

Research Article

Problem Gambling in Adolescents - Data from a Swedish School Survey

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Abstract

Introduction: The aim of this study was to explore the frequency of problem gambling among adolescents and suspected associated factors.

Methods: This study was based on data collected through a public health survey distributed in 2016 to pupils in 9th grade of primary school and in 2nd grade of secondary school. In total 13498 participants were included. Bayesian binomial regression models were used to assess whether the frequency of a suspected associated factor was different among those with and without problem gambling.

Results: Ten percent of boys in 9th grade of primary school and 2nd grade of secondary school were classified as problem gamblers. For girls, the corresponding frequencies were one percent and less than one percent. Problem gambling was associated with poor sleep and having tried smoking, alcohol, and other substances among both boys and girls in 9th grade of primary school and boys in 2nd grade of secondary school. Girls with problem gambling in 2nd grade of secondary school were associated with an increased prevalence of having tried smoking and having tried other substances and an increased prevalence of poor sleep.

Conclusion: We found that problem gambling was robustly associated with a substantially increased prevalence of poor sleep and

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having tried smoking, alcohol, and other substances among both boys and girls in 9th grade of primary school, as well among boys in 2nd grade of secondary school. Furthermore, teenagers with ASD should possibly be considered as more likely to engage in problem gambling, specifically when female.

Keywords: Associated factors; Bayesian statistics; Gambling; School survey

Introduction

Behavioural, or non-substance addictions, have relatively recently been formally acknowledged [1,2]. The fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5) included the new diagnostic category “Substance-Related and Addictive disorders”, listing not only alcohol and drug abuse but also gambling disorder [1]. Although gambling disorder traditionally considered an adult phenomenon, the behaviour usually begins in childhood or adolescence, and more frequently and in younger ages among males, in resemblance with both substance use disorders and pathological gaming [2]. Gambling disorder is the most established and most thoroughly investigated behavioural addiction, advantaging on a formal diagnosis and founded diagnostic criteria [1]. The research on gambling is rather expansive and includes literature focusing on Swedish population [3-5], though mainly among adults. The severity of the behaviour is currently uncontroversial as the condition has been associated with negative psychological consequences including an increased risk of suicide [4,6,7]. Previous research also demonstrate that gambling disorder shows a great comorbidity with various psychiatric conditions such as depression, anxiety disorders, low impulse control and bipolar disorder as well as alcohol, substance and nicotine use [2,7,8]. Kessler et al., showed that both nicotine, alcohol and drug dependence elevated the odds of pathological gambling [9]. The behaviour is traditionally considered mainly an adult problem but research has showed that problem gamblers debut in gambling at younger age than non-problem gamblers [9]. Additionally, a lot of the previous research about comorbidity relies on treatment-seeking samples [4,7,8] and as little is known about gambling in a younger population this study adds to the knowledge about gambling by addressing early debuting gambling among girls and boys in an ordinary school setting. The psychological health among adolescents is on the decline in the western world and current research suggests an association to the digital technological development; “a digital depression” [10,11]. A major study in the U.S. suggests that about 22 percent of teenagers exhibit multiple symptoms of depression whereas the lifetime overall U.S. prevalence rate of a full clinical depressive episode is 5 to 10 percent [10,11]. Psychological well-being among adolescents has been reported as poorer among those who spend more hours on electronic communication and in front of screens (e.g., social media, gaming, the Internet, texting) [11].

Autism Spectrum Disorder (ASD) Autism Spectrum Disorder (ASD) is an impairing and heterogeneous neurodevelopmental disorder with an early onset and a world-wide prevalence of 1 to 3 percent

[12]. The disorder is characterized by social impairments, communication difficulties, altered sensory processing, and repetitive and restricted behaviours [12,13]. Studies have showed possible social gains for online gamers; decreased feelings of loneliness, increased feelings of connectedness to friends, increased social capital between players and increased social bridging between players [14,15]. Based on the design of the games with repetitions and immediate reinforcement, it can be suspected that patients with ADHD / ASD have an increased risk of developing problem gambling [16,17].

We wanted to explore the frequency of problem gambling among Swedish pupils, and furthermore examine whether the frequency of the suspected associated factors outlined below differed among those with and without problem gambling. Specifically, using a large sample of Swedish pupils from primary and secondary school, we investigated whether those with and without problem gambling differed in the frequency of (1) often feeling low, (2) often feeling anxious, (3) self-reported ADHD, (4) self-reported ASD, (5) being satisfied with one's own general health, (6) poor sleep, (7) loneliness, and having tried (8) smoking, (9) alcohol, and/or (10) other substances.

Methods

Participants and procedures

This study is based on data collected through a public health survey distributed in 2016 to pupils in 9th grade in primary school and in 2nd grade of secondary school. The survey was distributed in all 33 municipalities in Skane, a region in southern Sweden, with a response rate of 77% in 9th grade and 73% in 2nd grade. The purpose of the survey was to investigate the current health, way of life, health hazards, and social factors among teenagers and adolescents, and was provided by Region Skane in cooperation with the municipal association of Skane. The survey was answered anonymously on computers in classroom settings. Participation was voluntary, all measures were based on self-reports, and all questions were described as optional. In addition to answering questions about problem gambling, respondents were extensively asked about various life circumstances, physical and psychological health factors and different risk-taking behaviours.

Measures

Problem gambling

The Lie/Bet questionnaire was used to identify respondents with gambling problems [18,19]. This brief yet diagnostically accurate screening instrument [20] contains only two questions (answered "yes" or "no"): 1) Having felt a need to gamble an increasing amount of money in the hopes of winning back what has been lost, and 2) Lying about the amount of gambling to people of personal importance. Problem gambling was defined as endorsing at least one of these two questions.

Associated factors

Based on previous research and clinical experience, we wanted to examine a broad range of suspected associated factors related to overall well-being, mental health and adverse behaviors. In order to examine the frequency of each factor, new binary variables were created from available survey questions. Two items based on the Health Behaviour in School-Aged Children Symptom Checklist were used to assess respondents' psychological health, both with separately verified satisfactory test-retest reliability [21]. Respondents rated how often they had "felt low" and "anxious/worried" during the past six

months on a five-point scale ("about every day", "more than once a week", "about every week", "about every month", "rarely or never"). Two new binary variables labelled "Often feeling low" and "Often feeling anxious" were created, where those who answered "about every day" or "more than once a week" were categorized as "yes" and all others as "no".

The survey included several questions on long-term somatic or psychiatric disorders. Respondents were asked whether they had "ADHD or ADD" and "Autism/Asperger's syndrome". Two new binary variables labelled "ADHD" and "ASD" were created, where those who affirmed ADHD/ADD or ASD were categorized as "yes" and all others as "no". Respondents were asked to rate their general health status on a five-point scale ("very good", "rather good", "neither good nor poor", "rather poor", "poor") using the Self-Rated Health instrument (SRH-5) [22]. A new binary variable labelled "Satisfied with health" was created, with those answering "very good" or "rather good" classified as "yes" and all others as "no".

Respondents were asked to rate how many hours a night they usually sleep on weekdays on a three-point scale ("less than 7 hours", "7-9 hours", "more than 9 hours"). A new binary variable labelled "Poor sleep" was created, with those answering "less than 7 hours" classified as "yes" and all others as "no". Respondents were asked to rate on a four-point scale ("have no close friend", "have one close friend", "have two close friends", "have several close friends") whether they presently have a close friend with whom they could talk in confidence about almost any personal matter. A new binary variable labelled "Loneliness" was created, with those answering "have no close friend" classified as "yes" and all others as "no".

Respondents were asked several questions about smoking, alcohol habits and illicit substances. Three new binary variables, labelled "Tried smoking", "Tried alcohol", and "Tried other substances" were created, with affirming of any kind of frequency classified as "yes" and all other responses as "no".

Statistical Analysis

All statistical analyses were carried out using the R statistical programming language, version 4.0.4 [23], and several functions from the R package tidyverse [24] were used during data processing. Due to its many advantages over the traditional frequentist approach, including the possibility of making genuine probabilistic statements about estimated parameters [25], we opted for a fully Bayesian approach to statistical analysis.

The R package brms [26], which interfaces R with the Stan probabilistic programming language [27], was used to specify Bayesian models. Bayesian binomial regression models with weakly informative priors centered around zero, which should have minimal impact on obtained estimates while still providing moderate regularization [28], were used to assess whether the frequency of a suspected associated factor was different among those with and without problem gambling. The R package emmeans [29] was used for post-processing of results. Differences are presented as estimated median absolute percentage differences along with associated odds ratios, both with 95% Highest Density Intervals (HDIs) presented within square brackets. An advantage of the HDI is that, in contrast to a frequentist confidence interval, a 95% HDI actually has a 95% probability of containing the values inside it [30]. Finally, since there is no notion of "statistical significance" in the Bayesian framework, we used the

Region of Practical Equivalence (ROPE) in conjunction with the 95% HDI as a decision boundary [30] in order to establish whether an estimated difference between those with and without problem gambling was of practical and/or clinical importance. We considered an estimated difference of 5% (or -5%) as the minimal difference for “practical equivalence”, and if the 95% HDI was not beyond this cut-off, we deemed the results as uncertain in terms of practical and/or clinical importance.

Results

Over ten percent of boys in both 9th grade of primary school and 2nd grade of secondary school were classified as problem gamblers. For girls, the corresponding frequency was just over one percent in 9th grade of primary school, and less than one percent in 2nd grade of secondary school. Additional details, including the number of valid responses in each group, are presented in table 1. Overall, four factors emerged as robustly more frequent among respondents with problem gambling (although the results varied depending on sex and grade): Poor sleep and having tried smoking, alcohol and other substances.

	Number of respondents	Valid responses	Problem gambling	No problem gambling
Boys in 9 th grade of primary school	4609	4002 (86.8%)	469 (11.7%)	3533 (88.3%)
Girls in 9 th grade of primary school	4497	4167 (92.7%)	48 (1.2%)	4119 (98.8%)
Boys in 2 nd grade of secondary school	3945	3407 (86.4%)	472 (13.9%)	2935 (86.1%)
Girls in 2 nd grade of secondary school	3955	3634 (91.9%)	27 (0.7%)	3607 (99.3%)

Table 1: Frequency of problem gambling among school pupils in southern Sweden, based on data collected in 2016.

Boys in 9th grade of primary school

In 9th grade of primary school, 43.3% (N = 202) of boys with problem gambling were classified as having poor sleep, compared to 25.5% (N = 897) of those without problem gambling, with an estimated difference of 17.8% [14%, 21.9%] and a corresponding odds ratio of 2.23 [1.86, 2.61]. Findings were similar for having tried smoking, alcohol and other substances. Almost half, 49.3% (N = 226), of all boys with problem gambling had tried smoking, compared to about one fourth, 27.7% (N = 963), of those without problem gambling, with an estimated difference of 21.7% [17.7%, 25.8%] and a corresponding odds ratio of 2.55 [2.14, 2.98]. As for having tried alcohol, this was true for 77.3% (N = 357) of those with problem gambling and 52.8% (N = 1857) for those without, with an estimated difference of 24.5% [20.9%, 27.9%] and a corresponding odds ratio of 3.04 [2.49, 3.66]. Finally, 15.9% (N = 73) of boys with problem gambling had tried other substances, compared to 4.9% (N = 172) of those without, with an estimated difference of 10.9% [8.1%, 13.8%] and an associated odds ratio of 3.63 [2.78, 4.56]. In addition, there was a robust although smaller group difference for all remaining suspected associated factors except for ADHD and ASD, but the estimated differences were not robustly beyond five percent. Further details are presented in table 2 and figure 1A.

Girls in 9th grade of primary school

Girls in 9th grade of primary school classified as problem gamblers had a higher frequency of poor sleep and having tried smoking

and other substances than boys in 9th grade, although the frequency of having tried alcohol was similar. 58.3% (N = 28) of girls with problem gambling were classified as having poor sleep, compared to 35.7% (N = 1460) among those without, with an estimated difference of 22.8% [10.9%, 34.1%] and an associated odds ratio of 2.54 [1.42, 3.9]. Furthermore, 63% (N = 29) of those with problem gambling had tried smoking, compared to 32% (N = 1306) of those without, resulting in an estimated difference of 31.2% [19.7%, 42.9%] and an associated odds ratio of 3.65 [1.94, 5.71]. Almost four out of five, 77.1% (N = 37), of girls with problem gambling had tried alcohol, compared to a bit more than half, 54.9% (N = 2252), among girls without, with an estimated difference of 22.5% [12.5%, 32.2%] and an associated odds ratio of 2.82 [1.35, 4.62]. Finally, 28.3% (N = 13) of girls with problem gambling had tried other substances, compared to 4% (N = 165) of those without, with an estimated difference of 24% [13.4%, 35%] and a corresponding odds ratio of 9.25 [4.54, 14.89]. Note, however, that the HDIs presented here are wider than the corresponding HDIs among 9th grade boys, due to the lower number of girls reporting problem gambling. Thus, these estimates are more uncertain. Girls with problem gambling had a higher prevalence of ASD and were less satisfied with their health compared to girls without problem gambling, although these estimates were not robustly beyond five percent. Detailed results are presented in table 3 and figure 1B.

Boys in 2nd grade of secondary school

Notably, differences between those with and without problem gambling were smaller for poor sleep and having tried smoking and alcohol among boys in 2nd grade of secondary school than among boys in 9th grade of primary school, while the difference for having tried other substances stayed more or less the same. 51.6% (N = 241) of boys with problem gambling were classified as having poor sleep, compared to 39.9% (N = 1167) of those without, with an estimated difference of 11.7% [7.5%, 15.7%] and a corresponding odds ratio of 1.61 [1.34, 1.87]. Furthermore, 66.2% (N = 307) of boys with gambling problems had tried smoking, while the same was true for 54% (N = 1564) of those without, with an estimated difference of 12.2% [8.4%, 16.2%] and a corresponding odds ratio of 1.67 [1.38, 1.96]. The vast majority of boys with 91.6% (N = 425) and without 81.6% (N = 2380) problem gambling had tried alcohol, with an estimated difference of 10% [7.5%, 12.3%] and an associated odds ratio of 2.46 [1.78, 3.2]. Finally, 28.2% (N = 130) of those with problem gambling had tried other substances, compared to 14.8% (N = 428) of those without, with an estimated difference of 13.4% [9.8%, 17%] and an associated odds ratio of 2.26 [1.85, 2.71]. Detailed results are presented in table 4 and figure 1C.

Girls in 2nd grade of secondary school

Again, due to the low number of girls with problem gambling in 2nd grade of secondary school, several estimates were uncertain. For instance, while 63% (N = 17) of girls with problem gambling and 44% (N = 1578) without were classified as having poor sleep, the estimated difference of 19.3% [4%, 34%] was not, with 95% probability, above the prespecified cut-off for practical equivalence (although the estimated difference was, with 95% probability, still above zero). As for having tried smoking, this was affirmed by 76.9% (N = 20) of girls with and 51.8% (N = 1857) of girls without problem gambling, with an estimated difference of 25.8% [12%, 38.3%] and an associated odds ratio of 3.23 [1.09, 6.28]. Notably, the difference in having tried alcohol was negligible, while 42.3% (N = 11) of girls with and 11% (N = 393) of girls without problem gambling had tried other

	N	Problem gambling	No problem gambling	Diff. [95% HDI]	OR [95% HDI]
Often feeling low	3855	11.6% (N = 52)	8.2% (N = 278)	3.4% [0.8%, 6%]	1.47 [1.1, 1.87]
Often feeling anxious	3845	10.3% (N = 46)	6.6% (N = 225)	3.6% [1.2%, 6.1%]	1.61 [1.18, 2.08]
Satisfied with health	3919	88.2% (N = 404)	94.1% (N = 3257)	-5.8% [-8.4%, -3.3%]	0.47 [0.35, 0.6]
ADHD	3852	3.6% (N = 16)	2.4% (N = 81)	1.1% [-0.3%, 2.7%]	1.5 [0.85, 2.22]
ASD	3853	3% (N = 13)	2% (N = 67)	0.9% [-0.4%, 2.3%]	1.49 [0.79, 2.3]
Poor sleep	3979	43.3% (N = 202)	25.5% (N = 897)	17.8% [14%, 21.9%]	2.23 [1.86, 2.61]
Loneliness	3964	12.5% (N = 58)	7.9% (N = 276)	4.5% [2%, 7.2%]	1.66 [1.25, 2.09]
Tried smoking	3940	49.3% (N = 226)	27.7% (N = 963)	21.7% [17.7%, 25.8%]	2.55 [2.14, 2.98]
Tried alcohol	3976	77.3% (N = 357)	52.8% (N = 1857)	24.5% [20.9%, 27.9%]	3.04 [2.49, 3.66]
Tried other substances	3939	15.9% (N = 73)	4.9% (N = 172)	10.9% [8.1%, 13.8%]	3.63 [2.78, 4.56]

Table 2: Problem gambling and associated factors among boys in 9th grade of primary school, based on data collected in southern Sweden in 2016.

Note: Diff., estimated difference; OR, Odds Ratio; HDI, Highest Density Interval. Estimated differences and odds ratios that, with 95% probability, are above the pre-specified cut-off for practical equivalence are highlighted in bold.

	N	Problem gambling	No problem gambling	Diff. [95% HDI]	OR [95% HDI]
Often feeling low	4076	22.2% (N = 10)	23.7% (N = 955)	-1.9% [-11.9%, 8.3%]	0.9 [0.42, 1.49]
Often feeling anxious	4071	20% (N = 9)	19.1% (N = 770)	0.4% [-8.8%, 10.2%]	1.02 [0.45, 1.7]
Satisfied with health	4104	74.5% (N = 35)	85% (N = 3449)	-10.2% [-21%, -0.2%]	0.52 [0.26, 0.86]
ADHD	4047	8.9% (N = 4)	2.9% (N = 118)	5.4% [-0.7%, 12.3%]	3 [0.69, 5.92]
ASD	4032	9.1% (N = 4)	0.9% (N = 37)	7.6% [1.3%, 14.6%]	10.09 [2.21, 20.3]
Poor sleep	4142	58.3% (N = 28)	35.7% (N = 1460)	22.8% [10.9%, 34.1%]	2.54 [1.42, 3.9]
Loneliness	4142	4.3% (N = 2)	6% (N = 245)	-2.2% [-5.9%, 2.5%]	0.61 [0.04, 1.46]
Tried smoking	4128	63% (N = 29)	32% (N = 1306)	31.2% [19.7%, 42.9%]	3.65 [1.94, 5.71]
Tried alcohol	4150	77.1% (N = 37)	54.9% (N = 2252)	22.5% [12.5%, 32.2%]	2.82 [1.35, 4.62]
Tried other substances	4124	28.3% (N = 13)	4% (N = 165)	24% [13.4%, 35%]	9.25 [4.54, 14.89]

Table 3: Problem gambling and associated factors among girls in 9th grade of primary school, based on data collected in southern Sweden in 2016.

Note: Diff., estimated difference; OR, Odds Ratio; HDI, Highest Density Interval. Estimated differences and odds ratios that, with 95% probability, are above the pre-specified cut-off for practical equivalence are highlighted in bold.

	N	Problem gambling	No problem gambling	Diff. [95% HDI]	OR [95% HDI]
Often feeling low	3308	13.8% (N = 63)	11.2% (N = 318)	2.5% [-0.1%, 5.5%]	1.27 [0.97, 1.59]
Often feeling anxious	3313	11% (N = 50)	9.2% (N = 263)	1.7% [-0.8%, 4.4%]	1.21 [0.9, 1.55]
Satisfied with health	3351	88.3% (N = 406)	91% (N = 2630)	-2.7% [-5.2%, 0%]	0.75 [0.56, 0.95]
ADHD	3309	2.7% (N = 12)	2.7% (N = 76)	-0.1% [-1.3%, 1.3%]	0.98 [0.49, 1.5]
ASD	3311	1.5% (N = 7)	2.7% (N = 78)	-1.2% [-2.2%, -0.1%]	0.54 [0.22, 0.92]
Poor sleep	3391	51.6% (N = 241)	39.9% (N = 1167)	11.7% [7.5%, 15.7%]	1.61 [1.34, 1.87]
Loneliness	3381	8.3% (N = 39)	7.3% (N = 212)	1% [-1.3%, 3.2%]	1.15 [0.81, 1.5]
Tried smoking	3361	66.2% (N = 307)	54% (N = 1564)	12.2% [8.4%, 16.2%]	1.67 [1.38, 1.96]
Tried alcohol	3379	91.6% (N = 425)	81.6% (N = 2380)	10% [7.5%, 12.3%]	2.46 [1.78, 3.2]
Tried other substances	3356	28.2% (N = 130)	14.8% (N = 428)	13.4% [9.8%, 17%]	2.26 [1.85, 2.71]

Table 4: Problem gambling and associated factors among boys in 2nd grade of secondary school, based on data collected in southern Sweden in 2016.

Note: Diff., estimated difference; OR, Odds Ratio; HDI, Highest Density Interval. Estimated differences and odds ratios that, with 95% probability, are above the pre-specified cut-off for practical equivalence are highlighted in bold.

substances, with an estimated difference of 31.1% [16.1%, 47.3%] and an associated odds ratio of 5.9 [2.5, 10.36]. Detailed results are presented in table 5 and figure 1D.

Dots represent the posterior median estimate, and bars represent 95% highest density intervals. Shaded regions indicate the region of

practical equivalence (i.e., a 5% difference in absolute terms). Estimates that with 95% probability are above the region of practical equivalence are shown in green, whereas estimates that with 95% probability are above zero are shown in blue, and estimates that are not, with 95% probability, above zero are shown in orange. Estimates

	N	Problem gambling	No problem gambling	Diff. [95% HDI]	OR [95% HDI]
Often feeling low	3579	33.3% (N = 9)	28.5% (N = 1011)	4.4% [-9.9%, 19.1%]	1.23 [0.49, 2.15]
Often feeling anxious	3585	33.3% (N = 9)	22.3% (N = 795)	10.6% [-3.9%, 25.3%]	1.71 [0.66, 2.96]
Satisfied with health	3570	76.9% (N = 20)	82.3% (N = 2918)	-4.8% [-18.2%, 8.1%]	0.74 [0.26, 1.46]
ADHD	3560	12% (N = 3)	3.3% (N = 118)	7.7% [-1.4%, 18.1%]	3.61 [0.48, 7.9]
ASD	3560	4% (N = 1)	0.8% (N = 28)	2.2% [-1%, 8.7%]	3.94 [0, 13.63]
Poor sleep	3617	63% (N = 17)	44% (N = 1578)	19.3% [4%, 34%]	2.19 [0.88, 3.84]
Loneliness	3629	7.4% (N = 2)	5.2% (N = 186)	1.3% [-4.8%, 9.4%]	1.27 [0.05, 3.09]
Tried smoking	3611	76.9% (N = 20)	51.8% (N = 1857)	25.8% [12%, 38.3%]	3.23 [1.09, 6.28]
Tried alcohol	3620	84.6% (N = 22)	81.7% (N = 2935)	3.8% [-7.8%, 14%]	1.32 [0.38, 2.96]
Tried other substances	3600	42.3% (N = 11)	11% (N = 393)	31.1% [16.1%, 47.3%]	5.9 [2.5, 10.36]

Table 5: Problem gambling and associated factors among girls in 2nd grade of secondary school, based on data collected in southern Sweden in 2016.

Note: Diff., estimated difference; OR, Odds Ratio; HDI, Highest Density Interval. Estimated differences and odds ratios that, with 95% probability, are above the pre-specified cut-off for practical equivalence are highlighted in bold.

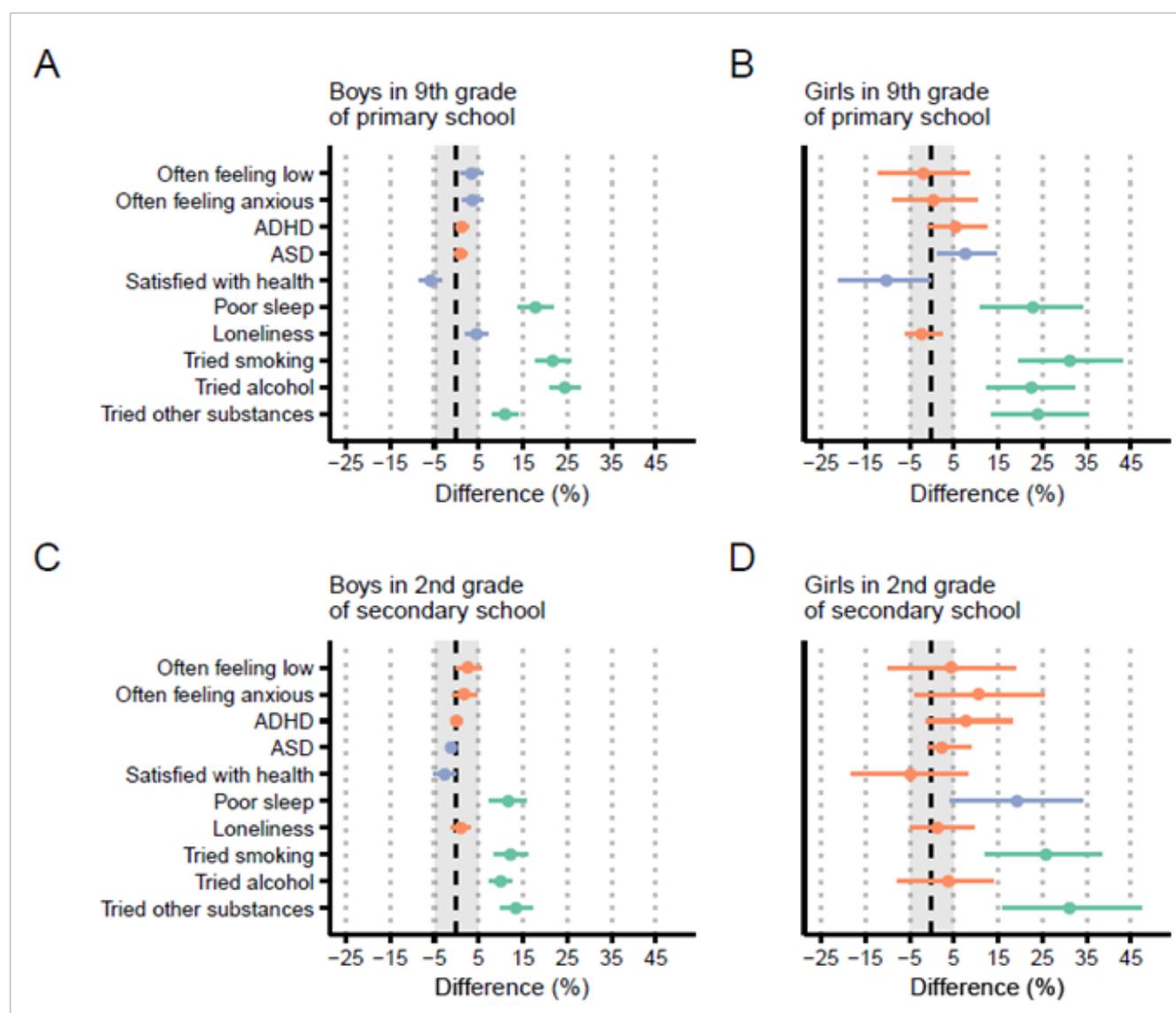


Figure 1 (A-D): Estimated differences in prevalence of factors that may be associated with problem gambling.

are based on data collected among school pupils in southern Sweden in 2016.

Discussion

Given the increasing interest in behavioural addictions and alarming reports on consequences of screen time and adolescents increasing psychological complaints [2,10,11], this study aimed to describe problem gambling and suspected associated factors within a population of Swedish pupils in an ordinary school setting, targeting adolescents in 9th grade of primary school and in 2nd grade of secondary school.

Our study adds to the knowledge of pathological gambling by investigating the male and female characteristics. The interest in behavioural addiction is increasing but there are still gaps to be filled. Gambling addiction is the most established and researched behavioural addiction but the phenomenon is mainly investigated among adults or within populations of care seeking gamblers [4,7,8]. Gambling with money is by Swedish law only allowed for adults (SFS nr: 2018:1138). Nevertheless, many children and adolescents engage in gambling [31,32]. Games with or without money constitute adjacent phenomena in the sense that monetary elements, such as so-called loot boxes, are common in computer games or through more computer-game-like virtual environments where games about money take place. One possibility for affirmative of gambling among adolescents under 18 years could be that the participants meant games containing such monetary elements when endorsing items on gambling in the questionnaire.

The difference in frequency between girls with and without problem gambling was notably larger than the difference between boys with and without problem gambling for several variables. For instance, the estimated difference in having tried other substances was 11% among boys in 9th grade and 24%, more than double, among girls in 9th grade. This might be explained by the fact that girls with problem gambling are fewer but exhibit worse psychiatric health problems [33,34].

Behavioural and substance addiction have previously been reported as robustly related [2]. Correspondingly, we observed that both the male and female problem gamblers in 9th grade showed a disproportionate prevalence of having tried cigarettes, alcohol and illicit drugs. The overrepresentation was seen among male and female problem gamblers in 2nd grade of secondary school, with the exception of the female experience of alcohol. This is well in line with previous research showing that male gamblers drink more female gamblers less [35]. Due to legal regulations on gambling most of the studies were done on adult populations but several studies - some as early as 1998 [36] showed that adolescent gamblers were more likely to drink alcohol, smoke tobacco and take drugs compared to non-gamblers [31,37,38]. Theories regarding the relationship between gambling and experience of cigarettes, alcohol and illicit drugs have been suggested to be excitement-seeking and risk-taking personality having similar social, environmental, neurobiological and genetic features [37,39-41]. Petruselka et al., [42] suggest socioeconomic status to play an important role in this bad marriage. Diaz et al., [39] found that tobacco and alcohol users are more likely to gamble and spend more on gambling products. Further research is needed to increase the understanding of the causality.

Autism Spectrum Disorder (ASD) is an impairing and heterogeneous neurodevelopmental disorder with an early onset, which affects

1 to 3 percent of the population [12]. ASD is characterized by social impairments, communication difficulties, altered sensory processing, and repetitive and restricted [12,13]. Studies have showed the following possible social gains for online gamers; decreased feelings of loneliness, increased feelings of connectedness to friends, increased social capital between players and increased social bridging between players [14,15]. Due to previous research [43-45] we had expected a higher prevalence of gambling in the ASD group but we only found such a relationship among the girls in 9th grade. This group had a higher prevalence of ASD and was less satisfied with their health compared to girls without problem gambling. In our study the total number of participants with ASD is too small (n=20) to draw any conclusions. There is a notable comorbidity between ADHD and ASD [46] and as we only logged the main diagnosis there might be a possibility that there are some subjects with ASD among the ADHD subjects and vice versa. Looking at neurodevelopmental disorders from the ESSENCE (Early Symptomatic Syndromes Eliciting Neurodevelopmental Clinical Examinations) perspective we could have created a group consisting of ASD plus ADHD subjects getting a more realistic picture [47]. ASD does not belong to the most frequent conditions investigated in relationship to problem or addictive gambling and even less to a potential gender discrepancy. Our results warrant a more thorough investigation of the potential link between neuropsychiatric conditions and problem gambling among female adolescents.

Previous research reports on a relationship between problem gambling and both bad sleep habits and sleep difficulties [48]. The association between screen time and sleeping difficulties is established and highly clinically relevant since previous research describes how insufficient sleep is associated to both mental health problems and poor academic performance [49,50]. Concordantly, respondents in our material with problem gambling showed a positive association to less than seven hours of sleep per night among female and male 9th graders and among male 2nd graders. Girls with problem gambling showed the same tendency and it cannot be ruled out that an association would have been seen in a larger data material.

Strengths and Limitations

Among the strengths of the current study are the large, representative sample size and the use of a Bayesian statistical approach, which allowed us to make genuine probabilistic statements about our obtained estimates. However, notwithstanding the strengths of a fully Bayesian approach, the number of girls with problem gambling was relatively small (n=75), and thus the number of girls with both problem gambling and the presence of an associated factor was even smaller. As indicated by the wider HDIs, our findings pertaining to girls are therefore less robust than those pertaining to boys.

The present study does exhibit several limitations. First, all measures used were based on self-report, which entails a risk for recall bias that could influence our findings. This study also shows considerable strengths. The survey was population based and included a large number of individuals along with a relatively high response rate, which reduces the risk of selection bias. Furthermore, to the best of our knowledge, this is the first study to highlight problem gambling and associated factors among Swedish teenagers.

Conclusion

Using a large, representative sample of Swedish adolescents, we found that problem gambling was robustly associated with a substantially increased prevalence of poor sleep and having tried smoking,

alcohol, and other substances among both boys and girls in 9th grade of primary school, as well as among boys in 2nd grade of secondary school. Due to the small number of girls with problem gambling in 2nd grade of secondary school our estimates were less certain, but problem gambling was nevertheless robustly associated with a substantially increased prevalence of having tried smoking and having tried other substances, as well as (less robustly) with an increased prevalence of poor sleep. Furthermore, teenagers with ASD should possibly be considered as more likely to engage in problem gambling, specifically when female. Important and clinically relevant questions have been revealed for future studies to answer. Our study adds important information for policy makers pointing at vulnerable groups to be considered in their work to prevent problem gambling.

Highlights

- Problem gambling was associated with poor sleep, having tried smoking and alcohol
- Problem gambling was associated with having tried illicit substances
- Female adolescents with ASD are more likely to engage in problem gambling

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Consent for Publication

Consent for publication has been given by all participants in the study.

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Conflict of Interest

All authors declare: no conflict of interest.

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