

## Prevalence, risk factors, and psychosocial adjustment of problematic gambling in adolescents: Results from two representative German samples

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*Background and aims:* Gambling disorder is a significant public health concern. Especially, male minors have been shown to gamble in a problematic way, despite legal prohibitions. *Methods:* We examined representative samples of students aged from 12 to 18 years ( $N = 9,309$ ) in two German federal states to provide prevalence data and clinical description of risk factors for problematic gambling. *Results:* We found that about 40% of the adolescents reported engaging in gambling activities within the past 12 months and found prevalence rates of 1.7% and 2.2% for problematic gambling. Especially, use of online gambling and slot machines was found to be related to problematic gambling. Male adolescents with a migration background were of higher risk for problematic gambling and psychopathological symptoms were significantly elevated among that group. *Discussion:* The results indicate that participation in gambling activities is common among underage adolescents and that prevalence of problematic gambling exceeds rates of adults. Similarly, problematic gambling is associated with increased psychopathological strain. *Conclusion:* Given that a high proportion of adult gamblers report having started gambling in adolescents, our data emphasize the need for prevention and early intervention strategies for problematic gambling.

**Keywords:** adolescents, epidemiology, prevalence, problematic gambling, mental illness, psychological stress

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### INTRODUCTION

Research into gambling behavior among adolescents has steadily increased in recent years. International studies have consistently found that problematic gambling mainly occurs in male adolescents and it is to be perceived as both, a major stressor in the adolescents' life and a predictor for gambling disorder in adulthood (Griffiths, 2009). In addition, it seems that the spreading availability and diversity of legal gambling lead to an increasing prevalence of adolescent gambling and consequently to gambling problems among young people (Calado, Alexandre, & Griffiths, 2017). A recent epidemiologic study on a representative sample of the US adolescents aged between 14 and 21 years found a prevalence rate of 2.1% for problematic gambling (Welte, Barnes, Tidwell, & Hoffman, 2008). The latest European study on adolescents' gambling behavior included 2,796 students aged from 11 to 16 years and was carried out in Great Britain (Ipsos MORI, 2015). Slot machines were the most popular type of gambling and the prevalence of problematic gambling amounted to 0.7% (Ipsos MORI, 2015), which, compared to 2% in 2008, indicates a decline (Ipsos MORI, 2009).

Griffiths (2009) reviewed 30 British studies and concluded that two thirds of the adolescents gambled on slot machines.

About 6% met criteria of problematic gambling or showed problems related to gambling. An Icelandic study addressed gambling in 1,500 adolescents aged between 13 and 18 years (Olason et al., 2011). Around 57% of the participants gambled at least once in the past year and 24% bet money on gambling websites. The prevalence rate for problematic gambling was 2.2%.

The most recent Germany-wide study (Meyer et al., 2011) examined a sample of 15,000 subjects between 14 and 64 years. The subsample of 14- to 17-year olds ( $N = 947$ ) had used almost all of the gambling opportunities in the past year to the same extent as adults had. Minors had already experienced problems related to gambling and the percentage of those adolescents meeting the DSM-IV criteria for problematic gambling amounted to 1.5%. Poker, slot machines, and sport bets were the most used gambling activities among them. This rate is especially alarming since gambling is strictly prohibited for minors in Germany. Slot

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machines can be found not only in state-licensed locations, where access is prohibited for minors, but also in restaurants or motorway service areas, where their availability is hard to control.

Problematic gambling has been linked to a variety of health-related problems. Subjects with gambling disorder were shown suffering from symptoms of exhaustion, insomnia, and pain syndromes (Bischof et al., 2013). Correlations between gambling disorder and stress-related markers, both psychological and psychophysiological (e.g., resulting in a heightened activation of the hypothalamic–pituitary–adrenal axis), have been demonstrated (Franco, Paris, Wulfert, & Frye, 2010). On a somatic level, gambling disorder is linked to heightened blood pressure (Larimer, Lostutter, & Neighbors, 2006) and has been discussed as a risk factor for coronary heart diseases (Germain et al., 2011; Morasco et al., 2006). There is evidence that gambling disorder leads to severe social conflicts and illegal activities, including fraud, arrest, and imprisonment (Korman et al., 2008; Williams, Royston, & Hagen, 2005). Despite the growing availability of data on adolescents' gambling habits, there have also been critical voices calling for higher methodological standards in this research area. Particularly, different authors have pointed out that prevalence rates for problem gambling among youth might be overestimating the problem and that these survey-based data should be completed by clinical data (Derevensky, Gupta, & Winters, 2003; Ladouceur et al., 2000).

It is a matter of concern that adolescents with problematic gambling might be affected by similar adverse outcomes as adults. Different forms of risk-prone behavior have been found to be more common among adolescents with problematic gambling (Valentine, 2008). It is argued that minors with problematic gambling are affected by deficits in concentration and school performance, interpersonal conflicts, depressive symptoms, and lower self-esteem (Forrest & McHale, 2012; Gupta & Derevensky, 2000; Shead, Derevensky, & Gupta, 2010; Stinchfield, 2004). There is growing evidence that adolescents with problematic gambling show signs of increased distress and react with dysfunctional coping styles (Bergevin, Gupta, Derevensky, & Kaufman, 2006; Nower, Derevensky, & Gupta, 2004).

Importantly, data from interviews with adult patients with gambling disorder suggest that the onset of gambling often takes place in adolescence (Volberg, 1994; Winters, Stinchfield, & Fulkerson, 1990). An early onset of gambling problems is related to an increased severity of gambling disorder symptoms in adults, more severe psychiatric symptoms, and higher rates of substance abuse (Burge, Pietrzak, & Petry, 2006; Lynch, Maciejewski, & Potenza, 2004).

Looking at patterns of comorbidity in gambling disorder reveals that the probability of additional mental disorder is increased (e.g., Shaffer & Korn, 2002). With few examples, studies focusing on psychopathology and comorbidity in adolescent gamblers are rare (e.g., Shead et al., 2010). Bischof et al. (2013) demonstrated that 95.5% of the adult gambling disorder group was affected by an additional mental disorder. Especially, substance-related disorders were common (89.8%), followed by affective (63.1%) and anxiety disorders (32.1%). These findings are supported by international studies (el-Guebaly et al., 2006). In addition,

surveys on comorbid substance abuse in adolescents with problematic gambling have shown strong associations (Forrest & McHale, 2012; Hurrelmann, Schmidt, & Kähnert, 2003; Lorains, Cowlshaw, & Thomas, 2011).

There is a lack of knowledge regarding adolescents' gambling behavior in Germany. No prevalence study addressing problematic gambling in minors that encompasses a large-scale representative sample has been conducted in Germany since 2003 (Hurrelmann et al., 2003). New gambling opportunities have been developed, like a variety of gambling activities that can be performed – and easily accessed – on the Internet. The purpose of this study was to update the knowledge on adolescents' gambling behavior by explicitly considering forms of online gambling that were not considered before (Hurrelmann et al., 2003). Second, we were interested to find out which adolescents are at risk of meeting criteria for problematic gambling and about psychosocial strain associated with this behavior. Based on international surveys, we assumed that especially Internet-based gambling can be highly attractive for adolescents. Similarly, we assumed that participants meeting criteria for problematic gambling will show increased psychosocial problems and psychopathological symptoms. To meet our research aims, we recruited the largest sample of adolescents in Germany available to date from two separate regions. Based on these samples, we estimated the prevalence of problematic gambling based on an established screening measure. In addition, we explored which gambling activities are most closely related to exhibiting problematic gambling with a special focus on Internet-based gambling activities. We were interested in identifying demographic markers associated with enhanced risk of problematic gambling and to characterize those adolescents meeting criteria for problematic gambling regarding psychosocial distress and psychopathological symptoms.

## METHODS

### *Sampling procedure and participants*

After elementary school, pupils attend one of four different school types in Germany: “Hauptschule” (lower secondary education), “Realschule” (middle school), “Integrierte Gesamtschule” (integrated school), or “Gymnasium” (high school), depending on their academic skills. Integrated schools are combining the teaching contents of the other school types (students are attending specific and shared courses according to their individual academic performance). Students who do not attend university after high school are visiting vocational schools with a special focus on the latter profession. All types of schools teach the same subjects, but “Hauptschule” offers a slower pace and additionally some vocational-oriented courses. Students are left here after the 9th grade, in comparison with the 10th in the “Realschule” and 12th/13th in the “Gymnasium.” Only after finishing the “Gymnasium” with the diploma (“Abitur”), it is possible to attend university.

Two independent representative samples of adolescents from two federal states of Germany (sample 1: Rhineland-Palatinate; sample 2: North Rhine-Westphalia) were recruited.

The research projects were funded by the Ministry of Social Affairs, Labour, Health, and Demography of the state Rhineland Palatinate and by the Ministry of Health, Equalities, Care, and Ageing of the state North Rhine-Westphalia and were in accordance with the Declaration of Helsinki with the permission by the ethics committee of the State Board of Physicians.

Over a period of 8 months (between 2011 and 2012), two representative samples of adolescents aged 12–18 years were drawn. The procedure was based on a random probability sample selection with a stratification regarding school type and regional population density. A second selection criterion regarded the specific school classes in the schools that were drawn. The sample sizes were calculated based on power calculations (see Supplementary Figure 1a and 1b). Questionnaires were provided to all the students attending class at the point of the data acquisition. A total of 139 schools were representatively selected (sample 1: 62; sample 2: 77). The response rate of the stratified schools amounted to 66.1% (sample 1) and 54.3% (sample 2). Participating and non-participating schools did not differ systematically regarding region or school-type. Due to the characteristics of the selection process, the distribution of pupils from different school types was unequal. Further differences in the school types selected were due to differences in the regional school systems. Data were collected from a total of 4,047 (sample 1) and 6,081 (sample 2) respondents. About 252 (6.2%; sample 1) and 382 (6.3%; sample 2) cases had to be removed from the data set because of missing data. From sample 2,  $n = 185$  students aged 19 years were excluded from the final data set. This was mainly because the sampling plan was defined to encompass the age group of 12–18 years. Moreover, we were interested in assessing the gambling behavior of underaged students; thus, it was decided to remove the 19-year olds from the subsequent analyses. A further reason was to assure age equality and comparability in both the samples. The final samples consisted of  $n = 3,795$  (sample 1) and  $n = 5,514$  (sample 2). Table 1 provides basic information on the demographics of the samples.

### Measures

*General Questionnaire.* Demographics and use of different gambling forms were assessed by self-reports. Lifetime prevalence (0 = no, 1 = yes) and 12-month prevalence (0 = no to 6 = almost daily) of 12 different gambling activities (slot machines, lotteries, poker, different types of Internet gambling offers, etc.) were assessed.

*DSM-IV-Multiple Response-Juvenile (DSM-IV-MR-J).* Prevalence of problematic gambling was assessed using the DSM-IV-MR-J (Fisher, 2000; Hurrelmann et al., 2003). Gambling behavior is classified by nine items referring to the past 12 month. The items measure 9 of 10 DSM-IV-criteria for gambling disorder: preoccupation with gambling, tolerance, loss of control, withdrawal, escape, chasing, lies, illegal and unsocial acts, and risked job, education, or relationship. Problematic gambling is indicated if at least four criteria have been met. Participants who meet two or three criteria fall into the category “at-risk gamblers.” None or one item endorsed represents “non-problematic gambling behavior.” In this survey, DSM-IV-MR-J showed high reliability (sample 1:  $\alpha = .85$ ; sample 2:  $\alpha = .84$ ).

Using the term problematic gambling instead of the DSM-5 terminology, “gambling disorder” considers that no diagnosis can be made based on self-report data.

*Perceived Stress Scale (PSS).* The scale measures perceived stress and can be used to assess the general vulnerability toward stress (Cohen, Kamarck, & Mermelstein, 1983). Stress vulnerability has been shown to contribute to mental disorders, e.g., depressive disorders or substance addiction (Rhodewalt, Hays, Chemers, & Wysocki, 1984). The PSS consists of 14 items with a 4-point Likert scale. It showed acceptable reliability for both surveys (sample 1:  $\alpha = .75$ ; sample 2:  $\alpha = .70$ ).

*Strengths and Difficulties Questionnaire (SDQ).* The SDQ assesses psychosocial symptoms with 25 items. The items range from 0 to 3 and compose five scales: hyperactivity, emotional symptoms, conduct problems, peer problems, and prosocial behavior. A total difficulties score can be calculated by summing the scores of each of the scales (excluding prosocial behavior). The total score ranges from 0 to 40. Goodman (1997) proposed cutoffs as follows: 0–13 normal, 14–16 heightened burden, and 17–40 salient burden. The German version of the SDQ showed sound psychometric properties (Essau et al., 2012; Klasen, Woerner, Rothenberger, & Goodman, 2003). Cronbach’s  $\alpha$  amounted to .54–.58 (conduct problems), .69–.71 (peer problems), .72–.74 (prosocial behavior), .72 (hyperactivity), and .71–.74 (emotional problems).

### Statistical analysis

SPSS 21.0 was used for statistical analysis. All psychometric instruments were tested for reliability (Cronbach’s  $\alpha$ ). Categorical and nominal variables are analyzed using  $\chi^2$  tests with Phi ( $\phi$ ) and Cramer’s  $V$  (CV) as indicators of effect size. Continuous variables were analyzed using analyses of covariance (ANCOVAs) with post-hoc analyses and Kruskal–Wallis test,  $t$ -tests, and non-parametric Mann–Whitney  $U$  tests, respectively. Cohen’s  $d$  and Eta-square ( $\eta^2$ ) were used as effect size parameters. All analyses were corrected according to Bonferroni–Holm method. Multiple regression analyses were conducted for the analyses of complex relationships between predictors and outcome variables.

### Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The institutional review board (State Board of Physicians) approved the study. All subjects were informed about the study and all provided informed consent. Parental consent was sought for those younger than 18 years of age.

## RESULTS

### Participation in gambling behavior and prevalence of problematic gambling

About 65.1% ( $n = 2,471$ ; sample 1) and 69.4% ( $n = 3,827$ ; sample 2) reported having participated in at least one gambling activity in their life. Gambling participation within

Table 1. Demographics and course of gambling participation of the two samples

Demographic variables	Sample 1			Sample 2		
	Never	Past	Active	Never	Past	Active
Gender (% , n)						
Male	25.2 (464)	20.7 (382)	54.1 (997)	23.4 (646)	22.3 (616)	54.2 (1,495)
Female	44.1 (860)	27.2 (530)	28.8 (562)	37.8 (1,041)	30.8 (850)	31.4 (866)
Age						
M (SD)	15.3 (1.71)	15.6 (1.66)	15.8 (1.60)	15.1 (1.56)	15.2 (1.62)	15.6 (1.63)
12–13 years (%)	45.4 (227)	24.6 (123)	30.0 (150)	36.5 (296)	29.1 (236)	34.4 (279)
14–15 years (%)	36.8 (424)	23.6 (271)	39.6 (455)	34.0 (763)	26.8 (601)	39.2 (878)
16–17 years (%)	32.9 (549)	24.2 (403)	42.9 (715)	27.6 (501)	26.1 (473)	46.2 (838)
18 years (%)	26.1 (125)	24.0 (115)	49.9 (239)	196 (127)	24.0 (156)	56.4 (366)
Migration background						
Yes (%)	35.2 (1,222)	24.1 (834)	40.7 (1,411)	30.6 (1,578)	26.6 (1,371)	42.8 (2,203)
School type						
Lower secondary (%)	38.2 (55)	19.4 (28)	42.4 (61)	37.7 (320)	22.6 (192)	38.7 (337)
Middle school (%)	37.2 (395)	23.3 (247)	39.5 (418)	30.5 (325)	28.0 (299)	41.5 (443)
High school (%)	38.0 (397)	24.6 (250)	37.4 (381)	29.0 (639)	630 (28.6)	42.3 (931)
Integrated school (%)	47.3 (26)	21.8 (12)	30.9 (17)	33.2 (274)	26.8 (221)	40.0 (330)
Vocational school (%)	30.4 (461)	24.7 (375)	44.9 (681)	22.6 (129)	21.7 (124)	55.8 (319)
Living with parents						
No (%)	31.7 (303)	23.1 (221)	45.2 (432)	27.6 (351)	27.2 (347)	45.2 (576)

Note. Sample 1:  $n=3,795$ ; sample 2:  $n=5,514$ . SD: standard deviation; Never: never engaged in gambling behavior in the past; Past: engaged in gambling behavior without having participated in the past 12 months; Active: participated in gambling behavior in the past 12 months; DSM-IV-MR-J: DSM-IV-Multiple Response-Juvenile.

the past 12 months amounted to 54.1% (sample 1) and 54.2% (sample 2) of the boys and 28.8% (sample 1) and 31.4% of the girls (sample 2); these adolescents were labeled as “active gamblers.” About 20.7% ( $n=382$ ; sample 1) and 22.3% ( $n=616$ , sample 2) of the boys reported having ever gambled in their lives but stopped at least 1 year ago. The same counts for 27.2% ( $n=530$ ; sample 1) and 30.8% ( $n=850$ ; sample 2) of the girls (Table 1). These gender differences became significant for both lifetime gambling participation ( $p=.001$ ) and past year gambling participation ( $p=.001$ ) independently of the samples.

The prevalence rates for problematic and at-risk gambling are depicted in Table 2.

The analyses of gender distribution revealed that in both samples [sample 1:  $\chi^2(2)=10.421$ ,  $p=.001$ ,  $CV=.166$ ; sample 2:  $\chi^2(2)=139.68$ ,  $p=.001$ ,  $CV=0.159$ ], boys were more often affected from problematic gambling and at-risk gambling than girls.

In both the samples, the DSM-IV-MR-J score and age correlated significantly (sample 1:  $r=.063$ ,  $p=.01$ ; sample 2:  $r=.038$ ,  $p=.01$ ). Moreover, a significantly [sample 1:  $\chi^2(6)=21.24$ ,  $p=.002$ ,  $CV=0.053$ ; sample 2:  $\chi^2(2)=25.10$ ,  $p=.001$ ,  $CV=0.048$ ] higher percentage of adolescents with problematic gambling was found among the age group of the 18-year olds (sample 1: 4.6%; sample 2: 2.6%) than among minors aged between 12 and 13 years (sample 1: 0.6%; sample 2: 1.0%).

Significant relationships were detected regarding level of school education [sample 1:  $\chi^2(8)=60.08$ ,  $p=.001$ ,  $CV=0.099$ ; sample 2:  $\chi^2(2)=35.65$ ,  $p=.001$ ,  $CV=0.057$ ]. Problematic gambling was more frequent in lower school types (sample 1: 2.0%; sample 2: 1.9%) and vocational

schools (sample 1: 3.5%; sample 2: 3.3%) than in high schools (sample 1: 0.5%; sample 2: 1.0%).

Migration background (defined as being not born in Germany) had a significant effect on problematic gambling [sample 1:  $\chi^2(2)=16.90$ ,  $p=.001$ ,  $CV=0.067$ ; sample 2:  $\chi^2(2)=25.41$ ,  $p=.001$ ,  $CV=0.068$ ]. Adolescents with a migration background (sample 1: 4.5%; sample 2: 4.7%) were more often affected by problematic gambling than those without it (sample 1: 2.0%; sample 2: 1.5%). For sample 2, no association was detected between coming from broken-home circumstances and problematic gambling, whereas in sample 1, a slight, but significant effect was found [ $\chi^2(2)=6.99$ ,  $p=.030$ ,  $CV=0.043$ ]; a higher percentage of problematic gamblers (2.7% vs. 2.0%) lived in a broken-home situation.

A small effect size was found in the region of living [ $\chi^2(4)=10.06$ ,  $p=.040$ ,  $CV=0.038$ ] in sample 1. In rural areas, problematic gambling occurred with a lower frequency (1.5%) than in small towns (2.6%) and in cities (2.6%).

#### *Problematic gambling behavior and preferred gambling activity*

$\chi^2$  tests revealed that especially last year's engagement in online casino gaming [sample 1: 28.2% with problematic gambling;  $\chi^2(2)=151.16$ ,  $p=.001$ ,  $CV=0.315$ ; sample 2: 30.1% with problematic gambling;  $\chi^2(2)=307.64$ ,  $p=.001$ ,  $CV=0.366$ ], online sports betting [sample 1: 20.2% with problematic gambling;  $\chi^2(2)=110.26$ ,  $p=.001$ ,  $CV=0.269$ ; sample 2: 19.8% with problematic gambling;  $\chi^2(2)=222.68$ ,  $p=.001$ ,  $CV=0.311$ ], and online poker playing [sample 1: 17.9% with problematic gambling;  $\chi^2(2)=130.96$ ,  $p=.001$ ,  $CV=0.293$ ; sample 2: 18.8% with



Table 2. Classification of the gambling behavior in both samples according to gender

Classification according to DSM-IV-MR-J	Sample 1 (n = 3,795)		Sample 2 (n = 5,514)	
	Male (n = 1,843)	Female (n = 1,952)	Male (n = 2,757)	Female (n = 2,757)
Non-problematic				
% (n)	89.9 (1,657)	97.8 (1,909)	91.4 (2,520)	98.4 (2,713)
95% CI	88.5–91.2	97.2–98.5	90.2–92.4	97.9–98.8
At risk				
% (n)	6.4 (118)	1.5 (29)	5.8 (160)	1.1 (30)
95% CI	5.4–7.5	0.9–2.0	4.9–6.8	0.7–1.5
Problematic				
% (n)	3.7 (68)	0.7 (14)	2.8 (77)	0.5 (14)
95% CI	2.9–4.5	0.4–1.1	2.2–3.5	0.3–0.8

Note. 95% CI: confidence interval (95%). Cutoff for problematic gambling: four criteria of the DSM-IV-MR-J fulfilled; cutoff for at risk gambling: 2–3 criteria of the DSM-IV-MR-J fulfilled. DSM-IV-MR-J: DSM-IV-Multiple Response-Juvenile.

problematic gambling;  $\chi^2(2) = 247.06$ ,  $p = .001$ ,  $CV = 0.328$ ] was related to a higher proportion of problematic gambling.

Since no differences between both samples became evident, we calculated regression analyses for the merged sample to predict with the DSM-IV-MR-J score by 12 gambling activities. These analyses were based on those adolescents reported having participated in any gambling activity in the past 12 months (Table 3).

Differences in the relationships between gambling activities and the score of the DSM-IV-MR-J were found. Using

Table 3. Prediction of gambling behavior according to DSM-IV-MR-J by age, gender, and participation in different specific activities: Results from multiple linear regression analysis

	B	SE B	$\beta$
Step 1			
Constant	0.91	0.20	–
Age	0.01	0.01	0.015
Gender	–0.41	0.04	–0.162***
Step 2			
Constant	0.79	0.18	–
Age	0.04	0.01	0.052***
Gender	–0.06	0.04	–0.025
Slot machines	0.32	0.02	0.301***
Sport betting (offline)	0.13	0.02	0.126***
Poker (online)	0.13	0.02	0.100***
Other Internet-based games	0.07	0.01	0.088***
Online casino games	0.17	0.04	0.087***
Roulette	0.13	0.03	0.069***
Card games	0.04	0.02	0.047**
Sport betting (online)	0.06	0.03	0.042*
Other skill games	0.02	0.02	0.020
Dice games	–0.01	0.02	–0.004
Scratch cards	–0.02	0.02	–0.012
Lotteries	0.02	0.02	–0.012

Note.  $N = 3,663$ ,  $R^2 = .027$  for step 1 [ $F(2) = 71.87$ ,  $p \leq .001$ ];  $R^2 = .326$  for step 2 [ $F(14) = 125.84$ ,  $p \leq .001$ ]; B: regression coefficient; SE B: standard error of B;  $\beta$ : standardized beta coefficient; DSM-IV-MR-J: DSM-IV-Multiple Response-Juvenile (Fisher, 2000).

\* $p \leq .05$ . \*\* $p \leq .01$ . \*\*\* $p \leq .001$ .

slot machines was the strongest predictor for gambling disorder, followed by (offline) sports betting and Internet-based gambling (online poker, other Internet-based games, and online casino games).

#### Psychosocial correlates of problematic gambling behavior

To investigate relationships between problematic gambling and psychosocial distress, ANCOVAs were calculated with the three gambling groups as the independent variables and the SDQ score including its subscales as dependent variables. Since significant correlations were found between SDQ and age, the latter was included as a covariate. Since there were differences regarding the sample size of the three groups, non-parametric tests were used to statistically consolidate the results. No differences between both samples were found; thus, we again calculated the ANCOVAs for the merged sample (Figure 1).

For boys, a significant main effect was found [ $F(2, 2275) = 123.63$ ,  $p < .001$ ;  $\eta^2 = 0.098$ ] with a small additional effect of age [ $F(1, 2275) = 12.07$ ,  $p = .001$ ;  $\eta^2 = 0.005$ ]. This effect was confirmed by a subsequent Kruskal–Wallis test [ $U(2) = 186.35$ ;  $p < .001$ ]. Post-hoc analyses showed that all three groups significantly differed from each other (each  $p < .001$ ).

For girls, the ANCOVA yielded a significant main effect [ $F(2, 1342) = 23.51$ ,  $p < .001$ ;  $\eta^2 = 0.034$ ] without an additional effect of age. Again, the Kruskal–Wallis test validated this finding [ $U(2) = 38.81$ ;  $p < .001$ ]. The post-hoc tests demonstrated significant differences between problematic gambling and non-problematic gambling ( $p < .001$ ), as well as between at-risk gambling and non-problematic gambling ( $p < .001$ ) but not between problematic and at-risk gamblers ( $p = .070$ ).

Afterward, the SDQ subscales were analyzed for both genders using multivariate analyses of covariance (with age as covariate). For boys, a main effect was found ( $p < .001$ ) with significant effects for emotional problems [ $F(2, 2263) = 43.36$ ,  $p < .001$ ;  $\eta^2 = 0.037$ ], conduct problems [ $F(2, 2263) = 140.90$ ,  $p < .001$ ;  $\eta^2 = 0.111$ ], hyperactivity [ $F(2, 2263) = 55.72$ ,  $p < .001$ ;  $\eta^2 = 0.047$ ], and peer problems [ $F(2, 2263) = 28.75$ ,  $p < .001$ ;  $\eta^2 = 0.024$ ]. For girls, a main effect occurred ( $p < .001$ ) with further significances

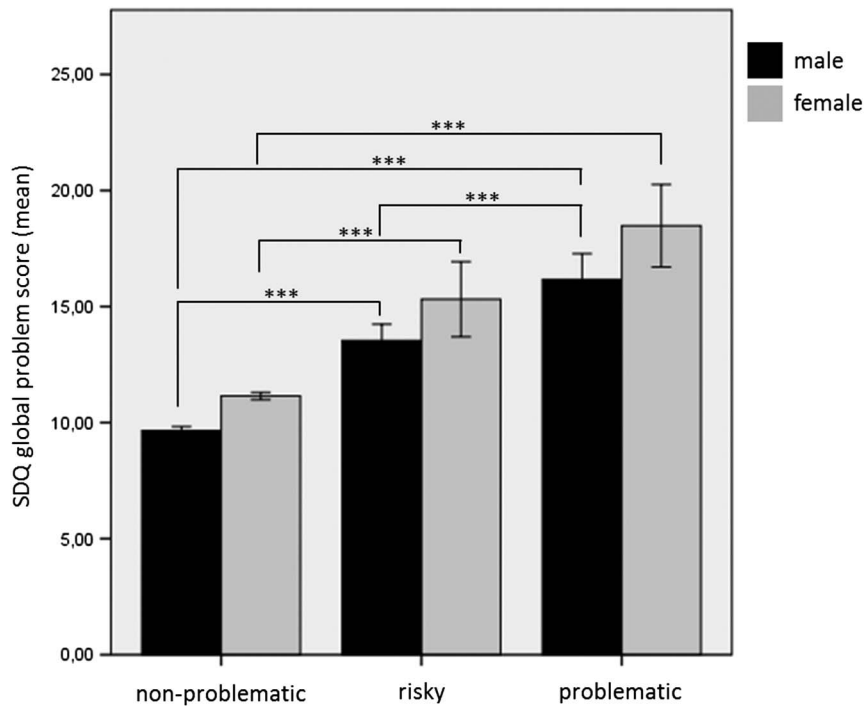


Figure 1. Means of the global problem score of the Strength and Difficulties Questionnaire (SDQ) according to gender and classification of gambling behavior; Y axis: mean score and standard errors of the total problem score of the SDQ; X axis: classification of gambling behavior according to DSM-IV-MR-J; only those adolescents were included, who reported having ever participated in gambling behavior ( $n = 6,298$ ).  $***p \leq .001$

for emotional problems [ $F(2, 1336) = 9.06, p < .001; \eta^2 = 0.012$ ], conduct problems [ $F(2, 1336) = 30.37, p < .001; \eta^2 = 0.043$ ], hyperactivity [ $F(2, 1336) = 3.59, p = .028; \eta^2 = 0.005$ ], and peer problems [ $F(2, 1336) = 17.99, p < .001; \eta^2 = 0.026$ ]. Details can be seen in Supplementary Table 2.

Additional group differences were found regarding feelings of distress according to the PSS that was used as a second dependent variable. The ANCOVA for the merged sample yielded a significant main effect [ $F(2, 3890) = 49.79, p = .001; \eta^2 = 0.025$ ]. The post-hoc tests revealed that problematic gambling ( $M = 20.5; SD = 5.72$ ) was associated with significantly higher scores than both at-risk gambling ( $M = 19.5; SD = 5.40; p = .001$ ) and non-problematic gambling ( $M = 17.1; SD = 5.65; p = .001$ ).

Finally, we were interested in engagement in other risky behaviors. For that purpose, we analyzed substance consumption within the three gambling groups. A significantly higher proportion of the problematic gambling group reported smoking on a daily basis [46.1%;  $\chi^2(6) = 81.50, p = .001, CV = 0.109$ ] than at-risk gambling (30.3%) or non-problematic gambling (19.9%). Similarly, daily alcohol consumption was more common among problematic gambling [17.4%;  $\chi^2(8) = 152.21, p = .001, CV = 0.149$ ], compared to at-risk gambling (6.4%) and non-problematic gambling (2.2%). Regarding frequency of Marijuana consumption, the ANCOVA yielded a significant effect [ $F(2, 3430) = 126.43, p < .001; \eta^2 = 0.069$ ]; adolescents with problematic gambling ( $M = 2.2, SD = 2.51$ ) reported a higher frequency of Marijuana consumption than at-risk gambling ( $M = 1.2, SD = 2.01, p < .001$ ) and non-problematic gambling ( $M = 0.5, SD = 1.30, p < .001$ ).

## DISCUSSION

This survey aimed to provide prevalence data and clinical description of factors related to problematic gambling among adolescents in two different German states. For this purpose, we investigated patterns of specific gambling participation, the prevalence of problematic and at-risk gambling and psychosocial correlates.

The results revealed a high rate of gambling participation in the past 12 months among minors amounting to 54% of the boys and 30% of the girls. These results are especially relevant regarding legislation in Germany, which specifies that adolescent gambling is an illegal activity.

Similar to previous surveys, a substantial percentage of adolescents met criteria for problematic gambling (2.2% in sample 1; 1.7% in sample 2). With regard to only those adolescents, reporting gambling activities in the past year, the prevalence rates doubled more than 4.9% in sample 1 and 3.8% in sample 2. These rates are well in accordance with previous reports (Olason et al., 2011; Welte et al., 2008).

Our results correspond to prior findings (Volberg, 1994) regarding gender distribution: boys were significantly more likely classified as problematic gamblers than girls. The group of problematic gamblers was characterized by a higher age, a lower level of education, and migration background. These results stress the necessity for implementing prevention programs in specific social environments (e.g., schools and city districts). Research is needed to better understand why these adolescents display an enhanced risk for problematic gambling. For example, it is reasonable to assume that not a migration background per

se is associated with problematic gambling but rather underlying aspects, e.g., acculturation strategies applied. Enhancing our knowledge here is inevitable for developing tailored prevention and early intervention strategies.

According to general etiopathological models, addiction develops when characteristics of the person, the environment, and the problematically performed activity coincide in an unfavorable way (Shead et al., 2010). It is postulated that availability and accessibility enhance the risk of developing an addictive behavior. In Germany, there is a high density of slot machines (Trümper & Heimann, 2012) and similarly the use of the Internet and its various applications (including gambling websites) is popular. This might contribute to explaining the high associations of the gambling activities and the degree of problematic gambling. Moreover, the influence of online-based gambling offers on problematic gambling behavior is in line with proposals of Griffiths and Wood (2000). They asserted that Internet gambling may be a high-risk behavior to develop problematic gambling for adolescents, since it comprises an unlimited access as well as a high event frequency. Knowing that online gambling has a major impact on addictive use is particularly alarming, since Internet gambling can be accessed in an almost completely unregulated and anonymous way. In addition, minors are hardly protected against developing dysfunctional gambling patterns (Potenza et al., 2011).

Another aim of the study was the assessment of psychosocial strain in the gambling groups. Our analyses revealed that adolescents meeting criteria for problematic gambling displayed significantly higher psychosocial distress compared to adolescents without gambling problems.

Problematic and at-risk gamblers showed more emotional, conduct and peer problems, hyperactivity, and less prosocial behavior in comparison to non-problematic gamblers. "Hyperactivity and concentration problems" suggest that problematic gambling experiences difficulties in cognitive aspects (e.g., attentiveness) that may be related to poorer school performance. "Problems in dealing with peers" refers to the degree and quality of social adjustment within a social community. Elevated scores of "behavioral problems" indicate that problematic gamblers tend to impulsive behavior and antisocial acts. This is consistent with findings that problematic gambling is associated with an increased probability of delinquent behavior (Folino & Abait, 2009; Williams et al., 2005). In accordance with the criteria of the DSM-IV, in which antisocial acts are considered as a diagnostic criterion, it might be concluded that the development of problematic gambling may promote subsequent delinquency. These findings again highlight associations between delinquency and problematic gambling. In addition, the poor performance of problem and at-risk gamblers on the "prosocial behavior" scale confirms the described relationships, as has been demonstrated before (Lorains et al., 2011). Unfortunately, in the DSM-5 the criterion that addresses criminal offenses for the purpose of continued gambling has been removed (American Psychiatric Association, 2013). However, the results suggest that delinquency could potentially be a significant aspect of problem gambling. Thus, we suggest collecting data from clinical samples exhibiting problematic or disordered gambling to again evaluate its diagnostic usefulness.

While the data suggest that problematic gambling is related to higher psychosocial strain, one has to remember the cross-sectional nature of the data. It might also be stated that higher stress levels and higher psychosocial symptoms might act as catalyzers for the exhibition of problematic gambling, which can thus be understood as a maladaptive coping strategy. Indeed, data from adult patients seeking treatment because of the gambling disorder demonstrate high rates of comorbid disorders among them and the direction of these associations are a matter of discussion (Müller et al., 2017; Petry, 2005).

While our data did not allow for investigating the stability of problematic gambling, we were at least able to retrospectively investigate the amount of adolescents having gambled in the past but discontinued gambling participation in the past year. This rate amounted to 27.2%–30.8% in girls and 20.7%–22.3% in boys. For future research, it could be interesting to have a special focus on these adolescents quitting gambling participation. This might give important insights into underlying reasons, motives, and changing attitudes and could be a useful prerequisite for developing public health campaigns (Slutske, Piasecki, Blaszczynski, & Martin, 2010).

Although this study was conducted with high methodological effort, there are limitations. The cross-sectional design does not allow for causal conclusions and a survey based on questionnaires is prone to biases. Although a validated self-report measure has been applied for classifying problematic gambling, this cannot replace a diagnosis derived from a clinical interview. Unfortunately, it was not possible to further elucidate the context where adolescent gambling takes place. Thus, we cannot accurately distinguish between adolescents engaging in peer-related gambling activities (e.g., friendly bets) and commercial gambling. Finally, the internal consistencies of some subscales of the SDQ were unsatisfying what should be remembered when interpreting the results. However, these limitations and in particular the results of this study can be understood as an incentive to apply longitudinal designs.

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