

## **Thoughts and acts of self-harm, and suicidal ideation, in online gamblers**

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To cite this article: Joanne Lloyd, Keith Hawton, William H. Dutton, John R. Geddes, Guy M. Goodwin & Robert D. Rogers (2016): Thoughts and acts of self-harm, and suicidal ideation, in online gamblers, *International Gambling Studies*, DOI: 10.1080/14459795.2016.1214166

To link to this article: <http://dx.doi.org/10.1080/14459795.2016.1214166>

### **Abstract**

Gambling problems have been linked to suicidal ideation and enhanced risk of suicide attempts. However, we know very little about the factors associated with either thoughts or acts of self-harm amongst people who gamble. A web-based study of 4,125 online gamblers (79% males; mean age 35.5 years) analysed using hierarchical multiple regression, revealed that self-reported non-gambling-related self-harm was negatively related to age and marital status, and positively related to problematic alcohol use. Self-reported acts of self-harm both related and unrelated to gambling were associated with drug misuse. Thoughts and acts of gambling-related self-harm were associated with problem gambling, gambling involvement, and parental problem gambling. All types of self-harm were associated with mood disorder symptoms, unemployment, and certain gambling motivations. When tailoring assessment and interventions for individuals at risk for gambling-related deliberate self-harm, it is important to recognise that contributory factors may include some

that differ from those for deliberate self-harm in general, and that there is potential value in evaluating gambling involvement and motivations, and history of parental gambling.

**Keywords:** problem gambling; internet gambling; mood disorder; substance abuse; suicide.

## INTRODUCTION

Gambling problems have been linked to suicidal ideation and enhanced risk of suicide attempts (Battersby, Tolchard, Scurrah, & Thomas, 2006; Brooker, Clara, & Cox, 2009; Hodgins, Mansley, & Thygesen, 2006; Manning & al., 2015), likely reflecting the co-occurrence of mood-related disorders and other psychological problems (Wong, Chan, Conwell, Conner, & Yip, 2010). Hodgins et al. (2006) found that, on average, suicidal ideation began more than 10 years prior to the onset of problematic gambling and was most marked in those with depressive illnesses, and actual suicide attempts were most strongly linked to substance misuse. Similarly, Maccallum and Blaszczyński (2003) reported that suicidal thoughts and acts in a sample of pathological gamblers were more closely related to depression than measures of problem gambling severity (Maccallum & Blaszczyński, 2003). While these data suggest a linkage of problem gambling and suicidality largely mediated by co-morbid psychiatric disorder (Hodgins et al., 2006), gambling problems also appear to show significant associations with suicide attempts when the presence of mood and substance misuse disorders is accounted for (Penney, Mazmanian, Jamieson, & Black, 2012).

In a study of completed suicides, gambling-related cases were less strongly associated with lifetime history of psychiatric diagnoses than non-gambling-related cases (Wong, Cheung, Conner, Conwell, & Yip, 2010). Similarly, in a sample of in-treatment pathological gamblers with a history of suicide attempts, almost two-thirds cited gambling problems as the principal reason for their most recent attempt (Kausch, 2003). Other studies have also shown features of gambling behaviour to be important, with greater gambling severity (Ledgerwood & Petry, 2004), gambling as a means of escape (Ledgerwood & Petry, 2004), longer gambling history and more days per month spent gambling (Ladd & Petry, 2003), all showing significant associations with suicidality. Collectively,

these divergent findings suggest that suicidality in some individuals with gambling problems is explained by co-occurring mood disorders but that, in other individuals, the relationship with gambling problems is more direct.

Self-harm (i.e. intentional self-injury or self-poisoning) includes acts involving suicidal intent and is strongly associated with suicidal ideation (Gunnell & Lewis, 2005; Hawton & van Heeringen, 2009). However, it also encompasses acts with other motivations/reasons (Hawton, Zahl, & Weatherall, 2003), and is one of the strongest predictors of future self-harm and suicide (Owens, Horrocks, & House, 2002). While research has explored the links between suicidality and gambling (e.g. Maccallum & Blaszczynski, 2003), and suicidality is encompassed within self-harm, we know very little about the distal and proximal factors in self-harm in its broader sense amongst gambling populations, and still less about the relationship between self-harm and gambling participation. There is also a dearth of knowledge about the presence of thoughts or ideation about self-harm in this population. In general, suicide ideators exhibit a very similar (but not identical) pattern of risk factors to enactors, with substance abuse (Hodgins et al., 2006) and heavy alcohol use (Gould et al., 1998; Haavisto et al., 2005) being more common amongst those who attempt suicide than amongst those who only think about it. In a study of problem gamblers specifically, both ideators and enactors showed elevated rates of mood disorders compared with controls, and this was more pronounced in the latter (Black et al., 2015). It is possible that a similar pattern of associations will be seen in those who think about self-harm or act on such thoughts.

We surveyed a large sample of online gamblers recruited via gambling websites, with the following two objectives: (i) to investigate the risk factors associated with self-harm in gamblers, and (ii) to

determine how these risk factors relate specifically to gambling-related thoughts of self-harm on the one hand, and gambling-related acts of self-harm on the other.

## **METHODS**

4,125 Internet users were recruited via hyper-links on gambling and gambling-related websites, with the incentive of entry into a prize draw for the chance to win an iPod. An online information sheet and check-box consent form were presented prior to completion of the survey. Respondents provided information about demographic characteristics, self-harm history, online gambling behaviour (frequencies, preferred activities, modes of access), and historical/current gambling problems and completed validated questionnaires for symptoms of mood, alcohol and substance disorders. Further details of the web-based methodology have been described elsewhere (Lloyd et al., 2010a, 2010b).

In order to assess occurrence of SH, related and unrelated to gambling, all participants were first asked to respond with a 'yes' or 'no' to self-harm the question; 'Has there been a time when you thought about harming yourself (in any way) because of problems with your gambling?' Those who responded 'yes' were then asked to answer the question 'Did this ever result in your harming yourself?' All respondents then answered the question 'Have you ever self-harmed (by any means) for other reasons?' These items provided indications of whether participants had a history of non-gambling-related acts of self-harm, gambling-related ideation about self-harm, or gambling-related acts of self-harm. Respondents also completed validated screening questionnaires used to identify the presence of symptoms of psychiatric disorder including the self-report criteria for DSM-IV (American Psychiatric Association, 2000) for problem gambling (scored as positive with a score of 3

or above, as per the British Gambling Prevalence Survey; Wardle, 2007)) the Mood Disorders Questionnaire (MDQ) to screen for symptoms of mood elevation and hypomanic experiences (scored as positive with a score of 7 items or more out of with a self-reported indication that these clustered together in the same period of time and caused moderate to severe problems (Hirschfeld et al., 2000)); the General Health Questionnaire (GHQ-12) (Goldberg, 1992) to screen for possible psychological distress. Those scoring above threshold on this also completed the PRIME-MD Patient Health Questionnaire (PHQ-9) (Spitzer et al., 1994) to assess DSM-IV items of current depressive symptoms (scored as positive when endorsing 5 or more out of 9 items, including an indication of lowered mood and/or anhedonia (Spitzer, Kroenke, & Williams, 1999)) or panic disorder (scored as positive when all 5 items were endorsed (Spitzer et al., 1999)).

Participants also completed the CAGE alcohol screen (Ewing, 1984) (with a cut-off of 2 used to indicate cases of possible dependence (Hays, Merz, & Nicholas, 1995)) – this 4-item scale was chosen for its brevity, and has adequate psychometric properties, although it performs slightly less well than the longer AUDIT (Meneses-Gaya et al., 2010). They were also asked to indicate which, if any, illicit substances they had used in the last 12 months. Those who had used substances also completed the 10-item Drug Abuse Screening Test (DAST) (Skinner, 1982) (positive with a score of 3 (Yudko, Lozhkina, & Fouts, 2007)). Finally, all participants provided information about their gambling frequency across a comprehensive list of online and offline activities, and whether their parents gambled, and, if they had, whether the respondent thought that this gambling was problematic.

In order to measure gambling motivations, respondents were asked to rate how often they were motivated to gamble for each of 11 different reasons, which, as reported elsewhere, loaded onto

three factors broadly defined as the 'coping/mood regulation' motivation factor, the 'enjoyment' motivation factor and the 'monetary' motivation factor (Lloyd et al., 2010a). Each individual was assigned a standardised score for each motivations factor.

## **Analysis**

We used hierarchical linear regression to test the relationships between history of self-harm (related or unrelated to gambling) on the one hand, and demographic, clinical and gambling-related variables on the other. This analysis treated the three items 'self-harm thoughts related to gambling', 'self-harm acts related to gambling', and 'self-harm acts unrelated to gambling' as repeated measures within each participant, in order to account for potential shared variance between the criterion variables (Hoffman & Rovine, 2007; Woltman et al., 2012). The models simultaneously estimated the strength of associations between presence of each of these measures and a single set of regressors (Lloyd et al., 2010a). Some regressors were categorical, and coded in binary format (e.g. gender with 'male' as the reference, employment status with 'employed' as the reference, and the presence of psychological symptoms:- i.e. problem gambling, mood elevation, panic disorder, current depressive experiences, drug misuse and alcohol dependence, with 'below threshold for caseness' always the reference. Continuous variables (e.g. age, gambling motivation scores) were represented as regressors in the form of standardized z scores.

First, gender, marital status, unemployment and age were entered as regressors into a minimal model in order to see how these basic demographic variables were related to the different types of self-harm assessed in the survey. Next, we added problem gambling, mood disturbance, depressive symptoms, panic, alcohol dependence, and substance misuse into the model simultaneously to assess the associations involving clinical variables. Finally, a separate model was constructed to look

at the effects of gambling-related variables. This included the minimal model (gender, marital status, unemployment and age), to which we simultaneously added gambling volume (defined as the total sum of frequency scores across a comprehensive list of on- and offline gambling activities), number of years gambling, and gambling motivation scores (all represented as z scores), along with problem gambling status and parental history of problem gambling (as categorical variables). Throughout, standard z-tests were used to examine the significance of regression coefficients, and statistical significance was taken at the 1% level ( $p < .01$ ). The larger the z-value (the mean of the regression coefficients divided by their standard error), the stronger the observed relationship between the motivation factor score and regressor. Analyses were conducted with SPSS 15 and MLWin 2.02 (<http://www.cmm.bristol.ac.uk/MLwiN/index.shtml>).

### **Ethical approval**

The survey was approved by a United Kingdom National Health Service Research Ethics Committee (OXREC C; 06/Q1606/151). After the presentation of an information page detailing the study, informed consent was obtained electronically, within the web survey.

## **RESULTS**

Demographic and clinical characteristics of the participants are presented in Table 1, and are broadly typical of those reported in previous samples of Internet gamblers in European and North American contexts (Griffiths, Wardle, Orford, Sproston, & Erens, 2008; McBride & Derevensky, 2009; Petry & Kiluk, 2002; Petry, Litt, Kadden, & Ledgerwood, 2007; Wood & Williams, 2007). Of 4,125 respondents, 7.3% indicated that they had contemplated harming themselves because of their gambling problems. Of the contemplators, 28.0% (2.0% of the total sample) reported that

they had actually self-harmed because of gambling problems. While only those who had contemplated self-harm related to gambling problems were asked whether this led to them going on to actually self-harm, it was assumed that those who had never contemplated self-harm had not gone on to self-harm, so a 'no' response was imputed for those who did not receive the question. Overall, 448 respondents (10.9% of the overall sample) indicated a history of having harmed themselves in the past for other reasons not related to gambling.

**[Table 1 about here]**

### **Gambling and non-gambling-related self-harm and demographics**

Table 2 shows that non-gambling-related acts of self-harm were reported more frequently by females ( $z=7.25$ ,  $p<.0001$ ) and respondents who were unemployed ( $z=6.63$ ,  $p<.0001$ ), and less frequently by older people ( $z=-4.00$ ,  $p<.0001$ ) and those who were married or had a partner ( $z=-3.30$ ,  $p<.001$ ). However, females were less likely to have considered self-harm because of gambling-related problems than males ( $z= -4.30$ ,  $p<.0001$ ). Unemployment was the only demographic characteristic that was significantly related to having actually self-harmed because of gambling-related problems ( $z=2.33$ ,  $p<.01$ ), and it was also significantly associated with having thought about self-harm because of gambling-related problems ( $z=4.06$ ,  $p<.0001$ ).

**[TABLE 2 ABOUT HERE]**

### **Self-harm and psychological symptoms**

Table 3 shows the basic model with 'caseness' for each of the psychological disorders added simultaneously. Gambling-related thoughts of self-harm were significantly associated with problem gambling ( $z=18.70$ ,  $p<.0001$ ), previous problematic hypomanic experiences (as scored on the MDQ)

( $z=9.81$ ,  $p<.0001$ ), and current depression ( $z=7.60$ ,  $p<.0001$ ) and panic ( $z=4.74$ ,  $p<.0001$ ) 'caseness' (as scored on the PRIME), but not with drinking problems (as scored with the CAGE) ( $z=-0.50$ ,  $p=.31$ ) or drug use disorders (as scored by the DAST) ( $z=0.50$ ,  $p=0.31$ ). Gambling-related acts of self-harm showed a very similar pattern, again being associated with problem gambling ( $z=7.50$ ,  $p<.0001$ ), problematic hypomanic experiences ( $z=5.00$ ,  $p<.0001$ ), and 'caseness' for depression ( $z=4.44$ ,  $p<.0001$ ) and panic ( $z=3.69$ ,  $p<.001$ ), and showing no significant association with drinking problems ( $z=1.20$ ,  $p=0.11$ ). They were, however, associated with drug use disorders ( $z=3.36$ ,  $p<.001$ ). Non-gambling-related acts of self-harm were not associated with problem gambling, but they were associated with all of the other psychiatric disorder caseness variables, i.e. problematic hypomanic experiences ( $z=4.85$ ,  $p<.0001$ ), caseness for depression ( $z=4.58$ ,  $p<.0001$ ) and panic ( $z=6.24$ ,  $p<.0001$ ), drinking problems ( $z=5.60$ ,  $p<.0001$ ) and drug use disorders ( $z=6.06$ ,  $p<.0001$ ).

### **Gambling characteristics**

Table 4 shows the associations between gambling and non-gambling-related self-harm thoughts and acts and the gambling behaviours and motivations. Having thought about harming oneself because of gambling-related problems was associated with problem gambling ( $z=9.00$ ,  $p<.0001$ ), parental problem gambling ( $z=4.33$ ,  $p<.0001$ ), number of years gambling ( $z=4.00$ ,  $p<.0001$ ), gambling for mood modification ( $z=14.80$ ,  $p<.0001$ ) and for monetary motives ( $z=5.50$ ,  $p<.0001$ ) but negatively associated with gambling for enjoyment motives ( $z=-9.00$ ,  $p<.0001$ ).

### **[TABLE 3 ABOUT HERE]**

Having actually harmed oneself because of problems related to gambling showed broadly the same set of associations as having thought about it. That is, gambling-related self-harm was associated

with problem gambling ( $z=4.71$ ,  $p<.0001$ ) and reports of parental problem gambling ( $z=3.78$ ,  $p<.001$ ) and with gambling for mood modification ( $z=5.00$ ,  $p<.0001$ ), but negatively associated with gambling for enjoyment ( $z=-4.00$ ,  $p<.0001$ ). It was associated with gambling volume ( $z=4.67$ ,  $p<.0001$ ) but not with number of years gambling ( $z=0.67$ ,  $p=.25$ ), nor with gambling for monetary motives ( $z=1.00$ ,  $p=0.16$ ).

Having harmed oneself for reasons unrelated to gambling was also significantly associated with gambling for mood modification ( $z=5.00$ ,  $p<.0001$ ), and was inversely associated with gambling for enjoyment ( $z=-3.33$ ,  $p<.0001$ ). Non-gambling related self-harm did not show reliable relationships with any of the other gambling-related variables (i.e. problem gambling, parental problem gambling, gambling for monetary reasons, years gambling or gambling volume) (all  $p$ -values  $>.05$ ).

**[TABLE 4 ABOUT HERE]**

## **DISCUSSION**

In an online sample of over 4,000 respondents we identified characteristic factors strongly associated with non-gambling related self-harm (female gender, age, unmarried/unpartnered marital status and problematic alcohol and substance use), others that were strongly associated with gambling-related thoughts and/or acts of self-harm (problem gambling, parental problem gambling and gambling involvement), and some that were related to all types of self-harm acts, both related and unrelated to gambling (mood disorders, unemployment, and certain types of gambling motivation). While links between suicide attempts and gambling problems have been reported previously (e.g. Maccallum and Blaszczyński, 2003; Battersby et al., 2006; Hodgins et al., 2006; Manning & al., 2015), to our knowledge, this is the first study to investigate the ways that thoughts and acts of self-harm more broadly (i.e. not specifically constrained to those with suicidal

intent), relate to gambling problems alongside other health experiences. The results can help inform assessment and treatment of gamblers who may be at risk of self-harm.

### **Self-harm and demographic characteristics of gamblers**

Consistent with findings of research on self-harm in general, non-gambling-related acts of SH were more frequent in females, younger individuals (Hawton, 2000) and those who were unemployed (Young, Van Beinum, Sweeting, & West, 2007), and less frequent in those who were married/partnered (Klonsky, 2011). Gambling-related thoughts of self-harm were also more frequent in those who were unemployed, but in contrast to non-gambling related self-harm they were not associated with marital status and were most frequent in males. Gambling-related acts of self-harm were associated with unemployment, but had no relationship to gender or marital status. Age was not a significant predictor of either thoughts or acts of gambling-related self-harm.

That males were more likely than females to report thoughts of gambling-related self-harm contrasts with findings that they are less likely to report acts of non-gambling-related self-harm, both in our sample and in other studies (Evans, Hawton, & Rodham, 2005; Bischof et al., 2015), and was not predicted a priori. This relationship remained statistically significant even when problem gambling was included as a regressor, suggesting that it did not reflect a bias towards more severe gambling problems in males. Finally, the observation that male gender was not significantly associated with acts of gambling-related self-harm could indicate that gambling-related self-harm ideation is more common in male gamblers or that our statistical power to detect relationships with other variables is limited by the relative infrequency of gambling-related self-harm acts. In any case, the usual pattern of higher risk of self-harm amongst females (Hawton, Harriss, et al., 2003) may be

absent or even reversed in gambling-related self-harm. This may be relevant when assessing or treating problem gamblers.

We also found that neither gambling-related thoughts of self-harm nor gambling-related acts of self-harm were more commonly reported in younger compared to older respondents, possibly indicating that, in contrast to non-gambling-related self-harm (Klonsky, 2011), the risk of gambling-related SH does not decline with age. However, the lifetime time-frame used in the self-harm questions, and the fact that duration of problem gambling was not included in the model, limits the conclusions that can be made about age effects. This relationship merits further study for its potential clinical significance, particularly given that self-harm in older age is associated with higher suicidal intent (Voshaar et al., 2011) and greater likelihood of completed suicide (Hawton, Zahl, et al., 2003; Murphy et al., 2012). Also, gambling participation is increasing in older sectors of the population (McNeilly & Burke, 2001; Pilver, Libby, Hoff, & Potenza, 2013; Tse, Hong, Wang, & Cunningham-Williams, 2012).

### **Mood and substance disorders and self-harm**

Gambling-related thoughts of self-harm were associated with mood symptoms (as indicated by positive 'caseness' for depression, panic, and hypomania). Both gambling-related and non-gambling-related acts of self-harm were associated with each of these symptom-sets and, in addition, with drug misuse. The links with mood disorders are consistent with the literature on self-harm in general, where co-occurrence of psychiatric disorders is common (Haw, Hawton, Houston, & Townsend, 2001). Our findings demonstrate that these mood-related factors also operate in self-harm linked to gambling or the experience of gambling problems. Interestingly, alcohol dependence

was not associated with either thoughts or acts of gambling-related self-harm, in contrast to its links with non-gambling related self-harm. This suggests that not all of the factors associated with SH in general appear to apply in gambling-specific cases of self-harm.

Our study is unusual in including a measure of hypomanic experience. The bipolar spectrum extends to 4-5% of the population (Merikangas et al., 2007). Bipolar diagnoses are associated with an increased risk of anxiety disorder (Merikangas, Jin, He, & et al., 2011), substance misuse (Levin & Hennessy, 2004), self-harm (Hawton, Sutton, Haw, Sinclair, & Harriss, 2005) and of gambling itself (McIntyre et al., 2007). Inquiry about hypomanic experience should accordingly be an important part of clinical assessment and may shape treatment options.

### **Self-harm and gambling-related behaviours**

Gambling-related thoughts of self-harm were significantly and positively associated with self-reported problem gambling, reported parental problem gambling, and number of years gambling. In addition, gambling-related self-harm thoughts were positively linked to both 'coping' and 'monetary' gambling motivations, but were inversely associated with the 'enjoyment' motivations. Gambling-related acts of self-harm showed similar links though there were no significant associations with 'monetary' motivations or with years gambling, but a significant association with current gambling volume. This latter effect may suggest that current level of involvement in gambling, rather than the duration of individuals' gambling history, is the more informative variable for judging risk of actual self-harm.

Non-gambling-related acts of self-harm were also significantly and positively associated with 'coping' gambling motivation score and significantly and negatively associated with 'enjoyment' gambling motivation score, but showed no significant association with other gambling-related variables (i.e. problem gambling, gambling involvement and years gambling, and suspected parental problem gambling). This indicates that, while there are differences in the associations with gambling-related versus non-gambling-related self-harm, there are also some common factors. The finding that gambling to cope is associated with non-gambling-related acts of self-harm is intriguing. Coping with adverse experiences has been cited as one of the top three motivators for 'non-suicidal self-injury' (Wilcox et al., 2012), and self-harm has been shown to be associated with maladaptive coping styles (Christian & McCabe, 2011; Evans, Hawton, Rodham, Psychol, & Deeks, 2005). In the current study, 'gambling to cope', as a motivating factor, may constitute an indirect measure of maladaptive coping, or it may simply be associated with the presence of lowered mood or depressive symptoms, that are in turn associated with gambling to modify mood and negative emotional states (Blaszczynski & Nower, 2002; Lloyd et al., 2010a). Regardless of the precise mechanism, the observation that these motivations were significantly linked to self-harm, even when problem gambling was included in the statistical model, highlights their potential as a new source of information when examining emotional risk factors for self-harm in gamblers.

## **Limitations**

Before considering the implication of our findings, we acknowledge some limitations. First, our study is subject to the inherent limitations of a web-based survey methodology (i.e. lack of control over multiple responses, and lack of clinical interview data available to determine whether respondents represent true clinical cases of disorders), and to those of a self-selected sample (e.g.

potential bias in type of respondent, limited generalizability, and inability to indicate general prevalence). In particular, it is likely that the online recruitment method resulted in an over-representation of online gamblers. While the majority of participants also engaged in offline gambling, there are differences between 'online', 'offline,' and 'mixed-mode' gamblers in terms of type and number of activities engaged in, and tendency to experience gambling problems (Gainsbury, Russell, Blaszczynski & Hing, 2015). Similarly, while the sample contained participants from a wide variety of geographical locations, over two-thirds were UK residents, and this may limit the generalizability of findings, given that gambling ecology varies considerably between countries (Abbott et al., 2013). It is also worth noting that we did not ask whether respondents who reported problematic gambling were treatment-seeking. Although comorbid mood disorders, including depression, are prevalent amongst treatment-seeking problem gamblers (Dowling et al., 2015), suggesting that self-harm amongst this sample is likely to be a pertinent concern, the extent to which the predictors of self-harm identified in the current study apply specifically to the treatment-seeking gamblers that clinicians are most likely to encounter in clinical practice, is difficult to estimate. Thus, caution should be exercised in generalizing from this study to the broader population of gamblers as a whole, and future research could explore whether similar predictors of gambling-related self-harm apply within samples of exclusively offline gamblers, amongst gamblers from different geographical locations, and amongst samples of treatment-seeking problem gamblers.

Because the study was cross-sectional we are unable to draw conclusions about direction of causality; further longitudinal research is needed in order to determine whether the associations observed indicate predictive risk factors for future self-harm.

Self-harm was assessed via three purpose-written items, which allowed for the creation of questions asking specifically about gambling-related self-harm, and minimised response burden (this was important as the current study formed part of a larger survey with multiple scales included, in addition to those described here (Lloyd et al., 2010)). However, the lack of an explicit definition of deliberate self-harm (or use of a pre-validated measure), raises the possibility that some respondents may have classified any harmful behaviours, such as poor lifestyle or substance misuse, as 'self-harm'. However, if this were the case, we might expect considerable elevation in reporting rates, whereas approximately eleven per cent of the sample reported self-harming for reasons unrelated to gambling, which is consistent with estimated prevalence rates of self-harm in young people in the general population of 7-14% (Evans et al., 2005). In addition, the order of the questions (enquiring whether the respondent had thought about harming themselves, before asking whether they had gone on to do so) was intended to prime respondents to consider specific, pre-meditated acts of deliberate self-harm, rather than retrospectively assess whether gambling caused them to behave in an unhealthy or risky manner. Nonetheless, the inclusion of a pre-validated measure such as the Self-Harm Inventory (Sansone & Sansone 2010), could have increased confidence in the applicability of the current study's findings to clinical measures of self-harm, and should be considered in future studies.

A key strength lies in the sample size that allowed the use of hierarchical regression models against validated screening assessments for psychological disorders. Furthermore, web-based studies can provide valid and practical methods of obtaining data in hard-to-access populations (e.g. Wood and

Griffiths 2007), yielding comparable results to postal surveys, even on sensitive topics (McCabe, 2004).

### **Summary and clinical Implications**

We have identified a number of features strongly associated with self-harm in online gamblers, and those specifically related to problem gambling. The findings highlight the potential importance of clinicians asking about gambling as a possible reason for self-harm in general, and of assessing risk of self-harm or suicide in problem gamblers. Indeed, we suggest that such enquiry should be routinely included in clinical assessment in these situations, including in older as well as younger people. Treatment for gambling-related problems (Seguin et al., 2010) may be an essential component of successful intervention in individuals at risk. Longitudinal investigations of at-risk gamblers could help further elaborate the associations with thoughts and acts of self-harm, and hence also increase our understanding of the relationship of gambling to suicide.

### **Conflicts of interest**

### **Competing interests**

The authors reported no biomedical financial interests nor potential conflicts of interests of relevance to this study. Keith Hawton, Guy Goodwin and John Geddes are National Institute for Health Research (NIHR) senior investigators. The views expressed are those of the authors and not necessarily those of the National Health Service (NHS), the NIHR or the Department of Health.

### **Constraints on publishing**

The funding agencies had no involvement in the research design, methodology, conduct, analysis or write-up. No constraints on publishing were reported by the authors.

### **Funding sources**

This work was supported by the Responsibility in Gambling Trust and the Economic and Social Research Council (ESRC), under grant number 164-25-0008.

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**Table 1: Demographic and clinical characteristics of the sample**

Characteristic		Value
<b>Demographic</b>		
M age in years (SD)		35.5 (11.8)
No. of female participants (%)		859 (20.9)
No. of UK residents (%)		2836 (68.8)
<b>Marital status, No. (%)</b>	Single	1704 (41.4)
	Married or living with partner	2170 (52.8)
	Divorced, separated or widowed	239 (5.8)
<b>Educational background, No. (%)</b>	Degree level or above	1724 (41.8)
	College/vocational training	1488 (36.0)
	Secondary and/or primary education	913 (22.2)
<b>Employment status, No. (%)</b>	Full-time employed	2303 (55.8)
	Part-time employed	254 (6.2)
	Self-employed	469 (11.4)
	Unemployed	273 (6.6)
	Retired	193 (4.7)
	Taking care of the house	196 (4.8)
	Student (undergraduate/postgraduate)	437 (10.6)
<b>Clinical</b>		
No. (%) reporting thoughts about self-harm because of gambling		300 (7.3)
No. (%) reporting acts of self-harm because of gambling		84 (2.0)
No. (%) reporting acts of self-harm unrelated to gambling		448 (10.9)
No. (%) problem gambling cases (above threshold on DSM-IV)		841 (20.5)
No. (%) cases of lowered mood (above threshold on PRIME PHQ-9)		343 (8.3)
No. (%) cases of mood elevation (above threshold on MDQ)		275 (6.7)
No. (%) cases of panic disorder (above threshold on PRIME)		133 (3.2)
No. (%) substance misuse cases (above threshold on DAST)		332 (8.1)
No. (%) cases problematic alcohol use (above threshold on CAGE)		1242 (30.2)

Note: PRIME PHQ-9 = PRIME Patient Health Questionnaire, 9-item; MDQ = Mood Disorders

Questionnaire; DAST = Drug Abuse Screening Test; CAGE = CAGE alcohol screen.

Table 2: Multivariate hierarchical regression; basic model: Associations between thoughts and acts of self-harm related and unrelated to gambling, and demographic characteristics.												
	Thoughts of self-harm: related to gambling				Acts of self-harm: related to gambling				Acts of self-harm : Unrelated to gambling			
	Mean $\beta$	SE	Z	p	Mean $\beta$	SE	Z	p	Mean $\beta$	SE	Z	p
Female	<b>-0.043</b>	<b>0.010</b>	<b>-4.30</b>	<b>***</b>	-0.004	0.005	-0.80	.21	<b>0.087</b>	<b>0.012</b>	<b>7.25</b>	<b>***</b>
Age (z)	-0.003	0.004	-0.75	.23	-0.001	0.002	-0.50	.31	<b>-0.020</b>	<b>0.005</b>	<b>-4.00</b>	<b>***</b>
Married/live with partner	-0.015	0.009	-1.67	.05	-0.002	0.005	-0.40	.34	<b>-0.033</b>	<b>0.010</b>	<b>-3.30</b>	<b>**</b>
Unemployed	<b>0.065</b>	<b>0.016</b>	<b>4.06</b>	<b>***</b>	<b>0.021</b>	<b>0.009</b>	<b>2.33</b>	<b>*</b>	<b>0.126</b>	<b>0.019</b>	<b>6.63</b>	<b>***</b>

\*Z> 2.3, p< .01; \*\*Z>3.09; p< .001; \*\*\*Z>3.72; p< .0001

**Table 3: Multivariate hierarchical regression; disorders model: Thoughts & acts of self-harm related and unrelated to gambling in basic model with psychiatric disorder caseness variables**

	Thoughts of self-harm: related to gambling				Acts of self-harm: related to gambling				Acts of self-harm: Unrelated to gambling			
	Mean $\beta$	SE	Z	p	Mean $\beta$	SE	Z	p	Mean $\beta$	SE	Z	p
<b>Gender (female)</b>	<b>-0.033</b>	<b>0.009</b>	<b>-3.67</b>	<b>**</b>	-0.001	0.005	-0.20	.42	<b>0.088</b>	<b>0.012</b>	<b>7.33</b>	<b>***</b>
<b>Age (z-score)</b>	0.006	0.004	1.50	.07	0.002	0.002	1.00	.16	<b>-0.015</b>	<b>0.005</b>	<b>-3.00</b>	<b>*</b>
<b>Married/LWP</b>	-0.005	0.008	-0.63	.26	0.001	0.005	0.20	.42	<b>-0.027</b>	<b>0.010</b>	<b>-2.70</b>	<b>*</b>
<b>Unemployed</b>	0.003	0.015	0.20	.42	-0.001	0.009	-0.11	.46	<b>-0.073</b>	<b>0.019</b>	<b>-3.84</b>	<b>**</b>
<b>Problem gambling</b>	<b>0.187</b>	<b>0.010</b>	<b>18.70</b>	<b>***</b>	<b>0.045</b>	<b>0.006</b>	<b>7.50</b>	<b>***</b>	0.019	0.012	1.58	.06
<b>Mood elevation (MDQ) caseness</b>	<b>0.157</b>	<b>0.016</b>	<b>9.81</b>	<b>***</b>	<b>0.045</b>	<b>0.009</b>	<b>5.00</b>	<b>***</b>	<b>0.097</b>	<b>0.020</b>	<b>4.85</b>	<b>***</b>
<b>Panic caseness</b>	<b>0.109</b>	<b>0.023</b>	<b>4.74</b>	<b>***</b>	<b>0.048</b>	<b>0.01</b>	<b>3.69</b>	<b>**</b>	<b>0.181</b>	<b>0.029</b>	<b>6.24</b>	<b>***</b>
<b>Depressed mood (PRIME) caseness</b>	<b>0.114</b>	<b>0.015</b>	<b>7.60</b>	<b>***</b>	<b>0.040</b>	<b>0.009</b>	<b>4.44</b>	<b>***</b>	<b>0.087</b>	<b>0.019</b>	<b>4.58</b>	<b>***</b>
<b>Drug misuse (DAST) caseness</b>	0.007	0.014	0.50	.31	<b>0.027</b>	<b>0.008</b>	<b>3.36</b>	<b>**</b>	<b>0.109</b>	<b>0.018</b>	<b>6.06</b>	<b>***</b>
<b>Alcohol dependence (CAGE) caseness</b>	-0.004	0.008	-0.50	.31	0.006	0.005	1.20	.11	<b>0.056</b>	<b>0.010</b>	<b>5.60</b>	<b>***</b>

\*Z> 2.3, p< .01; \*\*Z>3.09; p< .001; \*\*\*Z>3.72; p< .0001

**Table 4. Multivariate hierarchical regression; gambling characteristics model: Thoughts and acts of self-harm related and unrelated to gambling in basic model and gambling behaviour characteristics.**

		Thoughts of self-harm : related to gambling				Acts of self-harm : related to gambling				Acts of self-harm : unrelated to gambling			
		Mean $\beta$	SE	Z	P	Mean $\beta$	SE	Z	p	Mean $\beta$	SE	Z	P
Gender (female)		-0.022	0.010	-2.20	.01	0.001	0.006	0.17	.43	<b>0.085</b>	<b>0.013</b>	<b>6.54</b>	<b>***</b>
Age (z-score)		-0.002	0.004	-0.50	.31	0.000	0.003	0.00	.50	<b>-0.021</b>	<b>0.006</b>	<b>-3.50</b>	<b>**</b>
Married/living with partner		0.000	0.008	0.00	.50	0.000	0.005	0.00	.50	<b>-0.028</b>	<b>0.011</b>	<b>-2.54</b>	<b>*</b>
Unemployed		0.028	0.015	1.87	.03	0.012	0.009	1.33	.09	<b>0.118</b>	<b>0.020</b>	<b>5.90</b>	<b>***</b>
Problem gambling		<b>0.108</b>	<b>0.012</b>	<b>9.00</b>	<b>***</b>	<b>0.033</b>	<b>0.007</b>	<b>4.71</b>	<b>***</b>	0.031	0.016	1.94	.03
Parental problem gambling		<b>0.065</b>	<b>0.015</b>	<b>4.33</b>	<b>***</b>	<b>0.034</b>	<b>0.009</b>	<b>3.78</b>	<b>**</b>	0.025	0.020	1.25	.11
Gambling motivation (z-scores)	Coping/Mood modification	<b>0.074</b>	<b>0.005</b>	<b>14.80</b>	<b>***</b>	<b>0.015</b>	<b>0.003</b>	<b>5.00</b>	<b>***</b>	<b>0.035</b>	<b>0.007</b>	<b>5.00</b>	<b>***</b>
	Fun/enjoyment	<b>-0.036</b>	<b>0.004</b>	<b>-9.00</b>	<b>***</b>	<b>-0.012</b>	<b>0.003</b>	<b>-4.00</b>	<b>***</b>	<b>-0.020</b>	<b>0.006</b>	<b>-3.33</b>	<b>***</b>
	Monetary	<b>0.022</b>	<b>0.004</b>	<b>5.50</b>	<b>***</b>	0.002	0.002	1.00	.16	0.000	0.005	0.00	.50
Total gambling volume (z-score)		0.008	0.004	2.00	.02	<b>0.014</b>	<b>0.003</b>	<b>4.67</b>	<b>***</b>	0.003	0.006	0.50	.31
Years gambling (z-score)		<b>0.016</b>	<b>0.004</b>	<b>4.00</b>	<b>***</b>	0.002	0.003	0.67	.25	0.004	0.006	0.67	.25

\*Z> 2.3, p< .01; \*\*Z>3.09; p< .001; \*\*\*Z>3.72; p< .0001