidal thoughts (OR = 1.5, 95% CI = 0.6-3.6), NSSH (OR = 2.1, 95% CI: 0.7-6.8) and self-harm (OR = 2.4, 95% CI: 0.9-6.6) in the fully adjusted model (Model 10). However, problem gambling remained statistically significantly associated with suicide attempts (OR = 3.3, 95% CI: 1.1-9.5) after all measured factors had been controlled for.

The effect of perceived loneliness was consistently statistically significant in all models (Table 7). In the simple model that only contains gambling and loneliness as independent variables (model 1), ORs of all three levels of perceived loneliness with reference to feeling 'not lonely at all' are high and statistically significant (ranging from 1.9 to 21.8 with all 95% lower CI > 1.0) for all four studied outcomes. In the fully adjusted model (model 10), these ORs decreased, but remained (from 1.3 to 7.0) and were statistically significant (all 95% lower CI > 1.0 except the association between not often lonely with suicide attempts).

ORs of all statistically significant factors associated with suicidal thoughts, NSSH, self-harm and suicide attempts based on the fully-adjusted model (model 10) are tabulated in Table 8. After adjusting for the effects by the factors we considered on the suicidal behavior outcomes, we found females have a higher risk of lifetime suicide attempts than males (OR: 3.7, 95% CI: 1.1-12.7). In addition to loneliness, we also observed that smoking, alcohol misuse, CMD, probable psychoses and ADHD are robust risks factors of all four outcomes (Table 8).

We conducted diagnostic checks on multicollinearity by calculating the variance inflation factors (VIF) of all independent variables (Mansfield & Helms, 1982). The resulting tolerances were all above 0.2 and the highest VIF was 2.8, which is below the commonly used cut-off of 10 (Neter et al., 1996), suggesting that the potential bias in parameter estimates stemming from multicollinearity may not be problematic.

Table 7. Summary of relative risks (odds ratios with 95% CIs) of problem gambling and loneliness on lifetime suicidal thoughts, NSSH, self-harm and suicide attempts, in all hierarchical models.

Variable	Outcome	Model										
		0	1	2	3	4	5	6	7	8	9	10
Problem gambling												
	Suicidal thoughts	3.5 (1.7-7.2)	1.9 (0.8-4.4)	2.1 (0.9-4.7)	1.8 (0.7-4.6)	1.6 (0.6-3.8)	1.5 (0.6-3.9)	1.5 (0.6-3.8)	1.4 (0.6-3.5)	1.4 (0.6-3.3)	1.4 (0.6-3.4)	1.5 (0.6-3.6)
	NSSH	5.5 (2.3-13.2)	3.1 (1.3-7.6)	2.8 (1.0-8.0)	2.3 (0.7-7.1)	2.0 (0.7-6.1)	2.0 (0.6-6.2)	1.9 (0.6-6.0)	1.9 (0.6-5.8)	1.7 (0.6-5.2)	1.9 (0.6-5.9)	2.1 (0.7-6.8)
	Self-harm	5.3 (2.4-12.0)	3.2 (1.4-7.6)	3.2 (1.4-7.6)	2.7 (1.0-7.3)	2.3 (0.9-6.0)	2.3 (0.9-6.1)	2.2 (0.8-6.0)	2.2 (0.8-5.6)	2.2 (0.9-5.3)	2.2 (0.9-5.5)	2.4 (0.9-6.6)
	Suicide attempts	6.5 (2.7-15.4)	4.1 (1.6-10.5)	4.5 (1.8-11.4)	3.5 (1.2-10.2)	3.1 (1.1-8.5)	3.0 (1.1-8.7)	2.9 (1.0-8.5)	2.9 (1.0-8.1)	3.0 (1.1-8.2)	2.9 (1.0-7.8)	3.3 (1.1-9.5)
Loneliness												
Very much	Suicidal thoughts	-	21.5 (15.3-30.2)	22.2 (15.8-31.2)	16.6 (11.7-23.5)	10.3 (7.1-14.8)	10.1 (7.0-14.6)	9.3 (6.4-13.6)	8.7 (6.0-12.7)	7.3 (5.0-10.8)	7.4 (5.0-10.9)	7.0 (4.8-10.2)
	NSSH	-	21.8 (13.9-34.2)	23.4 (14.5-37.6)	14.5 (8.7-24.2)	9.8 (5.8-16.6)	9.3 (5.4-15.8)	8.0 (4.7-13.9)	7.4 (4.2-12.7)	6.7 (3.8-11.7)	6.8 (3.8-11.9)	6.2 (3.5-11.1)
	Self-harm	-	18.1 (12.5-26.1)	18.4 (12.6-26.8)	11.4 (7.6-17.2)	6.9 (4.5-10.7)	6.6 (4.3-10.4)	6.0 (3.9-9.4)	5.6 (3.6-8.8)	5.0 (3.2-7.9)	5.0 (3.2-8.0)	4.6 (2.9-7.4)
	Suicide attempts	-	16.1 (11.0-23.5)	15.2 (10.3-22.5)	9.1 (5.8-14.2)	5.1 (3.1-8.2)	4.8 (3.0-7.9)	4.4 (2.8-7.0)	4.2 (2.6-6.6)	3.4 (2.1-5.5)	3.4 (2.1-5.6)	3.0 (1.8-5.0)
Sometimes	Suicidal thoughts	-	7.5 (6.3-9.0)	7.3 (6.1-8.7)	6.2 (5.2-7.5)	4.6 (3.8-5.6)	4.6 (3.8-5.7)	4.4 (3.6-5.4)	4.3 (3.5-5.3)	4.0 (3.3-4.9)	4.0 (3.3-4.9)	3.9 (3.2-4.8)
	NSSH	-	6.0 (4.3-8.3)	5.5 (3.9-7.7)	4.3 (3.1-6.2)	3.4 (2.3-4.9)	3.4 (2.3-4.9)	3.1 (2.1-4.6)	3.0 (2.0-4.4)	2.8 (1.9-4.1)	2.7 (1.8-4.1)	2.5 (1.7-3.9)
	Self-harm	-	4.9 (3.9-6.2)	4.6 (3.6-5.8)	3.5 (2.8-4.6)	2.5 (1.9-3.4)	2.6 (1.9-3.4)	2.4 (1.8-3.2)	2.4 (1.8-3.1)	2.2 (1.6-2.9)	2.2 (1.6-3.0)	2.1 (1.5-2.8)
	Suicide attempts	-	3.8 (1.6-10.5)	3.5 (1.8-11.4)	2.8 (1.2-10.2)	1.9 (1.1-8.5)	1.9 (1.1-8.7)	1.8 (1.0-8.5)	1.8 (1.0-8.1)	1.6 (1.1-8.2)	1.6 (1.0-7.8)	1.5 (1.1-9.5)
Not often	Suicidal thoughts	-	2.9 (2.4-3.6)	2.8 (2.3-3.4)	2.6 (2.1-3.1)	2.3 (1.9-2.8)	2.3 (1.9-2.9)	2.3 (1.8-2.8)	2.2 (1.8-2.8)	2.1 (1.7-2.6)	2.2 (1.8-2.7)	2.1 (1.7-2.6)
	NSSH	-	2.9 (2.0-4.1)	2.5 (1.7-3.6)	2.2 (1.5-3.3)	2.0 (1.3-3.0)	2.0 (1.3-3.0)	1.9 (1.3-2.9)	1.9 (1.3-2.8)	1.8 (1.2-2.7)	1.9 (1.2-2.8)	1.8 (1.2-2.6)
	Self-harm	-	2.4 (1.8-3.1)	2.1 (1.6-2.8)	1.9 (1.4-2.5)	1.7 (1.2-2.2)	1.7 (1.3-2.3)	1.6 (1.2-2.2)	1.6 (1.2-2.2)	1.6 (1.2-2.1)	1.6 (1.2-2.1)	1.5 (1.1-2.0)
	Suicide attempts	-	1.9 (1.4-2.7)	1.8 (1.3-2.5)	1.7 (1.2-2.4)	1.4 (1.0-2.1)	1.5 (1.0-2.1)	1.4 (1.0-2.0)	1.4 (1.0-2.0)	1.4 (1.0-1.9)	1.3 (0.9-1.9)	1.3 (0.9-1.8)

Table 8. Model summary of fully-adjusted logistic regression model (model 10) for lifetime suicidal thoughts, NSSH, self-harm and suicide attempts. Shaded areas refer to statistically significant variables. Only variables that are statistically significant in any of the four outcomes are shown.

			Lifetime suicidal thoughts			Lifetime NSSH			Lifetime self-harm			Lifetime suicide attempts		
			OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value	OR	95% CI	*p*-value
Gambling (ref: non-gambler)		at-risk gambler	1.0	0.6-1.5	0.826	0.4	0.1-1.1	0.064	0.9	0.5-1.6	0.694	1.6	0.9-2.8	0.145
		problem gambler	1.5	0.6-3.6	0.364	2.1	0.7-6.8	0.193	2.4	0.9-6.6	0.081	3.3	1.1-9.5	0.030
Loneliness	feel isolated from other people	very much	7.0	4.8-10.2	<0.001	6.2	3.5-11.1	<0.001	4.6	2.9-7.4	<0.001	3.0	1.8-5.0	<0.001
	(ref: not at all)	sometimes	3.9	3.2-4.8	<0.001	2.5	1.7-3.9	<0.001	2.1	1.5-2.8	<0.001	1.5	1.1-2.2	0.019
		not often	2.1	1.7-2.6	<0.001	1.8	1.2-2.6	0.004	1.5	1.1-2.0	0.005	1.3	0.9-1.8	0.229
Core sociodemographics	sex (ref: male)	female	1.6	0.7-3.9	0.262	0.4	0.1-1.8	0.207	1.2	0.4-3.8	0.754	3.7	1.1-12.7	0.038
	age	16-34 years	1.4	0.9-2.3	0.140	3.8	1.6-9.0	0.003	2.4	1.2-5.0	0.015	1.7	0.7-4.2	0.232
	(ref: ≥ 55 years)	34-54 years	1.7	1.2-2.4	0.002	2.9	1.4-6.2	0.005	1.7	1.0-2.9	0.066	1.5	0.8-2.7	0.209
	ethnicity (ref: others)	White British	1.8	1.3-2.4	<0.001	2.2	1.3-3.8	0.003	2.0	1.4-3.0	0.001	1.8	1.2-2.8	0.007
	area deprivation	Q2	0.9	0.7-1.2	0.656	0.9	0.5-1.4	0.632	0.8	0.6-1.2	0.355	0.7	0.5-1.2	0.183
	(ref: Q1, least deprived)	Q3	1.0	0.7-1.3	0.783	0.7	0.4-1.1	0.123	1.0	0.7-1.4	0.933	1.1	0.7-1.8	0.744
		Q4	0.7	0.5-0.9	0.008	0.8	0.5-1.3	0.291	0.7	0.5-1.1	0.145	0.7	0.5-1.2	0.218
		Q5 (most deprived)	0.9	0.6-1.1	0.289	0.8	0.5-1.4	0.515	0.8	0.6-1.3	0.433	0.9	0.5-1.5	0.670
Individual-level factors	highest education level	no qualification	0.7	0.5-0.9	0.014	1.0	0.6-1.7	0.984	1.0	0.6-1.4	0.868	1.2	0.7-1.9	0.505
	(ref: degree/ teaching /HND/nursing)	A-level/GCSE/foreign/other	1.0	0.8-1.2	0.923	0.8	0.6-1.2	0.347	1.0	0.8-1.4	0.817	1.3	0.9-1.8	0.164
		debt	1.2	0.9-1.5	0.337	1.5	1.0-2.2	0.039	1.3	1.0-1.9	0.086	1.3	0.8-1.9	0.283
		no. of physical health conditions	1.2	1.1-1.2	<0.001	1.1	1.0-1.2	0.140	1.1	1.0-1.2	0.005	1.1	1.0-1.2	0.009
	smoking	quitted	1.1	0.9-1.4	0.161	1.1	0.8-1.5	0.644	1.2	0.9-1.5	0.232	1.0	0.8-1.4	0.835
	(ref: never)	smoke < 15 cig. per day	1.6	1.2-2.1	0.001	1.4	0.9-2.1	0.195	1.6	1.1-2.3	0.017	1.6	1.0-2.4	0.042
		smoke ≥ 15 cig. per day	2.1	1.6-2.8	<0.001	1.8	1.2-2.8	0.006	2.3	1.7-3.2	<0.001	2.6	1.7-3.9	<0.001
	alcohol misuse (ref: AUDIT score < 8)	AUDIT score ≥ 8	1.4	1.1-1.7	0.004	1.6	1.1-2.3	0.011	1.5	1.1-1.9	0.009	1.5	1.1-2.0	0.013
		substance misuse	1.6	1.1-2.2	0.008	1.7	1.1-2.6	0.015	1.5	1.0-2.2	0.028	1.3	0.8-2.1	0.272
Mental health		any CMD	2.4	2.0-2.9	<0.001	1.7	1.2-2.4	0.001	2.2	1.7-2.9	<0.001	2.5	1.8-3.4	<0.001
		probable psychoses	8.2	2.4-28.1	0.001	5.5	2.5-12.4	<0.001	9.6	3.6-25.8	<0.001	13.0	5.0-34.1	<0.001
		ADHD	1.6	1.2-2.1	0.001	1.8	1.3-2.7	0.002	1.6	1.2-2.2	0.001	1.5	1.0-2.1	0.031
Perceived social support	family & friends accept me just the way I am	not true	1.7	0.6-4.4	0.312	1.8	0.5-6.3	0.372	1.8	0.6-5.6	0.300	1.5	0.4-5.8	0.525
	(ref: certainly true)	partly true	1.6	1.2-2.3	0.003	1.0	0.6-1.6	0.872	1.1	0.8-1.7	0.488	1.3	0.8-2.2	0.239
Household factors		no. of children in household < 16 years	1.1	0.9-1.4	0.467	1.8	1.2-2.7	0.005	1.2	0.9-1.7	0.242	0.7	0.5-1.1	0.147
Social capital	trust people around here	neutral	1.2	0.9.1.5	0.192	1.2	0.8-1.8	0.346	1.2	0.9-1.7	0.281	1.0	0.7-1.4	0.829
	(ref: strongly/agree)	strongly disagree/disagree	1.4	1.1-1.8	0.012	0.9	0.6-1.4	0.662	1.1	0.8-1.6	0.440	1.3	0.9-1.9	0.235
	enjoying living around here	neutral	1.4	1.0-2.0	0.046	1.7	1.0-2.7	0.039	1.3	0.9-1.9	0.213	1.1	0.7-1.9	0.627
	(ref: strongly/agree)	strongly disagree/disagree	1.1	0.8-1.5	0.703	1.0	0.5-1.7	0.873	0.7	0.5-1.2	0.200	0.9	0.5-1.6	0.833
	feel safe around here	neutral	1.3	0.8-2.1	0.229	1.1	0.6-2.0	0.694	1.8	1.1-3.0	0.020	2.1	1.2-3.8	0.010
	(ref: strongly/agree)	strongly disagree/disagree	1.1	0.7-1.8	0.675	1.9	1.0-3.5	0.035	1.9	1.1-3.1	0.016	1.7	0.9-3.1	0.087
	move away from here	strongly agree/agree	1.2	1.0-1.5	0.035	1.5	1.0-2.1	0.048	1.4	1.1-1.9	0.014	1.4	1.0-2.0	0.069
	(ref: strongly/disagree)	neutral	1.2	0.9-1.5	0.144	1.3	0.8-2.2	0.264	1.4	0.9-2.0	0.115	1.3	0.9-2.1	0.197

4. Discussion

Main Findings

Our goal was to investigate the association between perceived loneliness and suicidal behaviours in at-risk and problem gamblers. We adjusted for other personal and social factors, including perceived social support, living arrangements and social capital that may affect this association. Overall, in the fully adjusted models problem gambling remained significantly associated with lifetime suicide attempt (OR 3.3). Subjective loneliness appeared consistently to be an important factor across all the models. Physical health, smoking, alcohol and substance misuse, mental health (CMD, psychosis, ADHD but not ASD trait) were also significantly associated with all outcomes. However, perceived emotional support, social capital (except for feeling safe) and living arrangements explained little of this association. In the fully adjusted model we found that females have a higher risk of lifetime suicide attempts than males (OR: 3.7, 95% CI: 1.1-12.7).

Limitations

Any inferences from these data must acknowledge potential limitations. Using a single-item measure for the construct of loneliness may not be optimal in terms of validity and reliability. The single question also includes social isolation which may be a different construct. However, previous literature has also used this single item and suggested high agreement between this single-item and overall scores of multiple-item scales (Fokkema et al., 2012; Stickley & Koyanagi, 2016).

The differential time frames for the responses to questions we used in these analyses is a serious issue for our study. Perceived loneliness was over a two-week timeframe, gambling referred to the last year and suicidal behaviours were considered over a lifetime. There may also be issues with recall bias, particularly over a lifetime. We had to use these variables rather than ones associated with shorter timeframes for gambling and suicidal behaviours to create robust models to deal with small sample sizes (for example, two participants who were problem gamblers who had attempted suicide in the past year; eight who had thoughts of suicide in the past year). We were necessarily limited by our data source and the need to create robust models for the analyses. Our results are therefore highly preliminary. Nevertheless, we believe that the consistency of the association between loneliness, gambling and suicidal behaviours warrants further investigation.

The individual physical health conditions used to construct the general physical health variable may be different in terms of severity and impact. We did not apply weighing to these conditions because we could not measure/compare these quantitatively. All the relevant questions asked in APMS were binary in nature and therefore we also could not compare severity across respondents. The method we adopted by summing the number of physical conditions has been used previously (Cowlishaw & Kessler ., 2016).

In any study, such as this, which uses a cross-sectional design, causality and its direction is impossible to determine ie any causal direction may be reversed.

Implications

Our results suggest that whilst the association between suicide attempts and problem gambling may be mediated through perceived loneliness, the association persists independent of it. It may be that addressing loneliness may also reduce the risk of suicide attempts in some problem gamblers. Addressing loneliness is an emerging field and evidence-based interventions for loneliness are yet to be fully evaluated. Any health care or other service provider or community or user group likely to be in contact with gamblers should be aware of the risk of suicidal behaviours and self-harm and should have appropriate policies and safeguarding procedures in place. Gambling industry customer service and land-based staff are at the frontline of dealing with this vulnerable group and need to be aware of the increased risk of suicidality among the people they deal with. Training of staff in suicide awareness, appropriate responses and sign-posting is essential. Our results also indicate a need to raise awareness amongst professional staff conducting psychosocial assessments for those attending healthcare services with self-harm and suicidal behaviours to ask about gambling behaviours and perceived loneliness/isolation. Raising awareness of these issues in women may be particularly important.

We found that mental health conditions, alcohol and substance misuse also remained significantly associated with gambling and suicidal behaviours. These findings suggest that it may be useful to routinely consider gambling-related behaviour and problems when assessing men and women for these conditions. Several evidence-based practices have been developed for gambling problems, but few mental health care providers in general mental health services, substance misuse services or those involved in crisis care for self-harm and suicidal behaviours are likely to be aware of, or have been trained in, these interventions.

Our results are highly preliminary and based on data that is now 12 years old. A recent study that combined the data from APMS 2000, 2007 (the dataset we use in the current study) and 2014 (McManus et al., 2019) found that the lifetime prevalence of self-reported NSSH increased from 2.4% (95% CI 2.0–2.8) in 2000 to 6.4% (5.8–7.2) in 2014 (McManus et al., 2019). Given this increase in the prevalence of self-harm and the radical change in the landscape in which gambling is now offered and promoted in Britain, there is an urgent need for more up to date insight based on larger sample sizes. Future research should explore the mechanisms and pathways that underpin any association between gambling, suicidal behaviours, self-harm and perceived loneliness/isolation. Since social capital and social support appeared unimportant in the statistical models, it may be worth exploring the possibility that alternative pathways, such as shame and guilt, affect perceived loneliness/isolation.

Conclusion

Our results, while highly preliminary, suggest an association between problem gambling, suicidal behaviours and perceived loneliness/isolation that warrants further investigation in more up-to-date datasets with larger sample sizes.

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