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# Physical And Mental Health Indicators Among Recreational, Subclinical And Problem Gamblers

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**Abstract.** Purpose: To examine the physical and mental health of people with different levels of gambling involvement and to appraise whether gambling may be beneficial for older recreational gamblers as reported in previous studies. Methodology: Pooled data from the Health Survey of England and the Scottish Health Survey between 2012 and 2016 was analyzed (N=31448). Individuals were classified using the Problem Gambling Severity Index into non-gamblers, recreational (non-problem), low-risk, moderate-risk, and severe problems. Multinomial logistic regression was used to examine the associations between physical and mental health and gambling involvement group. Results: Compared to non-gamblers, rates of hazardous drinking and smoking were elevated for all levels of gambling involvement (e.g., hazardous drinking: recreational RRR=3.71,low-risk RRR=6.74, moderate-risk RRR=4.58, severe RRR=4.16). Obesity was elevated for moderate (RRR=1.56), and recreational gamblers (RRR=1.44), but not for severe problem gamblers (RRR=1.29). Compared to non-gamblers, recreational gamblers scored highest on sense of wellbeing (RRR=1.06) and severe problem gamblers scored lowest (RRR=0.46). Finally, the interaction

of age and gambling status was not significant, suggesting no health benefit from gambling for older adults. Conclusion: Long-term monitoring of health behaviors among gamblers and promotion of healthier lifestyle among recreational gamblers is indicated.

**Keywords**: Health Effects, Mental Health, Recreational Gambling, Obesity, Problem Gambling.

## Introduction

General population studies of gambling have found that a portion of the population who gamble develop gambling problems, and problem gambling is associated with a wide range of negative health risks including hazardous alcohol consumption, smoking, depression, anxiety, and obesity (Algren et al., 2015; Black et al., 2013; Bonnaire et al., 2017; Browne & Rockloff, 2018; Cook et al., 2015; Delfabbro et al., 2021; Ford & Håkansson, 2020; Lam & Mok, 2017; Mazar et al., 2018; Morasco et al., 2006a, 2006b; Okunna et al., 2016; Turner et al., 2008). Research on the health outcomes of gambling focuses on gambling problems (Humphreys et al., 2021), and the research literature on recreational gamblers, defined as individuals who gamble but do not report any problems related to their gambling, is relatively sparse (Mazar et al., 2018; Okunna et al., 2016).

Among the small number of studies on recreational gambling, some research has found that recreational gamblers exhibit several health consequences associated with gambling (Desai et al., 2004, 2007; Levens et al., 2005; Morasco et al., 2006a, 2006b; Stefanovics et al., 2023). Desai, et al., (2007) found that recreational gamblers were more likely to have nicotine dependence, alcohol use, obesity, and chronic health conditions. Levens et al., (2005) reported that binge drinking was identified as a significant predictor of both at-risk and recreational gambling in the elderly. Similarly, Stefanovics, Potenza, and Tsai (2023) reported that recreational gamblers were more likely to have a substance use disorder and more likely to have student loans, but otherwise were not different from non-gamblers. . However, some of these studies have classified people who scored in the sub-clinical range of gambling behaviours with non-problem recreational gambling behaviours, obfuscating their different risk profiles.

Gambino (2006) has argued that people with subclinical levels of gambling problems are not the same as non-problem recreational gamblers. Weinstock et al., (2017) and Butler et al., (2020) have shown that people with subclinical problems have more negative health consequences compared to people who score zero on measures of problem gambling. Conversely, compared to non-gamblers, recreational gamblers exhibit no significant differences in physical health and mental health but had higher levels of alcohol and tobacco consumption (Mazar et al., 2018). However, recreational gamblers reported lower odds of alcohol or tobacco use compared to at-risk gamblers. These results suggest that recreational gambling is not inherently associated with adverse health outcomes.

Similarly, Humphreys et al. (2021) reported that recreational gambling positively affects overall sense of wellbeing, as recreational gamblers have less stress and are more satisfied with life. Considered together, the results of Mazar et al. (2018) and Humphreys et al. (2021) suggest that recreational gambling can be thought of as "healthy gambling." In contrast the findings from Desai et al. (2004, 2007) and Morasco et al. (2006a) suggest that recreational gamblers do experience at least some harm, and prevention efforts would be appropriate to limit the harms associated with recreational gambling.

It is also possible that the harm associated with recreational gambling may be age graded. For instance, some studies suggest that gambling may actually be beneficial to older adults (Desai, 2004; Vander Bilt et al., 2004). In particular, higher levels of sense of wellbeing and lower levels of chronic physical illness have been found among older recreational gamblers. It is speculated that this may be due to increased physical and social activity among older recreational gamblers (Desai, 2004; Vander Bilt et al., 2004). These findings suggest that the association between gambling behaviors and sense of wellbeing may vary depending on age.

In this study, we classified gamblers into different groups using the problem severity gambling index to examine the associations between physical and mental health among non-gamblers, recreational gamblers, low-risk gamblers, moderate-risk gamblers, and severe problem gamblers. Based on the literature reviewed above, we developed three hypotheses. First, compared to non-gamblers, we hypothesize that recreational gamblers will have higher levels of obesity, cigarette smoking and higher levels of alcohol use and chronic health problems. Second, we hypothesize that the relative risk of these health outcomes will increase with the severity of gambling problems. Third, based on research demonstrating that age moderates the health outcomes of recreational gamblers (Desai et al., 2004; 2007), we hypothesize that there will be an interaction between age and gambling status (non-gambler vs. recreational gambler) for sense of wellbeing and for physical health outcomes (any chronic condition vs none).

## Methods

### Data

To test these hypotheses, we used three waves of pooled cross-sectional data from the 2012, 2014, 2016, Health Survey of England (HSE) and the Scottish Health Survey (SHeS). To ensure comparability between the samples, the HSE and the SHeS used the same data collection procedures, and all surveys used a complex sampling design that were weighted to match the population distribution of England and Scotland for adults (aged 16+) (NatCen Social Research, Scottish Centre for Social Research 2018; Scottish Centre for Social Research, NatCen Social Research, 2015, 2018; Wardle, 2015; Wardle et al., 2014; Churchill &

Farrell, 2018). The HSE began in 1991 and is an annual survey of the people of England, which focuses on health and lifestyle. The SHeS started in 1995 to measure the health of the population of Scotland, with subsequent surveys conducted in 1998, 2003 and 2012 (Churchill & Farrell, 2018). Gambling variables were first included in these surveys in 2012, and the same set of gambling variables and covariates were available in the 2012, 2014, and 2016 waves for both surveys.

These surveys were appended to create one larger data set, which provided us with sufficient power to analyse people with moderate and severe gambling problems as separate groups. This is preferred because the cut-off for severe problem gambling was designed to match a diagnosis of pathological gambling (Ferris & Wynne, 2001) and clinical cases are typically at the severe end of gambling problems (Milic et al., 2022; Ronzitti et al., 2017). The analytic sample for the current study consisted of N=31,448, individuals with response data to gambling-related questions and complete covariate information.

The consent form and consent for publication were provided with the original questionnaire and can be found on the website for the original data sets (NatCen Social Research, Scottish Centre for Social Research 2018; Scottish Centre for Social Research, NatCen Social Research, 2015, 2018). This secondary analysis was reviewed and approved by the research ethics committees of the Centre for Addiction and Mental Health as study 113/2021 and University of Manchester as study (2022-14784-25365).

**Measures**

Problem gambling was measured using the Problem Gambling Severity Index (PGSI), a validated and widely used measure of problem gambling behavior (Ferris & Wynne, 2001; Holtgraves, 2009; Miller et al., 2013). Consistent with other studies using the PGSI (Delfabbro et al., 2021; Tseng et al., 2023), traditional PGSI cut-offs were used to classify low gambling problems (1-2), moderate gambling problems (3-7), and severe gambling problems (8+). Individuals who did not report gambling in the past year were classified as non-gamblers, while individuals who participated in at least 1 form of gambling but scored 0 on the PGSI were classified as recreational gamblers.

Two variables had large numbers of missing values: obesity (11%) and sense of wellbeing (13%). For obesity, which was a categorical variable, missing was included as a category in the analysis. For sense of wellbeing, which was a continuous variable, we used a mean substitution for the multivariate analysis. The treatment of missing values improved the power of the other variables being analysed, but did not change the effect of sense of wellbeing or obesity. The other variables had at most 2% missing values.

Age (16-24, 25-34, 35-44, 45-54, 55-64, 65+ years), sex (female, male), and survey country (England, Scotland) were included as sociodemographic covariates. Health covariates included self-reported

hypertension (no, yes), diabetes (no, yes), and obesity (body mass index (BMI) ≥ 30, < 30, missing), based on self-reported height and weight. In addition, the survey included a chronic health complaints questionnaire consisting of 13 questions on physical health complaints physical health (see Supplementary Files and Table S1 for details) and 1 question on mental health problems. A preliminary analysis found only trivial effects of the 13 physical health variables (see Supplementary Files and Table S1 for details)[i]. These physical health variables were combined into a single any chronic physical health complaint variable (no, yes) to test for an interaction of chronic conditions and age as reported by Desai et al., (2007). In addition, cigarette smoking status was measured as never, former or current smoking, while alcohol consumption was coded as non-drinker, moderate-risk drinker (men up to 21 per week / women up to 14 per week), hazardous/harmful drinking (men over 21 / women over 14). The cut off between moderate and harmful was based on the low-risk drinking guidelines in practice when the data was collected (Institute of Alcohol Studies, 2020).

In addition, sense of wellbeing was measured with the Warwick-Edinburgh Wellbeing Scale (WEMWBS), a validated continuous scale with higher scores reflecting higher levels of sense of wellbeing (Tennant et al., 2007). In the current data, the WEMWBS items had a Cronbach alpha of .92 suggesting a high degree of internal consistency. According to the Scottish Government, "Mental wellbeing is our internal positive view that we are coping well psychologically with the everyday stresses of life and can work productively and fruitfully." (Minister for Social Care, Mental Wellbeing and Sport, 2023).

**Statistical Analysis**

Weighted descriptive statistics were calculated for the sample and then prevalence estimates were calculated for the PGSI problem gambling categories. Multivariable multinomial logit models were then estimated to examine the covariates associated with the severity of problem gambling groups, with the non-gambling group serving as the reference in the main analysis. Test statements were then used to assess significant differences between the other PGSI groups, where applicable. To test our third hypothesis, and to replicate the results of Desai et al. (2004, 2007), we conducted an analysis of variance on sense of wellbeing as the dependent variable and age categories (less than 55 vs greater than 55) and gambling group (non-gambler vs. recreational gambler) as the independent variables. Moreover, we used logistic regression models on physical health complaints (any vs. none) as the dependent variable and age categories (less than 55 vs greater than 55), gambling group (non-gambler vs. recreational gambler) and an interaction term as the independent variables.

A series of sensitivity test were also included in the analyses. First, Currie et al. (2013) proposed an alternative scoring scheme (0 = no risk, 1-4 = low-risk, 5-7 = moderate-risk, 8+ = high risk) for the PGSI instrument.

To ensure the results were not sensitive to different cut-offs, the models were estimated using Currie's scoring scheme. A second sensitivity test was conducted to determine if the results for recreational gamblers was related to the type of game played. To test this possibility, we computed a variable contrasting people who only played lottery games (major lottery, instant lottery, other lotteries) coded as 0 compared to people who participated in at least one of the other types of game (EGMs, Table games, online gambling, bingo etc.) who were coded as 1. This lottery only vs. participation in any other game was used as a dependent variable with the same independent variables as the previous multinomial logistic regression. As a third sensitivity test, we tested the interaction of the health variable and sense of wellbeing effects using 65 and older to define the older group (as was the case in Desai et al., 2004, 2007).

Most of the analyses were conducted using Stata software, version 16.1., and used the complex sampling weights designed for the PGSI outcome measure in the appended data set. The analysis of variance for sense of wellbeing was conducted using SPSS version 27.

**Results**

Table 1 displays the sample characteristics for adults (aged 16+) from 2012 to 2016. Respondents in the analytic sample were slightly more likely to be female (51.1%), ranged from 16 to 99 years of age with an average of 46.5 years and were most likely to be from England (91.0%). Approximately one-quarter of respondents had a BMI of 30 $kg/m^2$ or more (23.3%), 6.5% reported having diabetes, 10.3% reported high blood pressure, and 37.7% reported having at least one physical health problem. Approximately half of the respondents reported never smoking cigarettes (51.5%), while 30.3% reported former smoking and 18.1% reported current cigarette smoking. Regarding weekly alcohol consumption, 65.0% reported moderate alcohol consumption while 19.8% reported hazardous/harmful drinking.

Table 1. Weighted Sociodemographic characteristics and health results of analytic sample (N= 31448), England and Scotland Household Survey (2012, 2014, 2016).

| Variables | N | %^ | 95% CI | |
|---|---|---|---|---|
| Sex | | | | |
| Female | 16055 | 51.1 | 50.4 | 51.7 |
| Male | 15393 | 48.9 | 48.3 | 49.6 |
| Age | | | | |
| 16-24 | 4085 | 13.0 | 12.4 | 13.6 |
| 25-34 | 5371 | 17.1 | 16.5 | 17.6 |
| 35-44 | 5241 | 16.7 | 16.2 | 17.2 |
| 45-54 | 5569 | 17.7 | 17.2 | 18.2 |
| 55-64 | 4585 | 14.6 | 14.1 | 15.0 |
| 65+ | 6598 | 21.0 | 20.5 | 21.5 |
| Country | | | | |
| England | 28602 | 91.0 | 90.7 | 91.2 |
| Scotland | 2846 | 9.0 | 8.8 | 9.3 |
| Obesity | | | | |
| No | 20379 | 64.8 | 64.1 | 65.5 |
| Yes | 7330 | 23.3 | 22.7 | 23.9 |
| Missing | 3739 | 11.9 | 11.5 | 12.3 |
| Diabetes | | | | |
| No | 29401 | 93.5 | 93.2 | 93.8 |
| Yes | 2047 | 6.5 | 6.2 | 6.8 |
| High Blood Pressure | | | | |
| No | 23956 | 76.2 | 75.6 | 76.7 |
| Yes | 7492 | 23.8 | 23.3 | 24.4 |
| Physical Health Problem | | | | |
| No | 19750 | 62.8 | 62.1 | 63.5 |
| Yes | 11698 | 37.2 | 36.5 | 37.9 |

| | | | | |
|---|---|---|---|---|
| Weekly Drinking Behavior | | | | |
| Non-drinker | 4791 | 15.2 | 14.7 | 15.7 |
| Moderate drinking | 20441 | 65.0 | 64.3 | 65.7 |
| Hazardous/harmful drinking | 6216 | 19.8 | 19.2 | 20.3 |
| Smoking Status | | | | |
| Never smoker | 16204 | 51.52 | 50.83 | 52.22 |
| Former smoker | 9562 | 30.40 | 29.79 | 31.03 |
| Current smoker | 5683 | 18.07 | 17.53 | 18.62 |
| Wellbeing (mean, sd) | 28867 | 51.0 (8.7) | 50.9 | 51.2 |

Note: Prevalence estimates were calculated using the PGSI weight. Sample size was *N= 31448 after mean substitution for Wellbeing.*

More than half of respondents from England and Scotland reported engaging in recreational gambling during the past year (55.8%), and 39.9% reported not gambling. A smaller percentage reported engaging in low-risk (2.8%), moderate-risk (1.1%) or severe problem gambling (0.45%) behaviors (Table 2). In terms of types of gambling behaviors, tickets to the national lottery (46.5%), scratch cards (20.8%), and other lottery tickets, including tickets for charity (14.5%) were the most prevalent types of gambling.

Multivariate multinomial regression models were then used to predict factors associated with the different PGSI gambling groups (Table 3), presented as Relative Risk Ratios (RRR) with 95% confidence intervals. All analyses controlled for the effects of sex, categorical age, and country, with non-gamblers serving as the referent group. All levels of gambling were more likely to be male from RRR = 1.21 (95% CI 1.14, 1.29) for recreational gamblers to RRR = 9.1 (95% CI 5.1, 16.2) for gamblers with severe problems. Similarly, compared to non-gamblers, all levels of gambling were higher for people in all age groups between 25 to 54 years, and the effects were strongest for people with moderate and severe problems in the 25 to 34 years age bracket.

For moderate gambling problems, all age groups were significant, and for people with severe gambling problems, all age groups except for the 55-64 years age group, were significant. For country, the only significant effect was for recreational gamblers who had 1.33 higher risk of being from Scotland than England, but this effect is trivial.

Sense of wellbeing, measured as a continuous variable, was significantly associated with all PGSI gambling groups, with higher sense of wellbeing scores for recreational gamblers, (RRR = 1.06, 95% CI: 1.02 to 1.11), and lower sense of wellbeing scores for low-risk, moderate-risk, and severe gambling problems, compared to non-problem gamblers. The largest effect size was observed for severe problem gamblers, compared to non-problem gamblers (RRR = 0.44 CI 0.37, 0.58). Effect sizes between each group from the univariate analyses are provided in the supplementary files (Table S2). The contrast of non-gamblers and recreational gamblers had a very small effect size, d = -.04, whereas the contrast of recreational gamblers and severe problem gamblers had a large effect size, d = .92. Compared to non-gamblers, recreational gamblers (first column) had a higher risk of being classified as obese, (RRR=1.44, CI 1.34, 1.56) and risk of diabetes (RRR=1.15, CI 1.02, 1.30). Moreover, recreational gamblers were more likely than non-gamblers to report hazardous/harmful drinking (RRR=3.71, 95% CI 3.34, 4.12) and were more likely to report former (RRR=1.29, 95% CI 1.21, 1.38) and current cigarette smoking (RRR=1.53, 95% CI 1.40, 1.67).

Compared to non-gamblers, people with severe gambling problems had higher rates of being a current smoker (RRR = 2.32, 95% CI 1.34, 4.00), and were more likely to engage in hazardous/harmful drinking, (RRR =

4.16, 95% CI 1.91, 9.07). The same pattern of results for people with severe problems was also true for low-risk and moderate-risk gamblers. The odds ratio for obesity was also significant among low-risk (RRR = 1.35, 95% CI 1.07, 1.71), and moderate-risk gamblers (RRR = 1.56, 95% 1.10, 2.22). In terms of physical health, the composite of the 13 medical complaints had no overall significant effect. Similarly, high blood pressure was not significant.

Table 2. Prevalence of problem gambling using Problem Gambling Severity Index (PGSI), using traditional scoring (*N* = *31448*); Household Survey England and Scotland (2012, 2014, 2016)

| *PGSI Category* | *PGSI Score* | *N* | % | 95% CI | |
|---|---|---|---|---|---|
| Non-gamblers | 0 | 12537 | 39.87 | 39.18 | 40.55 |
| Recreational gamblers | 0 | 17562 | 55.84 | 55.15 | 56.54 |
| Low risk | 1 to 2 | 870 | 2.77 | 2.53 | 3.02 |
| Moderate risk | 3 to 7 | 338 | 1.08 | 0.93 | 1.24 |
| Severe problem | 8 to 27+ | 142 | 0.45 | 0.36 | 0.57 |

Note: Prevalence estimates were calculated using the PGSI weight

Table 3
Multinomial regression of demographics variables onto demographic, health and mental health indicators using traditional scoring (*N* = 31448).

| | Recreational | | | | Low Risk | | | | Moderate Risk | | | | Severe | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | RRR | 95% CI | | | RRR | 95% CI | | | RRR | 95% CI | | . | RRR | 95% CI | | |
| Male | 1.21 | 1.14 | 1.29 | *** | 3.95 | 3.23 | 4.84 | *** | 4.03 | 2.86 | 5.69 | *** | 9.08 | 5.10 | 16.17 | *** |
| Age | | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16-24 | 0.93 | 0.79 | 1.03 | | 7.93 | 5.35 | 11.75 | *** | 10.02 | 5.17 | 19.40 | *** | 5.85 | 1.80 | 18.99 | ** |
| 25-34 | 1.48 | 1.32 | 1.66 | *** | 7.07 | 4.90 | 10.20 | *** | 10.15 | 5.61 | 18.36 | *** | 9.78 | 3.25 | 29.46 | *** |
| 35-44 | 1.58 | 1.40 | 1.73 | *** | 3.37 | 2.30 | 4.92 | *** | 6.41 | 3.47 | 11.82 | *** | 4.85 | 1.76 | 13.38 | ** |
| 45-54 | 1.41 | 1.27 | 1.55 | *** | 2.92 | 2.01 | 4.24 | *** | 3.34 | 1.71 | 6.53 | *** | 4.26 | 1.63 | 11.14 | ** |
| 55-64 | 1.35 | 1.22 | 1.49 | *** | 2.00 | 1.35 | 2.95 | ** | 2.15 | 1.14 | 4.07 | * | 3.13 | 1.18 | 8.33 | * |
| 65+ | Ref | | | | Ref | | | | Ref | | | | Ref | | | |
| Scotland | 1.32 | 1.25 | 1.40 | *** | 1.08 | 0.90 | 1.31 | | 1.19 | 0.89 | 1.57 | | 1.26 | 0.84 | 1.90 | |
| Obesity | | | | | | | | | | | | | | | | |
| No | Ref | | | | Ref | | | | Ref | | | | Ref | | | |
| Yes | 1.44 | 1.34 | 1.56 | *** | 1.35 | 1.07 | 1.71 | * | 1.56 | 1.10 | 2.22 | * | 1.29 | 0.74 | 2.25 | |
| Missing | 1.08 | 0.98 | 1.18 | | 1.03 | 0.76 | 1.40 | | 1.16 | 0.70 | 1.90 | | 0.66 | 0.19 | 2.24 | |
| Diabetes | 1.15 | 1.02 | 1.30 | * | 0.91 | 0.58 | 1.42 | | 1.92 | 0.99 | 3.72 | | 0.97 | 0.39 | 2.40 | |
| High Blood Pressure | 1.05 | 0.97 | 1.13 | | 1.00 | 0.75 | 1.35 | | 1.41 | 0.95 | 2.09 | | 1.36 | 0.74 | 2.49 | |
| Physical Health | 0.99 | 0.93 | 1.06 | | 1.05 | 0.84 | 1.30 | | 0.79 | 0.56 | 1.13 | | 0.93 | 0.50 | 1.76 | |
| Wellbeing | 1.06 | 1.02 | 1.11 | ** | 0.74 | 0.66 | 0.83 | *** | 0.67 | 0.58 | 0.78 | *** | 0.46 | 0.37 | 0.58 | *** |
| Weekly Drinking Behavior | | | | | | | | | | | | | | | | |
| Non-drinker | Ref | | | | Ref | | | | Ref | | | | Ref | | | |
| Moderate drinking | 2.71 | 2.49 | 2.95 | *** | 3.44 | 2.43 | 4.86 | *** | 1.85 | 1.15 | 2.96 | ** | 1.88 | 0.94 | 3.74 | |
| Hazardous/harmful | 3.71 | 3.34 | 4.12 | *** | 6.74 | 4.64 | 9.80 | *** | 4.58 | 2.74 | 7.67 | *** | 4.16 | 1.91 | 9.07 | *** |
| Smoking Status | | | | | | | | | | | | | | | | |
| Never smoker | Ref | | | | Ref | | | | Ref | | | | Ref | | | |
| Former smoker | 1.29 | 1.21 | 1.38 | *** | 2.01 | 1.56 | 2.59 | *** | 1.62 | 1.11 | 2.37 | ** | 1.25 | 0.59 | 2.65 | |
| Current smoker | 1.53 | 1.40 | 1.67 | *** | 3.04 | 2.41 | 3.84 | *** | 2.47 | 1.70 | 3.59 | *** | 2.32 | 1.34 | 4.00 | * |

Note: Sample size was *N= 31448 after mean substitution for Wellbeing. N*on-gamblers are the reference category for gambler-group comparisons. * p < .05; ** p < .01*** p < .001; + p < .056.

**Age related health benefits**

As noted in the introduction, we tested for possible interactions between age (under 55 and 55 and over) and gambling status (recreational vs. non-gambler) on sense of wellbeing (see Table 4). Compared to young participants, older people had higher scores on sense of wellbeing, $F$ (1, 26413) = 47.9, $p < .001$, and recreational gamblers had slightly higher scores on sense of wellbeing than non-gamblers, $F$ (1, 26413) = 12.7, $p < .001$, however, the interaction was not significant, $F$ (1, 26413) = 1.45, p = .23. Similarly, we used logistic regression to test the interaction of age and gambling status on having any chronic physical disorder as the dependent variable (see Table 5). Older people reported more health problems compared to young people, OR = 4.3, p < .001, but no effect of recreational gambling and no interaction between age and gambler status. Additional tests for obesity, high blood pressure and diabetes found only one interaction effect: diabetes OR = 1.40, p < .01. Further analysis revealed that older recreational gamblers have slightly higher odds of diabetes than older non-gamblers, OR = 1.21, p < .01. For younger participants, there was no difference in diabetes between non-gamblers and recreational gamblers OR = .87, ns.

Table 4. Welling-being scores by age group for non-gambler vs. non-problem gambler.

| | N | Mean | SD | N | Mean | SD | N | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|
| Non-Gamblers | | | | Recreational | | | Total | | |
| < 55 | 6856 | 50.8 | 9.1 | 9910 | 51.0 | 8.1 | 16765 | 50.9 | 8.5 |
| 55 or older | 4174 | 51.4 | 9.3 | 5477 | 51.9 | 8.6 | 9652 | 51.7 | 8.9 |
| Total | 11030 | 51.0 | 9.2 | 15387 | 51.3 | 8.3 | | | |

Table 5. Percent of people reporting any of the 13 physical health complaints.

| | N | % | N | % |
|---|---|---|---|---|
| | Non-Gamblers | | Recreational | |
| young than 55 | 8031 | 25.0 | 11511 | 25.0 |
| 55 or older | 4815 | 59.2 | 6224 | 59.7 |

Note: see Table S1 for full list of complaints.

***Sensitivity analyses***

To ensure that our findings were not impacted by the PGSI cut-offs, we repeated our analyses using the alternative cut point for scoring moderate and low-risk gamblers (Table S3). The results were very similar, and the substantive interpretation was nearly identical, with one exception: in the models estimated with the revised scoring, moderate problem gamblers had significantly higher risk of high blood pressure and diabetes compared to non-gamblers.

Second, to test whether recreational gambling was impacted by the type of gambling, we compared recreational gamblers who only played lotteries to recreational gamblers who played a least one other game as an additional sensitivity test. Slightly more than half (53.0%) of the recreational gamblers participated only in lottery games. People who played games other than lotteries were more likely to be younger (RRR = 2.7, $p < .001$ for those 25 to 34 and RRR = 2.0, $p < .001$ for those 16 to 24) and more likely to be male (RRR = 1.4, $p < .001$). The only significant health related variable was that compared to those who only played lotteries, people who played more than just lotteries, were more likely to report harmful or hazardous drinking, 1.8, $p > .001$. Of note, obesity, sense of wellbeing, smoking, diabetes, and any physical disorder were not significantly different between participants who only played lotteries and those who participated in at least one of other type of game.

As a third sensitivity test, we tested for interactions between the health variables and age, using 65 and over to define age (65 and older vs. under 65). As with the analysis reported above there was no significant interaction between age and gambling status (non-gambler vs. non-problem gamblers) for sense of wellbeing, for physical health, high blood pressure or obesity and the interactive effect for diabetes was very similar to the above analysis.

**Obesity**

Probably the most interesting finding from the study was the relationship between obesity and gambling. As noted above, compared to non-gamblers, obesity was significantly higher among recreation, low risk and moderate risk gamblers, but did not reach significance for high-risk gamblers. To understand this effect better we computed correlations between obesity and type of game the player reported participating in. In addition, we computed the relationship between the type of game played and the player's score on the PGSI. The results are presented in Table 6. The correlations of obesity and game category used gamma correlations; the correlation between PGSI scores and obesity used Spearman correlations. BMI had the largest correlations with bingo, gamma = .21, $p < .001$, and lotteries, gamma = .19, $p < .001$, but negative correlations with casino games, gamma = -.19, $p < .001$ and other games, gamma = -.14, $p < .001$. In contrast PGSI scores were highly significant for all types of games, but the strongest links were for online gambling, rho = .36, $p < .001$, EGMs, rho = .34, $p < .001$, Casino games, rho = .27, $p < .001$, and sports gambling, rho = .27, $p < .001$,

*Table 6. The relationship between game played and obesity, and problem gambling scores.*

| Game Type | BMI >30 (n = 27786) | | PGSI (N = 28457) | |
|---|---|---|---|---|
| Bingo | 0.21 | *** | .11 | *** |
| Casino | -0.19 | *** | .27 | *** |
| EGM | 0.05 | * | .34 | *** |
| Lottery | 0.19 | *** | .13 | *** |
| Online Gambling | -0.01 | | .36 | *** |
| Sports and Racing | -0.02 | | .27 | *** |
| Other | -0.14 | *** | .25 | *** |

***Note: for BMI we used gamma correlations and for PGSI scores, spearman correlations.***

## Discussion

The purpose of this study was to examine the associations between physical and mental health outcomes and problem gambling severity, with particular focus on differences between recreational gamblers and non-gamblers. In particular it was hypothesized that, compared to non-gamblers, recreational gamblers will have higher levels of obesity, cigarette smoking and higher levels of alcohol use and chronic health problems. Consistent with this hypothesis, we found that recreational gamblers were more likely to smoke cigarettes and to engage in hazardous drinking compared to non-gamblers and less likely compared to low-risk, moderate-risk or severe gamblers. Consistent with previous research (Desai et al., 2004, 2007) recreational gamblers were at higher risk of cigarette smoking and heavy/hazardous drinking compared to those who do not gamble.

Our second hypothesis was that the relative risk of these health outcomes will increase with the severity of gambling problems. Consistent with the second hypothesis the rates of smoking and hazardous drinking were even higher for people with low, moderate and severe problem gambling behaviours. The higher rates of alcohol consumption and smoking among all levels of gamblers, is consistent with Weinstock et al., (2017) and Butler et al., (2020) who found that subclinical gambling problems (low-risk and moderate-risk) had higher rates of smoking and heavy drinking compared to non-gamblers. Perhaps it is the very social nature of gambling that occurs in places where people consume alcohol and until 2007, could smoke (Thompson, 2015). However not all health effects increased with gambling severity. In addition, there was no overall effect of physical illness, and very few significant effects related to the 13 physical health complaints examined (see Table S1 in the supplementary files) suggesting that overall, gambling problems do not result in physical illness. For obesity, the effects were mixed. Compared to non-gamblers, obesity was higher for recreational gamblers and for, low-risk, and moderate-risk gamblers, but this effect was not significant for severe problem gamblers. For physical health, the results are mixed with smoking, drinking, increasing with gambling involvement, but no systematic effect in terms of physical complaints except obesity amongst recreational and subclinical problem gamblers.

In terms of sense of wellbeing, as measured by the WEMWBS (Tennant et al., 2007), recreational gamblers had slightly higher scores compared to non-gamblers. The contrast of recreational vs non-gamblers was very small, but it does indicate that the subjective sense of wellbeing for recreational gambling was not lower than for non-gamblers. On the other hand, sense of wellbeing scores decreased substantially with increasing levels of gambling problems from low-risk to severe (see Table S2 in the supplementary files). The effects of physical health and mental health, taken together, suggest that although recreational gambling is positively associated with a higher sense of wellbeing, the greater levels of smoking,

hazardous drinking, and obesity among recreational gamblers could lead to potential downstream health risks. .

Third hypothesis was based on research demonstrating that age moderates the health outcomes among recreational gamblers (Desai et al., 2004; 2007), and that there will be an interaction between age and gambling status (non-gambler vs. recreational gambler) for sense of wellbeing and for physical health outcomes (any chronic condition vs none). As noted above, Desai et al. (2004; 2007) reported higher sense of wellbeing of older adults who engage in recreational gambling and suggested that gambling may provide socialization opportunities, sensory, and cognitive stimulation. Analysis found that higher sense of wellbeing scores for recreational gamblers did not depend on age and that there was no interaction between age and gambling status for sense of wellbeing. Similarly, there was no interaction between age and gambling status for the chronic health effects. Thus, we did not replicate findings of Desai et al., (2004, 2007; Vander Bilt et al., 2004) of potential health benefits for recreational gambling that were unique for older adults. Sense of wellbeing was slightly higher for recreational gamblers compared to non-gamblers regardless of age, and the only age-related health interaction was found was for diabetes which was slightly higher for recreational gamblers. The interaction for diabetes would suggest that in terms of diabetes, older recreational gamblers are somewhat less physically healthy compared to older non-gamblers and is consistent with the higher rate of obesity for recreational gamblers. Note that these tests for interaction effects comparing non-gamblers and recreational gamblers in this study excluded subclinical gamblers so the analysis was cleaner, and had a much larger sample size than in previous studies. Thus, this study had sufficient power to detect very small interaction effects, and we can be confident that there is no advantage to recreational gambling specifically for older people, but a very small improvement in sense of wellbeing for recreational gambling overall regardless of age.

In the multivariate analysis, we found no evidence of an elevated risk of obesity among people with severe gambling problems. These results present us with a bit of a puzzle: elevated rates of obesity among recreational gamblers, low-risk and moderate problem gamblers, but not among severe problem gamblers. This situation may simply be due to the relatively small sample of severe problem gamblers ($n$ = 144). Alternatively, the difference may be due to the type of gambling. According to Lam and Mok (2017), the games most strongly related to obesity were lotteries and bingo. In contrast most severe problem gamblers play casino and online games rather than lotteries. Their findings were replicated in the present study; obesity was positively related to bingo and lotteries, but negatively related to casino games and other games. In contrast games with the strongest relationship to PGSI scores, were online, EGMs, sports gambling, and casino games. Thus, the games that were the most problematic were either not strongly related to obesity or even negative related to obesity suggesting that the effects of obesity see in the present

study are related to the type of game played. Severe problem gamblers play games that are less associated with obesity.

In our view, obesity, may be a more direct consequence of participation in some types of recreational gambling that are more sedentary activities. Public health efforts could be directed toward encouraging more physical activity among recreational gamblers. In addition, more research is needed to better understand the relationship between obesity and severe problem gambling behaviours. It is possible that recreational gamblers can transition to at-risk or problem gambling states, indicating potential underlying unhealthy gambling behaviors or risk factor (Mazar et al., 2018). As such, interventions aimed at reducing the transition to gambling problems need to be explored to promote positive play such as setting limits and understanding the game's odds (Armstrong et al., 2019; Delfabbro et al., 2020; Dixon et al., 2019; Wood & Griffiths, 2008, 2015).

## Limitations

As with all observational studies, there are several limitations that should be noted. First, the data are between 8-12 years old, and the prevalence estimates for the severe gambling groups may be different now. However, the goal of the current study was to examine the association between physical and mental health and gambling severity, and there is no reason to think the patterns of associations have been impacted by the age of the data. We believe that the rich data source, containing gambling variables in three waves of data, provide us with the ability to disaggregate recreational gamblers from low-risk gamblers as well as moderate risk from severe problem gamblers. Second, this study was based on repeated cross-sectional, which precluded us from establishing the temporal ordering between independent variables and gambling severity. Future research using longitudinal data would help to better understand the time ordering of variables. Third, based on the availability of data and research design, results of this study can only confer possible associations between investigated variables and outcomes not causation. There were several health-related variables that were not included in the survey such as traumatic life experiences, traumatic brain injury, drug abuse, and impulsivity. Fourth, a more detailed account of financial status and debt load and other financial harms would also have been helpful in defining the impact of gambling on participants' lives. Finally, having multiple sets of data is useful for monitoring gambling behavior over time and provides the power to detect small differences however, some of the variables were different between the three data sets. For example, there was a measure of psychological distress in some of the data sets, but it was not included in this paper because it was only available for the 2012 and 2016 datasets. Gambling research would benefit greatly from consistent measures of gambling, which would allow for trend analyses over time to facilitate surveillance and monitoring of problematic gambling behaviors.

## Conclusion

In summary, recreational gamblers are somewhat more likely to smoke, drink heavily, and be obese compared to those who do not gamble at all, but had the highest score in terms of their sense of wellbeing. According to this data, obesity is significantly elevated among recreational, low-risk and moderate-risk gamblers, but not severe problem gamblers. Given that this is a cross-sectional study, we cannot determine if obesity is causally related to recreational gambling, however it is plausible to suggest that these results due to the fact that some forms of gambling are sedentary activities. Different interventions may be appropriate for problem and recreational gamblers (Delfabbro et al., 2021). Increasing opportunities for physical activity may be indicated for recreational and subclinical problem gamblers. People with gambling problems have substantially higher rates of smoking, heavy drinking and poor mental health compared to recreational and non-gamblers. People who score as low-risk and moderate-risk for gambling problems had intermediate scores between problem and recreational gamblers on sense of wellbeing, stress, smoking, heavy drinking. Long-term monitoring of gambling behaviors is needed to determine if the elevated rate of smoking, drinking and obesity among recreational gamblers, translate into poorer health over time. The somewhat higher rates of obesity among recreational gamblers, may be linked to the sedentary nature of gambling and recreational gamblers should be encouraged to be more physically active. Finally, research is needed to better examine the obesity rate among people with the most severe level of gambling problems.

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In addition, the MoHLTC provides salary and office space for all CAMH hospital staff.

**Statement of Competing Interests**

The authors declare that they have no conflict of interest. Turner, in the past three years has received funding from the Canadian Institute for Health Research, Ontario Ministry of Health and Long-Term Care (MoHLTC), Gambling Research Exchange (GREO) and Ontario Lottery and Gaming (through GREO). In all cases, the contract included guarantees of independence and intellectual property rights for the researcher, and the funders made no attempt to influence the study at any point. The author has also acted as a consultant on gambling problems for various government and legal entities, reviewed grant applications and articles for publication.

**Authors/ contributions**

NT and NET were co-leads on the grant awarded to conduct the study. SC, NET, OSR contributed to the original report and conducted statistical analyses. NET and JM revised the paper. JS and HB provided important context and interpretation. All authors contributed to the final paper.

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**Ethics Approval**

Ethics approval: The study was reviewed and approved as a secondary analysis by the research ethics committees of Centre for Addiction and Mental Health as study 113/2021 and University of Manchester as 2022-14784-25365. The consent form used in the data collection, included consent for publication.

**Data availability**

The data used in this study was downloaded from the following website: https://ukdataservice.ac.uk/

The specific data sets can be found at the following:

1. NatCen Social Research, Scottish Centre for Social Research. (2018). Gambling in England and Scotland, 2016: Combined

Data from the Health Survey for England and the Scottish Health Survey. [data collection]. UK Data Service. SN: 8416, https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=8416. DOI: http://doi.org/10.5255/UKDA-SN-8416-1

2. Scottish Centre for Social Research, NatCen Social Research. (2015). Gambling in England and Scotland, 2012: Combined Data from the Health Survey for England and the Scottish Health Survey. [data collection]. UK Data Service. SN: 7631, DOI: http://doi.org/10.5255/UKDA-SN-7631-1

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## Supplementary analyses

### Univariate Analysis

#### *Health complaints*

As shown in Table S1, the survey included 14 different types of medical complaints as well as additional questions on high blood pressure, obesity, and diabetes. Overall, there were very few differences between the problem gamblers. Table S1 indicates which variables were significantly different from non-gamblers. Not surprisingly a preliminary analysis found that age was correlated with nearly all of the physical illnesses reported, but not for mental disorders. Consequently, we used logistic regression of the groups of gamblers onto each of the 17 disorders included on the survey and included age to control for age effects. We also included a summary variable of any of the first 13 complaints reported (excluding mental health problems) to determine if the groups differed overall in terms of these physical complaints. Table S1 provides the differences between the groups in terms of 17 medical disorders included on the survey. Given that we have conducted 17 separate analyses we would recommend only interpretating findings with a significance of < .001 and only interpret odds greater than 1.4 or less than .7. Of these disorders, compared to non-gamblers, non-problem gamblers had significantly higher odds of a number of disorders, but the only meaningful effect was for Obesity OR = 1.41, $p < .001$ and infectious disorders OR = .57, $p < .001$; as indicated in Table S1, a few other variables were significant but trivial. Severe problem gamblers had significantly higher odds compared to non-gamblers of mental disorders OR = 2.32, $p < .001$, musculoskeletal problems, PG OR = 1.8 $p < .01$, and high blood pressure, OR = 1.62, $p < .05$ after controlling for age. Compared to non-gamblers, moderate problem gamblers had higher odds of high blood pressure OR = 1.65, $p < .01$, diabetes OR = 1.95, $p < .01$, endocrine and metabolic problems OR = 1.62, $p < .05$, genital urinary system complaints OR = 1.96, $p < .05$, and ear complaints 3.08, $p< .001$. Finally, low risk gamblers, only differed from non-gamblers in terms of higher odds of obesity 1.54, $p < .05$. Note that for high blood pressure without controlling for age, moderate and severe problem gamblers appear to have lower rates of high blood pressure, but after adjusting for age, they have higher odds of having high blood pressure. Adjusting for age, we estimate the prevalence for diabetes was 6.2% for non-gamblers, 6.7% for recreational gamblers, 10.3% for moderate problem gamblers and 7.6% for severe problem gamblers thus explaining the significant odds ratios. Similarly, after adjusting for age, the estimated prevalence for high blood pressure would be 22.7% for non-gamblers, 29.0% for moderate problem gamblers and 23.7% for severe problem gamblers. For obesity, the changes after adjusting for age were less dramatic with the estimated prevalence of 23.0% for non-gamblers, 28.8% for recreational gamblers, 28.3% for low risk gamblers, 29.4% for moderate problem gamblers and 25.4% for severe problem gamblers.

In addition, it should also be noted that compared to non-problem gamblers mental health problems were significantly more common for moderate (OR = 1.7) and severe problem gamblers (OR = 3.2). The contrast for low risk and non-problem was not significant.

Table S1. Physical health complaints among gamblers by problem gambling category (N = 31972).

| | Non-gamblers | Non-problem gamblers | Low-Risk gamblers | Moderate Risk gamblers | Severe problem gamblers |
|---|---|---|---|---|---|
| N | 12846 | 17167 | 904 | 346 | 152 |
| Neoplasms & benign growths | 2.1 | 2.1 | 1.4 | 1.8 | 0.8 |

| | | | | | |
|---|---|---|---|---|---|
| Endocrine & metabolic | 8.3 | 8.9*** | 4.3 | 7.4* | 3.9 |
| Nervous System | 4.2 | 3.2*** | 3.7 | 5.3 | 1.7 |
| Eye complaints | 2.8 | 2.0*** | 1.4 | 2.5 | 0.0 |
| Ear complaints | 2.5 | 2.6 | 2.2 | 3.8*** | 0.2 |
| Heart & circulatory system | 10.7 | 10.9*** | 6.2 | 7.6 | 6.9 |
| Respiratory system | 7.0 | 7.7*** | 6.6 | 6.4 | 3.6 |
| Digestive system | 4.7 | 4.8 | 4.6 | 3.6 | 3.1 |
| Genito-urinary system | 2.3 | 2.1 | 1.1 | 3.0* | 0.0 |
| Skin complaints | 1.3 | 1.3 | 1.4 | 0.2 | 0.0 |
| Musculoskeletal system | 16.5 | 15.8 | 10.7 | 8.9 | 17.1* |
| Infectious Disease | 0.3 | 0.2*** | 0.0 | 0.1 | 0.0 |
| Blood & related organs | 1.0 | 1.0 | 1.0 | 1.2 | 0.2 |
| Any physical complaint | 37.9 | 37.2 | 27.3 | 28.0 | 30.3 |
| Other medical issues | | | | | |
| Mental disorders | 7.1 | 5.6*** | 6.7 | 9.1 | 15.9*** |
| High Blood Pressure | 23.4 | 24.3*** | 14.0 | 19.2** | 19.4* |
| Diabetes | 6.3 | 6.6*** | 3.1 | 6.6** | 4.3 |
| Obesity (BMI > 30) | 22.6 | 29.1*** | 22.6* | 27.3* | 23.8 |

Note: Significance levels were determined controlling for age. PG = moderate to severe problem gamblers; NG = non-gamblers and NPG = people who score zero on both DSM—4 and PGSI. The sample size is slightly lower for high blood pressure (31932), diabetes (31980) and obesity (28178). “Any complaint” includes the first 13 disorders, but excludes mental health, blood pressure, obesity, or diabetes.
* $p < .05$; *** $p < .001$

**Mental Health**

As noted above, problem gamblers were significantly more likely to report mental health problems relative to non-gamblers. Table S2 presents the means comparing groups of gamblers in terms of Wellbeing and gives the effect sizes estimates for each pairwise comparison. As shown in Table S2, most of these pairwise comparisons between these groups were significant. The mean wellbeing score for non-problem gamblers was somewhat higher than for non-gamblers, however the effect size was trivial, (d=-.04). On the other hand, the effect sizes contrasting both non-gamblers and non-problem gamblers from problem gamblers were large (e.g., .79 and .92 respectively). The contrasts between non-problem gamblers and low and moderate risk gamblers were small (d = .35) and medium (d = .47) effect sizes. Moderate and severe problems did not different in terms of well-being.

***Table S2. Wellbeing per group and effect sizes (d).***

| | *Wellbeing* | | | *Non-gamblers* | *Non problem gamblers* | *Low risk* | *Moderate risk* |
|---|---|---|---|---|---|---|---|
| | *N* | *M* | *SD* | | | | |
| *Non-gamblers* | *11030* | *51.0* | *9.2* | | | | |
| *Non problem gamblers* | *14905* | *51.3* | *8.3* | *-0.04*** | | | |
| *Low risk* | *772* | *48.5* | *8.6* | *0.28**** | *0.35**** | | |
| *Moderate risk* | *292* | *47.5* | *8.1* | *0.38**** | *0.47**** | *0.12* | |
| *Severe problem* | *129* | *43.7* | *9.6* | *0.79**** | *0.92**** | *0.54**** | *0.44**** |
| *Total* | *27126* | *51.1* | *8.7* | | | | |

*Note: significance statistics are based on a Oneway analysis of variance using Bonferroni corrections*; ** p < .01; *** p < .001.

*Sensitivity Analysis*

We conducted two additional analyses as sensitivity analyses. The first, Table S3, examined the effect of using a different cut point between low risk and moderate problem gamblers, and the second examined if moderate and severe should be combined into a single group (S9).

*Low risk; original scoring vs Currie et al., (2013)*

As noted in the introduction, Currie et al., (2013) have published an alternative scoring scheme with a higher cut point between low risk and moderate problem gamblers (see also Williams and Volberg, 2014). Namely that a low risk should be people who score from 1 to 4 and moderate risk should be for people who score 5 to 7. We have followed the original scoring scheme in this paper but examine the effect of shifting the cut point between these two categories in a separate multivariate analysis. This alternative set of results are presented in Table S3; only low risk and moderate risk are presented because the results for non-problem and severe problem are

essentially the same as in the main analysis. The results using Currie's scoring method are largely the same except that diabetes and hypertension reach significance for moderate problem gamblers which is somewhat surprising given the smaller sample of moderate risk gamblers. In addition, the effects for former smokers for moderate drinking dropped to non-significance likely due to the smaller number of people who fall into the moderate risk category, but otherwise the effects were the same. These analysis did not find any evidence the preferred the original scoring or the modified scoring scheme further analysis is needed.

*Table S3*
Low risk and moderate risk using the alternative scoring from Williams & Volberg (2014).

| | RRR | upper | lower | signif. | RRR | upper | lower | signif. |
|---|---|---|---|---|---|---|---|---|
| Male | 3.89 | 3.23 | 4.69 | *** | 4.75 | 2.66 | 8.48 | *** |
| Age | | | | | | | | |
| 16-24 | 8.28 | 5.79 | 11.83 | *** | 8.54 | 2.80 | 26.01 | *** |
| 25-34 | 7.32 | 5.26 | 10.19 | *** | 12.08 | 4.59 | 31.77 | *** |
| 35-44 | 3.60 | 2.56 | 5.08 | *** | 8.66 | 3.32 | 22.55 | *** |
| 45-54 | 2.89 | 2.05 | 4.09 | *** | 3.96 | 1.46 | 10.69 | ** |
| 55-64 | 2.04 | 1.43 | 2.90 | ** | 1.87 | 0.67 | 5.24 | |
| 65+ | ref | | | | | | | |
| Scotland | 1.07 | 0.90 | 1.27 | | 1.48 | 0.96 | 2.29 | |
| Obesity | | | | | | | | |
| No | ref | | | | | | | |
| Yes | 1.38 | 1.11 | 1.72 | * | 1.65 | 1.02 | 2.68 | * |
| Missing | 1.02 | 0.77 | 1.35 | | 1.50 | 0.76 | 2.98 | |
| Ever Diabetes | 0.93 | 0.61 | 1.43 | | 2.99 | 1.34 | 6.65 | ** |
| Ever High Blood Pressure | 1.03 | 0.79 | 1.33 | | 1.80 | 1.02 | 3.17 | * |
| Physical Health Problem | 0.96 | 0.79 | 1.18 | | 1.03 | 0.61 | 1.74 | |
| Wellbeing† | 0.72 | 0.65 | 0.80 | *** | 0.73 | 0.59 | 0.91 | ** |
| Weekly Drinking Behavior | | | | | | | | |
| Non-drinker | ref | | | | | | | |
| Moderate drinking | 2.89 | 2.13 | 3.92 | *** | 2.35 | 1.15 | 4.81 | ** |
| Hazardous/harmful drinking | 6.09 | 4.37 | 8.50 | *** | 4.53 | 2.08 | 9.88 | *** |
| Smoking Status | | | | | | | | |
| Never smoker | ref | | | | | | | |
| Former smoker | 2.02 | 1.61 | 2.53 | *** | 1.06 | 0.60 | 1.89 | |
| Current smoker | 2.83 | 2.28 | 3.51 | *** | 3.11 | 1.82 | 5.34 | *** |

Note: Only Low and Moderate risk are included in this table because the values for recreational and severe problems results are the same in this analysis as shown in Table 3 in the main document. The non-gamblers are the reference category for this table.

[1]The physical health complaints were Neoplasms & benign growths, Endocrine & metabolic, Nervous System, Eye complaints, Ear complaints, Heart & circulatory system, Respiratory system, Digestive system, Genito-urinary system, Skin complaints, Musculoskeletal system, Infectious Disease , Blood & related organs. These health complaints each increased with age, but were otherwise were unrelated to each other. A reliability measure would be meaningless.

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