Association between problem gambling and functional disability: a nationally representative study conducted in the United Kingdom

Running title: Problem gambling and functional disability

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Abstract

Objectives: Problem gambling is associated with multiple detrimental health outcomes. However, to date, no study has investigated the association between problem gambling and functional disability. Therefore, the aim of this study was to investigate the association between problem gambling and functional disability in a UK nationally representative sample.

Methods: Cross-sectional data from the 2007 Adult Psychiatric Morbidity Survey were analyzed. Problem gambling was assessed using a questionnaire including 10 DSM-IV criteria, while functional disability referred to at least one difficulty in one of seven activities of daily living and instrumental activities of daily living. Control variables included sociodemographic factors, smoking status, alcohol dependence, drug use, the number of chronic physical condition, depression, and anxiety disorder. The problem gambling-functional disability relationship was studied using a logistic regression model.

Results: This study included 6,941 adults aged ≥16 years (51.2% women; mean [SD] age 46.3 [18.6] years). The prevalence of functional disability was significantly higher in the at-risk problem gambling/problem gambling group than in the no problem gambling group (46.2% versus 32.1%, p-value<0.001). After adjusting for control variables, both at-risk problem gambling (OR = 1.55, 95% CI = 1.03-2.35) and problem gambling (OR = 3.05, 95% CI = 1.09-8.52) were positively and significantly associated with functional disability.

Conclusions: In this large representative sample of UK adults, problem gambling was associated with higher odds for functional disability. If confirmed with longitudinal studies, these results suggest that those suffering from problem gambling should receive targeted intervention to aid in the prevention of functional disability.

Keywords: Problem Gambling; Functional Disability; Cross-sectional Study; UK; Epidemiology

Introduction

Based on the World Health Organization (WHO), disability corresponds to an umbrella term to describe impairments, activity limitations and participation restrictions that may be experienced by a person with a physical or psychiatric disorder in interaction with their environment[1]. In the UK, there is a high prevalence of disability with more than 11 million individuals living with a chronic condition, impairment or disability[2]. Such a high prevalence of disability is problematic since disability is associated with unemployment, reduced choice and control over daily lives, increased discrimination, and less participation in cultural, leisure and sporting activities[2]. Importantly, disability is associated with a higher risk of early all-cause mortality[3]. It is thus important to identify risk factors of disability to implement targeted intervention.

One potential but understudied risk factor is problem gambling. Problem gambling may be defined as gambling that results in disruption or damage to oneself or one's family, or interference with one's daily life[4]. The estimated proportion of the global population with past 12-month problem gambling ranges from 0.1% to 5.8%[5]. This relatively high prevalence of problem gambling is of concern, as problem gambling has been found to be associated with multiple mental and physical health complications. For example, one study, in a large sample (N=10,056) of Canadian women (aged ≥15 years), found that those with problem gambling were more likely to report low general health, poor mental health (e.g., decreased psychological well-being, depression and suicidal attempts) and poor physical health (e.g., chronic bronchitis, fibromyalgia and migraine headaches)[6]. Other studies have found similar findings[7,8]. It is therefore feasible that problem gambling is associated with functional disability, but to our knowledge, no study has investigated this association to date. Problem gambling may be associated with functional disability through multiple mental and physical health problems[6].

Moreover, it is possible that problem gambling is associated with functional disability via a reduction in daily activities and an increase in sedentary behavior, specifically for those who partake in online gambling which has increased over recent decades[9,10].

Given this background, the aim of the present study was to investigate the association between problem gambling and functional disability in a sample of 6,941 UK adults. We hypothesized that at-risk problem gambling and problem gambling would be positively associated with having functional disability.

Methods

Study participants

This study used data from the 2007 Adult Psychiatric Morbidity Survey (APMS). Details on this survey has been previously published[11-13]. To summarize, the APMS survey was a nationally representative survey of adults aged ≥16 years living in private households in England. The survey fieldwork was undertaken by the National Center for Social Research and Leicester University between October 2006 and December 2007. A multistage stratified probability sampling design was used with the sampling frame consisting of the small user postcode address file and the primary sampling units corresponding to postcode sectors. Face-to-face interviews were conducted to obtain participant information, while some data were self-completed with the use of a computer. Sample weights were constructed to obtain a nationally representative sample, and these weights accounted for non-response and the probability of being selected. The response rate of the survey was 57%. Finally, informed consent was obtained for all participants, and ethical permission for the study was obtained from the Royal

Free Hospital and Medical School Research Ethics Committee. The flow chart of the study participants is displayed in **Figure 1**.

Variables

Functional disability (dependent variable)

Functional disability was defined as at least one difficulty in one of seven activities of daily living (ADL) and instrumental activities of daily living (IADL). ADL and IADL corresponded to: (a) personal care such as dressing, bathing, washing, or using the toilet; (b) getting out and about or using transport; (c) medical care such as taking medicines or pills, having injections or changes of dressing; (d) household activities like preparing meals, shopping, laundry and housework; (e) practical activities such as gardening, decorating, or doing household repairs; (f) dealing with paperwork, such as writing letters, sending cards or filling forms; and (g) managing money, such as budgeting for food or paying bills.

Problem gambling (independent variable)

A self-completed questionnaire based on the 10 DSM-IV diagnostic criteria for pathological gambling was used to assess problem gambling[14,15]. DSM-IV diagnostic criteria for pathological gambling were the following: (a) preoccupation with gambling (e.g., preoccupied with reliving past gambling experiences or planning the next venture, or thinking of ways to get money with which to gamble); (b) need to gamble with increasing amounts of money to achieve the desired excitement; (c) repeated unsuccessful efforts to control, cut back, or stop gambling; (d) restless or irritable feeling when attempting to cut down or stop gambling; (e) gambling as a way of escaping from problems or relieving feelings of helplessness, guilt, anxiety or depression; (f) return gambling another day to get even after losing money gambling; (g) lying to family members, therapists, or to others to conceal the extent of involvement with

gambling; (h) committing illegal acts such as forgery, fraud, theft, or embezzlement to finance gambling; (i) jeopardizing or losing a significant relationship, job, or educational or career opportunity because of gambling; and (j) relying on others to provide money to relieve a desperate financial situation caused by gambling. The diagnosis of problem gambling relied on two steps. In the first step, participants were asked if money had been spent on gambling in the previous year, and the 10-item questionnaire was administered to those who answered "yes". Following a previous APMS study[15], no problem gambling, at-risk problem gambling, and problem gambling corresponded to 0, 1-2, and $\geq$3 criteria, respectively. Problem gambling was included as a 2-category (no problem gambling versus at-risk problem gambling/problem gambling) and a 3-category variable (no problem gambling, at-risk problem gambling, and problem gambling) in the descriptive and inferential analyses, respectively.

Control variables

Sociodemographic factors. Sociodemographic factors included sex (male or female), age (years), ethnicity (British White or Other), marital status (married/cohabiting or single/separated/divorced/widowed), qualification (having a qualification [i.e., degree, no degree, advanced-level, General Certificate of Secondary Education, and other]: yes or no), employment (yes or no), and income (sex-equivalized income tertiles; high $\geq$£29,826, middle £14,057–<£29,826 and low <£14,057).

Smoking status. Smoking status was assessed using the following question: "Have you ever smoked a cigarette?". Respondents were dichotomized as never and past/current smokers.

Alcohol dependence. Excessive alcohol consumption was screened using the Alcohol Use Disorders Identification Test (AUDIT)[16], and alcohol dependence was assessed with the Severity of Alcohol Dependence Questionnaire (SADQ-C) in participants with an AUDIT score of $\geq$10 [17]. Alcohol dependence in the past six months was defined as a SADQ-C score of $\geq$4.

Drug use. Drug use corresponded to the use of at least one of the following drugs in the past year: cannabis, amphetamines, cocaine, crack, ecstasy, heroin, acid or LSD, magic mushrooms, methadone, tranquilizers, amyl nitrite, anabolic steroids, and glues.

Chronic physical conditions. Chronic physical conditions included allergies, arthritis, asthma, bladder problems or incontinence, bone, back, joint or muscle problems, bowel or colon problems, bronchitis or emphysema, cancer, cataract or eyesight problems, diabetes, ear or earing problems, epilepsy, heart attack or angina, high blood pressure, infectious disease, liver problems, migraine or frequent headaches, skin problems, stomach ulcer or other digestive problems, and stroke. These conditions had to be diagnosed by a physician or another health professional, and to be present in the previous 12 months. The number of chronic physical conditions was included as a continuous variable in the analyses.

Depression and anxiety disorder. The presence of depression and anxiety disorder in the past week was assessed using the Clinical Interview Schedule Revised (CIS-R). Anxiety disorder included generalized anxiety disorder, panic disorder, phobia, and obsessive-compulsive disorder.

Statistical analyses

Differences in the sample characteristics by problem gambling and functional disability status were tested with Chi-squared tests for all variables except age and the number of chronic physical conditions (Student's t-tests). Differences by problem gambling status in the prevalence of functional disability, the distribution of the number of difficulties in ADL and IADL, and the prevalence of difficulties in individual ADL and IADL were further studied using Chi-squared tests. Problem gambling was used as a 2-category variable in the descriptive analyses because the number of participants with problem gambling was too small (i.e., N=41) and stable estimates could not be obtained. Finally, the association between at-risk problem

gambling/problem gambling and functional disability was investigated using four regression models. Model 1 was adjusted for sex, age, ethnicity, marital status, qualification, employment, and income. Model 2 was adjusted for factors in Model 1 and smoking status, alcohol dependence and drug use. Model 3 was adjusted for factors in Model 2 and the number of chronic physical conditions. Finally, Model 4 was adjusted for factors in Model 3 and depression and anxiety disorder. Given that there were around 21% of missing values for income, a missing category was included for this variable in the regression models. Results from the logistic analyses are presented as odds ratios (ORs) and 95% confidence intervals (CIs). The sample weighting and the complex study design were taken account in all analyses. The level of statistical significance was set at p-value<0.050. The statistical analyses were performed with R 3.6.2 (The R Foundation)[18].

Results

This study included 6,941 adults aged ≥16 years (51.2% women; mean [standard deviation] age 46.3 [18.6] years; **Table 1**). The prevalence of at-risk problem gambling/problem gambling and functional disability was 3.3% and 32.5%, respectively. Male sex, younger age, single/separated/divorced/widowed, no qualification, quit/current smoking, alcohol dependence, drug use, and anxiety disorder were more frequent in adults at risk for or with problem gambling than in those without problem gambling (p-values<0.050). The prevalence of functional disability was significantly higher in the at-risk problem gambling/problem gambling group than in the no problem gambling group (46.2% versus 32.1%, p-value<0.001). In addition, the proportion of individuals with 1-2 (29.1% versus 20.8%) and ≥3 difficulties in ADL/IADL (17.1% versus 11.2%) was significantly higher in those at risk for or with problem gambling than in those without problem gambling (p-value<0.001; **Figure 2**). In terms of

individual ADL and IADL, difficulties with personal care (12.6% versus 7.4%, p-value=0.005), with dealing with paperwork (23.5% versus 12.6%, p-value<0.001), and with managing money (21.5% versus 8.9%, p-value<0.001) were significantly more common in the at-risk problem gambling/problem gambling group than in the no problem gambling group (**Table 2**). Finally, the results of the logistic regression models are displayed in **Table 3**. At-risk problem gambling (OR=1.81, 95% CI=1.22-2.66) and problem gambling (OR=3.83, 95% CI=1.65-8.89) were positively and significantly associated with functional disability in the model adjusted for sociodemographic factors only. These results remain significant for both at-risk problem gambling (OR=1.55, 95% CI=1.03-2.35) and problem gambling (OR=3.05, 95% CI=1.09-8.52) in the fully adjusted model (i.e., the model adjusted for sex, age, ethnicity, marital status, qualification, employment, income, smoking status, alcohol dependence, drug use, the number of chronic physical conditions, depression, and anxiety disorder).

Discussion

In the present nationally representative sample of UK adults, about one third of the sample reported functional disability, and around 3% reported at-risk problem gambling/problem gambling. Furthermore, it was observed that at-risk problem gambling and problem gambling were both positively and significantly associated with functional disability after adjusting for a wide range of potential confounders (i.e., sex, age, ethnicity, marital status, qualification, employment, income, smoking status, alcohol dependence, drug use, the number of chronic physical conditions, depression, and anxiety disorder).

Findings from the present study support previous research that have showed that problem gambling is associated with several negative health outcomes[6-8]. Moreover, findings from this

study add to previous literature through suggesting for the first time that there is a significant association between problem gambling and functional disability.

Problem gambling may be associated with functional disability through several pathways. First, as mentioned previously, problem gambling is associated with multiple detrimental health outcomes[6] that are also associated with a higher risk of functional disability. For example, problem gambling is associated with higher levels of stress and depression[19,20], and stress and depression are associated with higher levels of functional disability[21,22]. Interestingly, in the present study, the inclusion of depression and anxiety disorder in the regression analyses was associated with a substantial decrease in the strength of the association between problem gambling and functional disability (i.e., the OR decreased from 3.50 to 3.05). Second, it is feasible that online gambling is associated with excessive time spent sedentary[23], and this in turn can lead to functional disability[24] via triggering downregulation of certain biomechanical, physiological, and neurological parameters, which might preface reductions in physical function[25]. Third, those who suffer from problem gambling are more likely to be from a lower socio-economic status (SES)[26] and those from a lower SES are more likely to suffer from functional disability[27], potentially via an unfavorable lifestyle behavior profile[28,29]. However, it should be noted that the present study did control for proxy measures of SES (i.e., qualification, employment and income). Fourth, those experiencing problem gambling may be less likely to invest in their health (e.g., partake in physical activity, consume a healthy diet, or visit a medical practitioner when needed) as they may want to invest more time in gambling and therefore increasing their risk of functional disability[30]. Finally, it is also plausible that those with functional disability may be more likely to develop gambling problems[31], and this may involve stress or depression. In this context, it is possible that the association between problem gambling and functional disability is bi-directional.

Findings from the present study suggest that intervention is needed to prevent the development of functional disability among people with problem gambling. An effective strategy to prevent against functional disability is the promotion of physical activity[32]. Interestingly, in addition to physical activity, interventions improving functional disability have also been utilized as way in which to manage problem gambling[33]. Second, it is important to prevent the occurrence of chronic physical and mental disorders in the problem gambling population, while one key measure is to provide adequate management and treatment for these disorders, in order to reduce their negative impact on functional status. It may be prudent to consider developing policies to implement initiatives and interventions in this population to not just focus on problem gambling per se but also to implement lifestyle change (e.g., promotion of physical activity, promotion of breathing exercises to improve mental health) to aid in the prevention of functional disability. In light of the COVID-19 pandemic, reports have been produced to suggest that levels of gambling online may have indeed increased in the UK[34]. It may now be more prudent than ever before to implement such interventions and initiatives. In terms of future research, studies of longitudinal nature are warranted to corroborate these findings. Besides, more data is needed to elucidate the mechanisms of the association between problem gambling and functional disability.

Strengths of the present study include the large sample size and the use of nationally representative data. However, findings of the present study must be interpreted in light of its limitations. First, there are slight differences in terms of the definition of problem gambling between the fourth and the fifth edition of the DSM (e.g., illegal acts have been replaced from the definition in the fifth edition), and this may have impacted the study results. Second, difficulties in ADL and IADL were used as a proxy for functional disability in this study,

despite the fact that disability is a relatively complex concept. Third, there was no data on physical activity, and therefore we could not investigate the influence of physical activity in the problem gambling-functional disability relationship. Finally, the study was cross-sectional in nature, and it is not known whether problem gambling or risk precedes functional disability or whether functional disability precedes problem gambling.

In conclusion, in this large representative sample of UK adults, problem gambling or risk was associated with a higher odds of functional disability. Future research of a longitudinal nature is now required to determine the direction of the association. If confirmed with longitudinal studies, our study results suggest that those who suffer from problem gambling should receive targeted intervention to aid in the prevention of functional disability and wider literature suggests that such interventions may be best to utilize physical activity.

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Table 1

Sample characteristics (overall and by problem gambling and functional disability status)

Characteristics	Category	Overall (N=6,941)	Problem gambling			Functional disability		
			No (N=6,728)	At-risk problem gambling/problem gambling (N=213)	P-value[a]	No (N=4,341)	Yes (N=2,600)	P-value[a]
Sex	Male	48.8	47.9	74.6	<0.001	49.7	46.9	0.047
	Female	51.2	52.1	25.4		50.3	53.1	
Age	Mean (SD)	46.3 (18.6)	46.5 (18.6)	41.5 (18.8)	0.001	42.4 (16.8)	54.4 (19.6)	<0.001
Ethnicity	British White	85.2	85.3	80.5	0.106	84.3	87.0	0.033
	Other	14.8	14.7	19.5		15.7	13.0	
Marital status	Married/cohabiting	62.8	63.2	51.0	0.002	65.9	56.3	<0.001
	Single/separated/divorced/widowed	37.2	36.8	49.0		34.1	43.7	
Qualification	No	23.9	23.6	35.3	<0.001	17.1	38.1	<0.001
	Yes	76.1	76.4	64.7		82.9	61.9	
Employment	No	39.4	39.6	33.2	0.077	29.4	60.2	<0.001
	Yes	60.6	60.4	66.8		70.6	39.8	
Income	High	36.1	36.3	31.3	0.062	42.5	22.7	<0.001
	Middle	32.3	32.4	27.2		32.7	31.4	
	Low	31.6	31.3	41.4		24.8	45.9	
Smoking status	Never	35.0	35.3	26.3	0.022	37.2	30.3	<0.001
	Quit/current	65.0	64.7	73.7		62.8	69.7	
	No	92.3	92.7	78.8		92.1	92.6	

					P-value[a]			P-value[a]
Alcohol dependence	Yes	7.7	7.3	21.2	<0.001	7.9	7.4	0.522
Drug use	No	90.8	91.1	81.4	<0.001	90.8	90.7	0.882
	Yes	9.2	8.9	18.6		9.2	9.3	
Number of chronic physical conditions	Mean (SD)	1.3 (1.5)	1.3 (1.5)	1.4 (1.5)	0.483	0.9 (1.1)	2.2 (1.9)	<0.001
Depression	No	97.1	97.1	96.5	0.597	99.0	93.1	<0.001
	Yes	2.9	2.9	3.5		1.0	6.9	
Anxiety disorder	No	93.4	93.6	86.6	<0.001	96.8	86.2	<0.001
	Yes	6.6	6.4	13.4		3.2	13.8	

Abbreviations: SD standard deviation; DSM Diagnostic and Statistical Manual of Mental Disorders; ADL activity of daily living; and IADL instrumental activity of daily living.

Data are percent unless otherwise specified.

Problem gambling was assessed using a questionnaire based on the 10 DSM-IV diagnostic criteria for pathological gambling, and it was used as a dichotomous variable in the descriptive analyses (no problem gambling and at-risk problem gambling/problem gambling).

Functional disability was defined as the presence of at least one difficulty in seven ADL and IADL.

[a] P-values were based on chi-squared tests except for age and the number of chronic physical conditions (Student's t-tests).

Table 2

Differences by problem gambling status in difficulties in individual activities of daily living

and instrumental activities of daily living

Variable	No problem gambling	At-risk problem gambling/problem gambling	P-value[a]
Difficulties with personal care such as dressing, bathing, washing, or using the toilet	7.4	12.6	0.005
Difficulties with getting out and about or using transport	10.6	13.4	0.169
Difficulties with medical care such as taking medicines or pills, having injections or changes of dressing	2.9	3.5	0.636
Difficulties with household activities like preparing meals, shopping, laundry and housework	11.1	14.7	0.119
Difficulties with practical activities such as gardening, decorating, or doing household repairs	21.4	25.8	0.140
Difficulties with dealing with paperwork, such as writing letters, sending cards or filling forms	12.6	23.5	<0.001
Difficulties with managing money, such as budgeting for food or paying bills	8.9	21.5	<0.001

Abbreviation: DSM Diagnostic and Statistical Manual of Mental Disorders.
Data are percentages unless otherwise stated.
Problem gambling was assessed using a questionnaire based on the 10 DSM-IV diagnostic criteria for pathological gambling, and it was used as a dichotomous variable in the descriptive analyses (no problem gambling and at-risk problem gambling/problem gambling).
[a] P-values were based on chi-squared tests.

Table 3

Association between at-risk problem gambling/problem gambling and functional disability estimated by adjusted logistic regression models
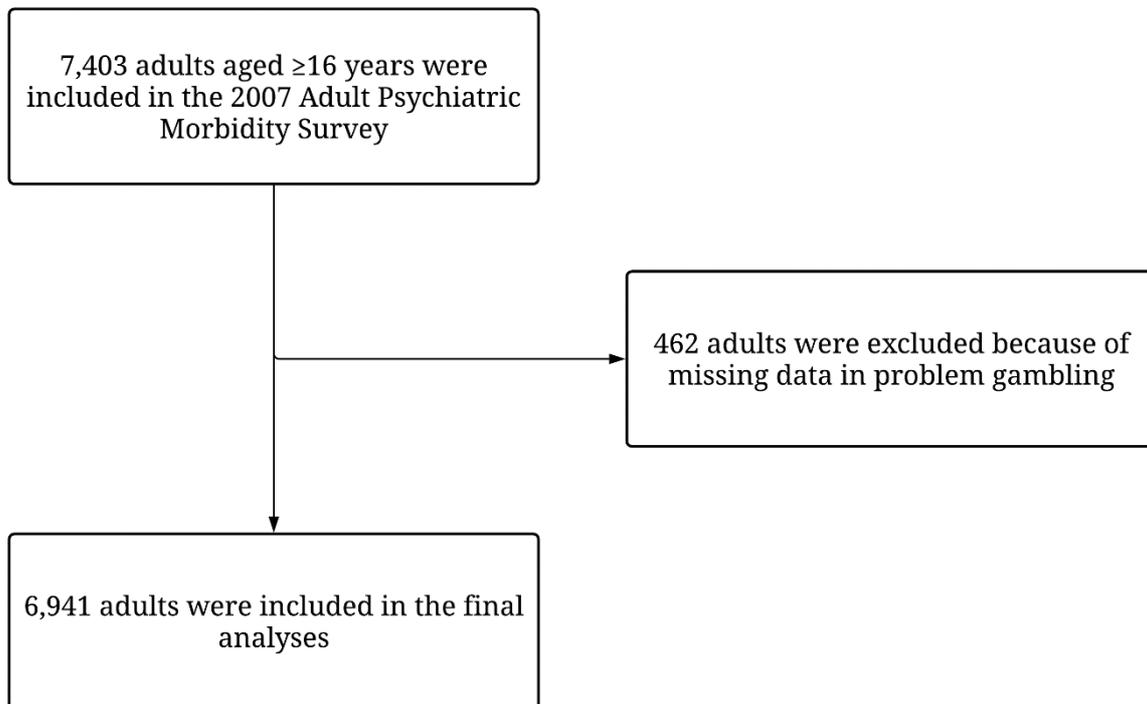
Regression models	Problem gambling	OR	95% CI	P-value
Model 1 (adjusted for sex, age, ethnicity, marital status, qualification, employment, and income)	At-risk	1.81	[1.22,2.66]	0.003
	Problem gambling	3.83	[1.65,8.89]	0.002
Model 2 (adjusted for factors in Model 1 and smoking status, alcohol dependence and drug use)	At-risk	1.70	[1.15,2.51]	0.008
	Problem gambling	3.53	[1.54,8.09]	0.003
Model 3 (adjusted for factors in Model 2 and the number of chronic physical conditions)	At-risk	1.54	[1.01,2.35]	0.045
	Problem gambling	3.50	[1.40,8.76]	0.008
Model 4 (adjusted for factors in Model 3 and depression and anxiety disorder)	At-risk	1.55	[1.03,2.35]	0.038
	Problem gambling	3.05	[1.09,8.52]	0.035

Abbreviations: OR odds ratio; CI confidence interval; DSM Diagnostic and Statistical Manual of Mental Disorders; ADL activity of daily living; and IADL instrumental activity of daily living.

Problem gambling was assessed using a questionnaire based on the 10 DSM-IV diagnostic criteria for pathological gambling, and it was used as a three-category variable in the inferential analyses (no problem gambling, at-risk problem gambling and problem gambling).
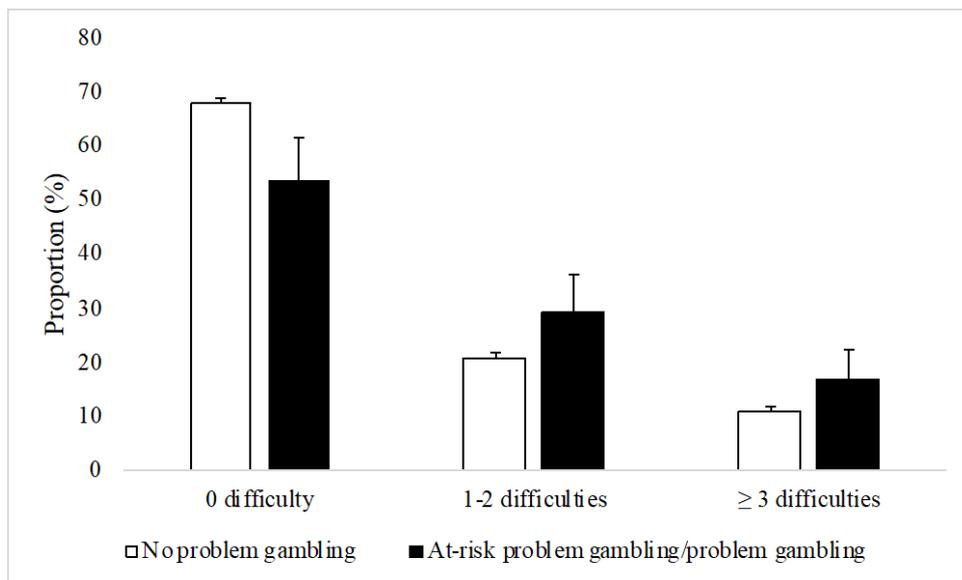
Functional disability was defined as the presence of at least one difficulty in seven ADL and IADL.

The association between problem gambling and functional disability was assessed with four adjusted logistic regression models. The fully adjusted model (Model 4) included sex, age, ethnicity, marital status, qualification, employment, income, smoking status, alcohol dependence, drug use, the number of chronic physical conditions, depression, and anxiety disorder. Given that there were around 21% of missing values for income, a missing category was included for this variable in the regression models.

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┌─────────────────────────────┐
│ 7,403 adults aged ≥16 years were │
│ included in the 2007 Adult Psychiatric │
│       Morbidity Survey       │
└─────────────────────────────┘
               │
               │                    ┌──────────────────────────────┐
               ├───────────────────▶│ 462 adults were excluded because of │
               │                    │  missing data in problem gambling  │
               │                    └──────────────────────────────┘
               ▼
┌─────────────────────────────┐
│ 6,941 adults were included in the final │
│            analyses            │
└─────────────────────────────┘
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Figure 1

Flow chart of study participants

Figure 2

Number of difficulties in ADL and IADL by problem gambling status

Abbreviations: ADL activities of daily living; and IADL instrumental activities of daily living.
Problem gambling was assessed using a questionnaire based on the 10 DSM-IV diagnostic criteria for pathological gambling, and it was used as a dichotomous variable in the descriptive analyses (no problem gambling and at-risk problem gambling/problem gambling).
The number of difficulties in ADL and IADL was categorized into three groups (i.e., 0, 1-2 and ≥3 difficulties).
The distribution in the number of difficulties in ADL and IADL was significantly different between adults without problem gambling and those at risk for problem gambling or with problem gambling (chi-squared test p-value<0.001).
Bar represents upper end of 95% confidence interval.