

## Problem gambling, risk behaviours, and mental health in adolescence: A person oriented study

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### Abstract

Adolescent gambling is becoming a public health problem. While comorbidities with other externalizing behaviours have been ascertained, few studies focus on adolescents with a multi-problem behaviour pattern, i.e., alcohol and tobacco use, in addition to antisocial behaviour, which includes problem gambling. The purpose of this study was to identify adolescents with multi-problem behaviours, i.e., alcohol abuse, daily smoking, antisocial behaviour, and problem gambling and to investigate the differences in relation to gender. Unlike most studies on this topic, we adopted a person-oriented approach to identify groups of adolescent boys and girls who reported multi-problem risk behaviours, i.e., alcohol abuse, daily smoking, antisocial behaviour, and problem gambling. Moreover, we explored to what extent these adolescents exhibited mental health problems, i.e., depressive, psychosomatic, and ADHD symptoms, as well as sleep problems. The sample consisted of 1,526 adolescents from two age cohorts, 15- to 16-year-olds ( $n = 711$ , 47%) and 17- to 18-year-olds ( $n = 815$ , 53%). Latent Variable Mixture Modeling (LVMM) revealed one group with low rates of all risk behaviours and three groups with multi-problem behaviours. Among the latter three groups, two reported problem gambling and had higher levels of mental health problems. These results suggest that gambling can be added to the constellation of risk behaviours in adolescence and might be more associated with mental health problems than other externalizing behaviours.

**Keywords:** Gambling, risk behaviours, mental health problems, adolescents

## Introduction

Adolescent gambling is of interest to public health. Despite the fact that gambling is illegal for underage individuals, it has been estimated that 22% of 16-year-olds in Europe have experienced some form of gambling. are at increased risk of developing addiction problems. A recent review shows that 0.2 to 12.3% of European adolescents exhibit problem gambling (Calado et al., 2017). In Sweden, more than one-quarter of 15-year-old boys who gamble are at risk of developing gambling related problems (Svensson & Sundqvist, 2019). Moreover, the development of new technologies (i.e., smartphones, social networks) magnifies their exposure to remote gambling possibilities (Griffiths & Parke, 2010), which might in turn increase the percentage of young people with gambling problems in the future.

Most “problem behaviours,” i.e., smoking, drinking, and antisocial behaviour, start in adolescence. Decades of research have demonstrated that a certain amount of experimentation with such behaviours is more or less normal during adolescence (e.g., Pape & Hammer, 1996; Skogen et al., 2009) and not necessarily related to negative consequences. However, a relatively small percentage of young people who engage in such behaviours develop more severe problems in adulthood, such as mental health disorders (Jessor, 2016). This situation is particularly the case of those adolescents who exhibit multi-problem behaviours at an early stage. Finally, although most reduce their involvement in risk behaviours during the transition from adolescence to adulthood, those who engage in a pattern of multi-problem behaviours are likely to continue the same pattern in early adulthood (Jessor, 2016). Therefore, it is important to identify these adolescents to prevent negative consequences in adulthood.

While alcohol use, smoking, and antisocial behaviour have been recognized as risk behaviours and employed to identify young people with multi-problem behaviours, the role of problem gambling is nevertheless still a subject of debate. We hypothesize that this behaviour might have the same function as other problem behaviours and can thus be considered a “modern” problem behaviour. In support of this hypothesis, adolescents report similar motives for gambling (Stewart & Zack, 2008), drinking alcohol (Graziano et al., 2012), using drugs (Settanni & Giannotta, 2011), and engaging in unprotected sex (Giannotta et al., 2009). Moreover, comorbidity has been observed between problem gambling and alcohol abuse (Barnes et al., 2009; Edgren et al., 2016; French et al., 2008), smoking (for a review, see McGrath & Barrett, 2009), and antisocial behaviour (e.g., Brunelle et al., 2012; Räsänen et al., 2015), suggesting that some adolescents might show a multi-problem behaviour pattern that includes gambling.

However, the literature on this topic presents an important limitation. Studies of multi-problem behaviours that also include gambling have largely employed a variable-oriented approach where the magnitude of co-occurrence is measured (see, e.g., Cook et al., 2015; and for a review, Peters et al., 2015). Another common

approach is to identify underlying subgroups of problem behaviours, which is particularly effective for pinpointing groups of individuals who share common behaviours or features and are therefore at risk of certain negative outcomes, in this case mental health problems. Whereas some studies have focused on subtypes/clusters of gamblers who share common features, i.e., frequency of gambling (e.g., Goldstein et al., 2013; Gupta et al., 2013; Moon et al., 2016), to the best of our knowledge only one study identified groups of adolescents who reported multi-problem behaviours including gambling in a population sample (Turner et al., 2011). However, the study used both externalizing and internalizing behaviours to identify the groups, which makes it difficult to understand the contribution of each problem behaviour to increasing the risk of mental health problems. Moreover, although mental health problems have been associated with problem gambling (Gupta et al., 2013; Nower et al., 2005), knowledge of the role of mental health problems in groups of adolescents with multi-problem behaviours including problem gambling is scarce. Identifying subgroups of young people with multi-problem behaviours, with or without gambling, may improve our understanding of the relationship between problem gambling and mental health problems.

In the present study, we focus on the most common adolescent risk behaviours, namely, alcohol abuse, smoking, and antisocial behaviour, and employ a person-oriented approach to identify subgroups of adolescents that present a multi-problem behaviour pattern, with and without problem gambling. As gambling and mental health problems differ between boys and girls (Ellenbogen et al., 2007), we will investigate whether a gender difference operates between these subgroups. Moreover, we examine whether these subgroups differ in terms of mental health problems, i.e., sleep problems, depressive and anxiety symptoms, psychosomatic and ADHD symptoms. In summary, the goals of the present study are both to identify groups of adolescents at risk of gambling, alcohol abuse, antisocial behaviour, and daily smoking as well as differences related to gender, and to investigate the mental health of these groups in terms of depressive and psychosomatic symptoms, sleep problems, and ADHD symptoms.

## **Method**

### **Participants and Procedure**

This study was based on data from the Survey of Adolescent Life in Västmanland conducted in 2012. The adolescent population of Västmanland County is considered fairly representative of Swedish society because of its educational, income, and employment level distribution, as well as in terms of its urban and rural areas (SCB, 2021). Moreover, the rates of gambling among adolescents have been fairly stable from 2012 to date (Guttormsson, 2020). The target population was students in grade 9 (15- to 16-year-olds) of compulsory school and in the second year of upper secondary school (17- to 18-year-olds). The students answered the questionnaire during class (administered by their teacher) and were informed that participation was voluntary, anonymous, and that they could end their participation at any time.

The original sample consisted of 4,440 adolescents (2,186, 49.2% boys). For the purpose of the present study, only adolescents with gambling experience were included, which comprised 1,526 individuals (1,021, 67% boys). Most of the young people were of Scandinavian ethnicity ( $n = 1,141$ , 75%). Finally, 80% ( $n = 1,220$ ) lived in a family where both parents were employed, 18% ( $n = 281$ ) had one unemployed parent, while 2% did not know ( $n = 24$ ) what their parents did for a living.

The study adhered to the Swedish guidelines for the social sciences and humanities in accordance with the Declaration of Helsinki. Under Swedish law (Ethical Review Act 2003:460), this type of anonymous study does not require ethical approval.

## Measures

### *Problem gambling*

The severity of problem gambling was measured with the Problem Gambling Severity Index (PGSI, Orford et al., 2010). The scale comprises nine items: (1) *Have you bet more than you could really afford to lose?* (2) *Have you needed to gamble with larger amounts of money to get the same excitement?* (3) *Have you tried to win back money you lost?* (4) *Have you borrowed money or sold anything to get money to gamble?* (5) *Have you felt that you might have a problem with gambling?* (6) *Have you felt that gambling has caused you any health problems, including stress or anxiety?* (7) *Have people criticized your betting, or told you that you have a gambling problem, whether or not you think it is true?* (8) *Have you felt your gambling has caused financial problems for you or your household?* and (9) *Have you felt guilty about the way you gamble or what happens when you gamble.* Response alternatives ranged from never (0) to almost always (3). The score ranges from 0 to 27 with 8 or more points indicating problem gambling. Cronbach's alpha was 0.92.

### *Alcohol*

Alcohol use was measured with a revised version of the Alcohol Use Disorders Identification Test—Consumption (AUDIT-C) (see Åslund & Nilsson, 2013). Because of the young age of our sample, the original scale was slightly modified and more response alternatives were added. The index score ranged from 0 to 14, which was used as a continuous variable in the LMVV and ANCOVA analyses. Boys with a score of  $\geq 7$  and girls with  $\geq 6$  were defined as high alcohol consumers. This cut-off point allowed us to describe the sample and to interpret the results of the LMVV. Cronbach's alpha was 0.91.

### *Antisocial behaviour*

Antisocial behaviour was measured using a 16 item questionnaire (Åslund et al., 2011). The participants were asked about the frequency of any delinquent and violent behaviour they had been involved in. The sixteen items were as follows:

How often have you (1) *had gambling debts?* (2) *taken goods in a store, shop, or kiosk without paying?* (3) *deliberately smashed or wrecked windows, streetlights, benches, or other public things?* (4) *without permission, painted graffiti, or scrawled on, for example, a public wall?* (5) *stolen a bike?* (6) *threatened or forced someone to give you money, cigarettes, or something else?* (7) *driven a moped, motorbike, or car while drunk?* (8) *threatened or forced someone to give you money, cigarettes, or something else?* (9) *stolen a moped, motorbike, or motor scooter?* (10) *been involved in breaking into and stealing something from a car?* (11) *been involved in a fight during your leisure time (not at school)?* (12) *carried tear gas, pepper spray or similar at school or in your free time?* (13) *by yourself threatened another person to do something she did not want to do?* (14) *carried a weapon (knuckle-duster, baseball bat, knife, switchblade, or similar) at school or during your leisure time?* (15) *hit or kicked someone so hard she needed medical attention?* and (16) *deliberately hurt someone with a knife, switchblade, knuckle-duster, or similar item?* The responses range from *never* (0) to *more than 10 times* (4) with an index score from 0 to 64. Cronbach's alpha was 0.94.

### ***Tobacco use***

The adolescent boys and girls were asked whether they smoked and the response alternatives were: (1) *no, never*; (2) *I have quit*; (3) *yes, sometimes*; and (4) *yes, everyday* (4). The item was dichotomized into daily smokers (1, *everyday*) and others (0, *never, quitters, and sometimes*).

### ***Psychosomatic symptoms***

Psychosomatic symptoms were measured with nine items from the WHO scale assessing the following symptoms in the last three months: (1) *headache*, (2) *stomach ache*, (3) *feeling nervous*, (4) *feeling sleepy*, (5) *feeling irritated*, (6) *feeling stressed*, (7) *pain in the shoulders or neck*, (8) *pain in the back or hips*, and (9) *pain in the hands, knees, legs or feet* (Åslund & Nilsson, 2013). The answers range from *never* (0) to *always* (4), with the index score from 0 to 36. Cronbach's alpha was 0.82.

### ***Sleep problems***

The Karolinska Sleep Questionnaire (KSQ, Åkerstedt et al., 2002) was used to measure subjective sleep and sleepiness. The KSQ is a well-validated instrument and contains 18 questions: have you been bothered by the following complaints during the past three months? (1) *difficulties falling asleep*; (2) *difficulties waking*; (3) *repeated awakening with difficulty going back to sleep*; (4) *heavy snoring*; (5) *insufficient sleep*; (6) *light and superficial sleep*; (7) *breathing interruptions during sleep*; (8) *nightmares*; (9) *not thoroughly rested*; (10) *premature awakening*; (11) *disturbed sleep*; (12) *feeling exhausted when awaking*; (13) *sleepiness at school or at work*; (14) *sleepiness during leisure time*; (15) *drowsiness or prolonged fatigue*; (16) *involuntary naps at school or at work*; (17) *involuntary naps during leisure time*; and (18) *having to fight sleep to stay awake*. Response alternatives range from *never* (0) to *5 times or more per week* (5), with index scores from 0 to 90. Cronbach's alpha was 0.90.

### *Depressive symptoms*

The Depression Self-Rating Scale Adolescent version (DSRS-A, Svanborg & Ekselius, 2003) was used. The scale consists of 15 items based on the DSM-IV criteria for major depressive disorder, namely, (1) *dysphoric* or (2) *irritable mood* or (3) *loss of interest or pleasure in most activities*, in addition to (4) *sleep disturbances*, (5) *weight loss*, or (6) *gain* or (7) *appetite disturbances*, (8) *psychomotor agitation* or (9) *retardation*, (10) *fatigue* or (11) *loss of energy*, (12) *feelings of worthlessness* or (13) *guilt*, (14) *concentration disturbances*, and (15) *thoughts of suicide*. The adolescents were asked about their depressive feelings in the last two weeks, with a Yes/No response alternative. In accordance with the DSRS scale, the index used in the analysis was calculated by adding the reported symptoms, where each symptom was counted only once (0–9 points). Cronbach's alpha was 0.81. Moreover, a dichotomous variable was created, in which adolescent boys and girls fulfilling the DSM-IV A-criterion were classified as depressed. This variable was used to describe the sample.

### *ADHD Symptoms*

The World Health Organization Adult ADHD Self Report Scale (ASRS; Kessler et al., 2005) was used. The first 6 of the 18 questions are valid for use as a short screening and were employed in the present study. The questions were the following: (1) *How often do you have trouble wrapping up the finer details of a project once the challenging parts have been done?* (2) *How often do you have difficulty getting things in order when you have to do a task that requires organization?* (3) *When you have a task that requires a lot of thought, how often do you avoid or delay getting started?* (4) *How often do you have problems remembering appointments or obligations?* (5) *How often do you fidget or squirm with your hands or feet when you have to sit for a long time?* and (6) *How often do you feel over active and compelled to do things, as if driven by a motor.* The response alternatives ranged from never (0) to very often (4). Cronbach's alpha was 0.80.

### *Covariates*

Gender (male, female), Age (Grade 7 and Grade 9), and Socio-Economic Status (SES) were used as covariates in the analyses. SES was assessed by the following question: *Imagine society as being like a ladder. At the bottom are those with the least money, and at the top are those with the most. If you think about how wealthy your own family is compared to the rest of society, where would you place your family on this ladder?* There were 7 possible response alternatives, which ranged from 1 (*very bad*) to 7 (*very good*) (Åslund & Nilsson, 2013).

### **Statistical Analyses**

To investigate the first research question, we performed Latent Variable Mixture Modeling (LVMM, Muthén, 2001). The LVMM enables person-centered analysis

aimed at identifying subgroups of individuals with similar values in a selected number of variables. Therefore, this technique focuses on similarities and differences among people rather than relationships between variables. In LVMM, subgroup membership must be inferred from the data. Individuals who are classified in the same group share the same level of risk concerning problem gambling, alcohol use, smoking, and antisocial behaviour. This analysis technique allows both continuous and categorical variables in the same model. In our analysis, the measure of smoking was dichotomous (no/yes) and treated as categorical, i.e., the probability of each category of individuals (e.g., non-smokers vs. daily smokers) belonging to a certain group was estimated. Model fit indices were used to evaluate the number of groups that best fitted the empirical data. The group solution with the lowest Bayesian Information Criterion (BIC), the Highest Classification Accuracy (AIC), and a non-significant Lo Mendell Rubin Likelihood Ratio Test (LMR-LRT) (Muthén, 2001) was chosen. More specifically, a non-significant LMR-LRT score means that adding one more class to the model would not result in an improved model fit. To handle missing data, we estimated the models using full information maximum likelihood (FIML).

Finally, we used chi-square tests and ANCOVA models to investigate the relationships between different groups, gender, and mental health, while controlling for age, gender, and SES.

## Results

### Descriptive statistics

Table 1 presents a description of the principal variables in the study. To facilitate interpretation of the results, we presented dichotomous variables for alcohol, gambling, and depression using the thresholds for problem behaviours outlined in the Measures section. The sample in the analysis included adolescents with experience of gambling. Among these young people, a minority reported problem gambling (9%,  $N = 138$ ), followed by daily smoking (13%,  $N = 196$ ), and alcohol abuse (36%,  $N = 591$ ).

Boys had more problem gambling, alcohol abuse, and antisocial behaviour than girls, while girls reported more depressive, psychosomatic, and ADHD symptoms as well as sleep problems (Table 1).

### Groups at risk of multi-problem behaviour

LVMM revealed that the four-class solution had the best model fit (see Table 2).

The first group (LOW RISK) consisted of 1,296 (85%) adolescents who reported a low level of antisocial behaviour ( $M = 19.71$ ,  $SE = .35$ ), a low level of alcohol use ( $M = 4.44$ ,  $SE = .13$ ), a low probability of being a daily smoker (10%), and no problem gambling ( $M = .51$ ,  $SE = .04$ ). The second group (MODERATE-HIGH

**Table 1**  
*Descriptive statistics of study variables*

Variables	Total sample % or <i>M</i> ( <i>SD</i> )	Boys % or <i>M</i> ( <i>SD</i> )	Girls % or <i>M</i> ( <i>SD</i> )	<i>t</i> or $\chi^2$ value/ <i>df</i>
Problematic gambling				
Severe gambling	9% ( <i>N</i> =138)	12% ( <i>N</i> =122)	3% ( <i>N</i> =17)	$\chi^2(1)=28.92^{**}$
Acceptable gambling	91% ( <i>N</i> =1388)	88% ( <i>N</i> =899)	97% ( <i>N</i> =477)	
Alcohol consumption				
Problematic drinkers	40% ( <i>N</i> =591)	41% ( <i>N</i> =399)	40% ( <i>N</i> =192)	$\chi^2(1)=0.61$ , n.s.
Non problematic drinkers	60% ( <i>N</i> =873)	61% ( <i>N</i> =584)	60% ( <i>N</i> =289)	
Smoking				
Daily smokers	13% ( <i>N</i> =196)	12% ( <i>N</i> =122)	15% ( <i>N</i> =73)	$\chi^2(1)=2.25$ , n.s.
Non daily smokers	87% ( <i>N</i> =1330)	88% ( <i>N</i> =885)	85% ( <i>N</i> =417)	
Antisocial behaviors	23.8 (12.97)	25.66 (14.24)	20.05 (8.75)	<i>t</i> (1481)=8.00 <sup>**</sup>
Depressive symptoms				
High symptoms	26%	21% ( <i>N</i> =216)	36% ( <i>N</i> =180)	$\chi^2(1)=40.27^{**}$
Low symptoms	74%	79% ( <i>N</i> =805)	64% ( <i>N</i> =314)	
Psychosomatics symptoms	13.52 (6.99)	12.24 (6.90)	16.15 (6.38)	<i>t</i> (1496)=10.54 <sup>**</sup>
Sleep problems	26.74 (17.13)	24.44 (16.91)	29.79 (17.27)	<i>t</i> (1510)=4.42 <sup>**</sup>
ADHD symptoms	2.00 (1.77)	1.90 (1.76)	2.22 (1.76)	<i>t</i> (1510)=3.32 <sup>**</sup>

Note. *M* = mean; *SD* = standard deviation, *N*=number; <sup>\*\*</sup>*p*>.001.

**Table 2**  
*Class solutions of the LVMM models*

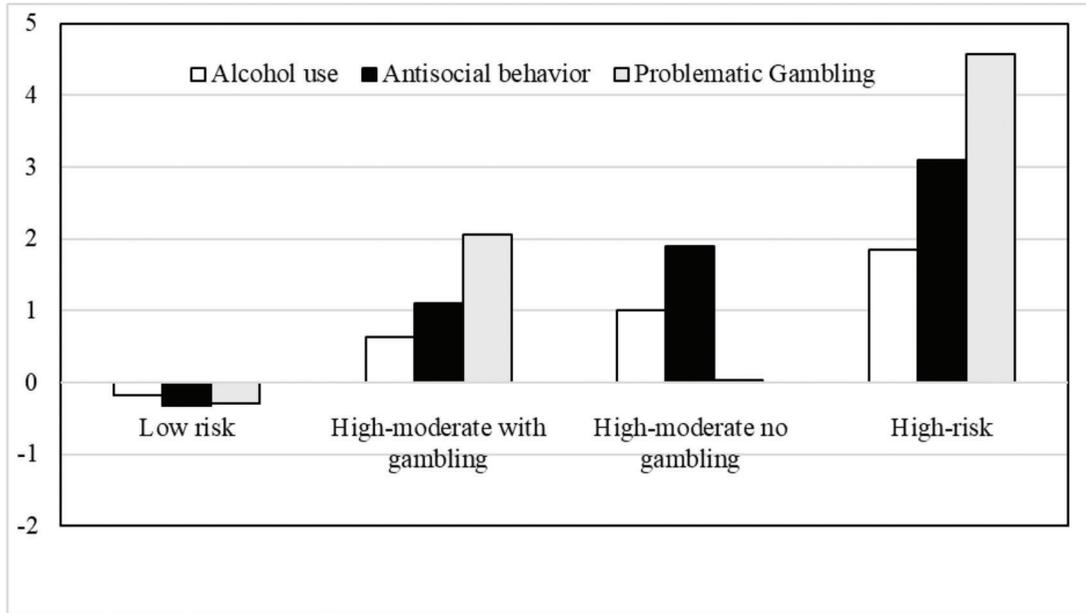
	AIC	BIC	Entropy	LMR-LRT
2 Classes	28516.8	28580.5	.99	> .001
3 Classes	27377.7	27468.3	.99	> .001
4 Classes	26940.6	27057.9	.97	n.s.

Note. *N* = 1412. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; LMR-LRT = Lo Mendell Rubin Likelihood Ration Test.

risk with GAMBLING) consisted of 99 (7%) adolescents who reported problematic alcohol use ( $M = 7.98$ ,  $SE = .65$ ) and gambling ( $M = 12.42$ ,  $SE = .59$ ), high rates of antisocial behaviour ( $M = 38.03$ ,  $SE = 2.32$ ), and low probability of being a daily smoker (28%). The third group (MODERATE-HIGH risk without GAMBLING) was composed of 90 adolescents (6%) who exhibited quite high antisocial behaviour rates ( $M = 48.45$ ,  $SE = 4.12$ ), low problem gambling ( $M = 2.21$ ,  $SE = .94$ ), and problematic alcohol use ( $M = 9.66$ ,  $SE = .67$ ) with an almost equal chance (44%) of being or not being daily smokers. Finally, the fourth group (HIGH risk) was made up of 41 (2%) adolescents who were mainly daily smokers (probability 68%) with very problematic alcohol use ( $M = 13.31$ ,  $SE = .55$ ), very problematic gambling ( $M = 25.59$ ;  $SE = .52$ ), and very high rates of antisocial behaviour ( $M = 64.01$ ,  $SE = 2.99$ ) (see Figures 1 and 2).

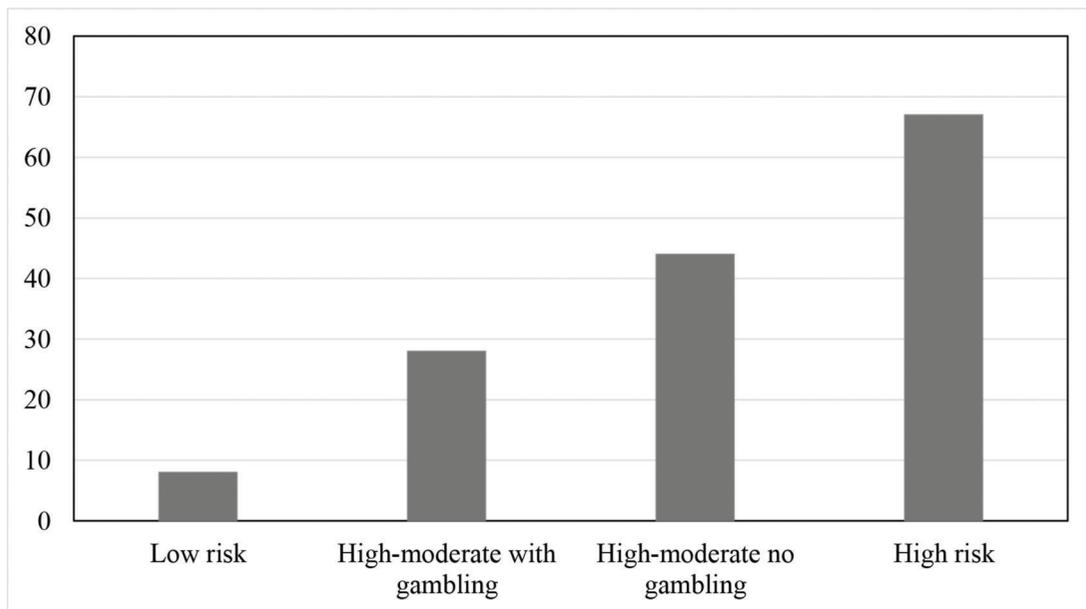
**Figure 1**

Graphic representation of reported rates of alcohol use, antisocial behaviors, and problematic gambling across groups (expressed as z-scores).



**Figure 2**

Probability of being a daily smoker across groups (expressed as a %).



In general, boys were overrepresented in all four groups compared to girls ( $\chi^2 = 50.55$ ,  $df = 3$ ,  $p < .001$ ). However, the difference was greater in the first three risk groups (MODERATE-HIGH risk with GAMBLING: 87% boys vs. 13% girls; MODERATE-HIGH risk without GAMBLING: 89% boys vs. 11% girls; and HIGH risk: 88% boys vs. 12% girls) compared to the LOW risk group (64% boys vs. 35% girls).

### **Different groups and mental health problems**

To investigate whether the four groups of adolescents differed in terms of mental health problems, ANCOVA models were employed to control for age, gender, and SES. The HIGH risk group reported more psychosomatic symptoms ( $F(6, 1483) = 58.21$ ,  $p < .001$ ), depressive symptoms ( $F(6, 1498) = 61.71$ ,  $p > .001$ ), sleep problems ( $F(6, 1495) = 72.81$ ,  $p < .001$ ), and ADHD symptoms ( $F(6, 1498) = 24.17$ ,  $p < .001$ ) than the LOW risk group (see Table 3). The HIGH risk group also exhibited higher levels of psychosomatic symptoms and sleep problems than the other two risk groups. However, the adolescents in the HIGH risk group were found to have a similar rate of ADHD symptoms to the other two risk groups. When it comes to the two MODERATE-HIGH risk groups, they did not differ in terms of psychosomatic symptoms, sleep problems, or ADHD symptoms. However, the MODERATE-HIGH risk with GAMBLING group reported higher depressive symptoms than the MODERATE-HIGH risk without GAMBLING group, as well as similar rates to the HIGH-RISK group. Thus, the LOW risk group had the lowest level of mental health problems, while both the MODERATE-HIGH risk with GAMBLING group and the HIGH risk group reported the highest level of mental health problems.

### **Discussion**

The purpose of this study was to identify adolescents with multi-problem behaviours, i.e., alcohol abuse, daily smoking, antisocial behaviour, and problem gambling, and to investigate differences in relation to gender. Moreover, we intended to determine whether these groups differed in terms of mental health. We found four groups of adolescents. The first group, the LOW risk group, consisted of adolescent boys and girls with low levels of the above-mentioned risk behaviours. This group represented most of the adolescents who gamble. The other two groups, the MODERATE-HIGH with GAMBLING and the MODERATE-HIGH without GAMBLING risk groups, were smaller and were both problematic, but for different reasons. They were quite similar regarding alcohol use and antisocial behaviour but differed in terms of problem gambling and daily smoking. The young people in the MODERATE-HIGH with GAMBLING group reported problem gambling, whereas those in the MODERATE-HIGH without GAMBLING group reported more daily smoking. Boys were overrepresented in all groups compared to girls, with a greater difference in the three risk groups. The four groups exhibited different levels of mental health problems, with the HIGH risk group being the most compromised. However, the MODERATE-HIGH with GAMBLING group did not differ from the HIGH risk

**Table 3**  
*Means (M) and Standard Deviations (SD) between the subgroups*

Variables	LOW RISK group <i>M (SD)</i>	MODERATE-HIGH risk with GAMBLING group <i>M (SD)</i>	MODERATE-HIGH risk without GAMBLING group <i>M (SD)</i>	HIGH risk group <i>M (SD)</i>
Depressive symptoms	2.42 (2.60)a	5.28 (2.88)b	4.16 (3.06)c	6.20 (3.03)b
Psychosomatics symptoms	12.93 (6.28)a	14.82 (8.94)b	15.96 (7.22)b	23.85 (11.87)c
Sleep problems	24.23 (14.89)a	39.38 (18.65)b	34.91 (16.25)b	59.14 (27.42)c
ADHD symptoms	1.84 (1.67)a	2.76 (1.92)b	2.94 (1.91)b	3.31 (2.26)b

*Note.* Across rows, means with different subscripts differ significantly ( $p < .05$ ) whereas means sharing the same subscripts do not differ.

group in terms of depressive symptoms. In summary, our study supports the idea that problem gambling is likely to be practiced by those who are already at risk of other typical risk behaviours in adolescence, i.e., heavy alcohol and tobacco use and antisocial behaviour. Adolescents with these behaviours are also more at risk of developing mental health problems.

A set of conclusions can be drawn from this study. First and foremost, our results seem to suggest that problem gambling can partly occur for similar reasons and be triggered by the same mechanisms as more conventional risk behaviours, such as alcohol abuse and antisocial behaviour. Two findings point to this conclusion. First, none of the groups reported problem gambling only. Second, the MODERATE-HIGH with GAMBLING risk group also showed elevated rates of alcohol use and antisocial behaviour, which indicates an etiological overlap between behaviours. This finding is in line with previous studies that have identified similar risk factors for problematic alcohol use, gambling, and antisocial behaviour (e.g., Shead et al., 2010; Vitaro et al., 2001). Moreover, our study also confirms the idea that adolescents who engage in multi-problem externalizing behaviours are particularly at risk of mental health problems. However, given the lack of difference in depressive symptoms between the MODERATE-HIGH with GAMBLING and HIGH risk groups, our study highlights the fact that problem gambling might play a stronger role in the development of mental health problems than other risk behaviours, such as alcohol and antisocial behaviour. Many studies have pointed out a comorbidity between alcohol use (e.g., Danzo et al., 2017), antisocial behaviour (McGrath & Barrett, 1994), smoking (Leventhal et al., 2016), gambling (Richard & Derevensky, 2017), and mental health problems. The present study adds that the risk of depressive symptoms differs in adolescents who show varying patterns of multi-problem behaviours, suggesting that problem gambling might be more important than other risk behaviours, such as daily smoking.

Interestingly, this study found that problem gambling differed between the two MODERATE-HIGH risk groups. The group that reported problem gambling did not consist of daily smokers. This finding has two implications. First, given that approximately 60% of adult pathological gamblers also smoke and that the comorbidity with smoking is higher than for other types of substance (Lorains et al., 2011), finding a group of adolescents with problem gambling who do not smoke on a daily basis is quite unexpected. As underlying impulsivity has been hypothesized as a common factor in gambling and smoking (McGrath & Barrett, 2009), it is possible that this subgroup consisted of adolescents with problem gambling but with a lower level of impulsivity. However, this hypothesis should be tested in future studies. Second, the group of adolescents exhibiting multi-problem behaviours that included problem gambling was characterized by higher levels of depressive symptoms compared to the group with multi-problem behaviours but without gambling. This discovery is not surprising, as approximately 38% of all pathological gamblers fulfil the criteria for mood disorders (Lorains et al., 2011; Richard & Derevensky, 2017). However, to our knowledge, this study is the first to highlight the importance of problem gambling in relation to other externalizing behaviours when identifying

adolescents with mental health problems. Future investigations should further confirm this result and investigate the factors behind these associations.

This study enjoys certain limitations. First, all measures were self-reported, which prevented us from identifying adolescents with a clinical diagnosis. Second, as the design was cross-sectional, we are unable to conclude whether the adolescents developed mental health problems because of their problem behaviours or vice versa. Finally, as our sample only included those who gambled at least once, adolescents with problem behaviours are overrepresented. This fact can be observed from the percentage of adolescents with a possible diagnosis of depression and problematic alcohol use. However, as the purpose of the study was to investigate the role of gambling in relation to other problem behaviours, the decision to exclude those persons who did not gamble appears appropriate. In summary, we suggest that our results should be confirmed using a longitudinal design and a multi-informant approach.

The study also holds certain strengths. To our knowledge, it is one of the few studies to apply a person-oriented approach to identifying adolescents who exhibit the most common risk behaviours, namely alcohol use, smoking, antisocial behaviour, and problem gambling. While a variable-oriented approach can show the potential comorbidity of these behaviours, a person-oriented approach allows us to go one step further and identify adolescents who show comorbidity with specific risk behaviours and those who do not. In the case of the present study, a person-oriented approach helped us to understand that not all adolescents who report multi-problem behaviours are at risk of problem gambling. However, among such adolescents, those who present problem gambling are at risk of mental health problems.

## Conclusions

Despite increased interest, adolescent gambling is still fairly unexplored compared to other risk behaviours that occur in adolescence. In this study, we contributed to the existing literature by showing that problem gambling can be part of a range of multi-problem behaviours that include typical adolescent risk behaviours, i.e., alcohol and tobacco use as well as antisocial behaviour. In addition, we highlighted an increased risk of mental health problems in adolescents with multiple problems who gamble compared to those who reported multi-problem behaviours without gambling. These findings highlight the need to complement the variable-oriented approach with a person-oriented approach to identify adolescents with multiple problems who are potentially at risk of mental health problems.

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