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Exposure to Gambling Advertisements and Gambling Behavior in Young People

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Abstract A cross-sectional survey of 4617 adolescents and young adults from 38 schools in two German states was conducted in 2014 to assess the association between gambling advertisements and gambling behavior. Exposure to ten gambling advertisements was measured with masked ad images; students indicated contact frequency and brand recall. Main outcomes were several gambling behaviors including probable pathological gambling assessed with the South Oaks Gambling Screen (SOGS $\geq$ 5). A total of 65.4 % of the students reported gambling at least once in their life; 42.2 % gambled in the last 12 months; 6.9 % gambled in the last week, and 2.8 % reported probable pathological gambling. The average frequency that one of the selected ads had been seen at least once was 29.5 %, the average brand recall rate was 9.4 %. After adjustment for confounding, multilevel mixed-effects logistic regressions revealed that high gambling ad exposure was positively related to all assessed gambling outcomes, with the strongest association for weekly gambling. Future studies need to clarify the temporal sequence and specificity of these associations.

Keywords Gambling · Advertising · Young people · Germany

Introduction

Large amounts of money are spent by the gambling industry to advertise their products in sports arenas, newspapers, billboards, TV, radio and the Internet. In several countries such as Sweden and the USA, an increase in advertising volume has taken place over the last years (Hanss et al. 2015). According to a Guardian report gambling ad frequency in

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television has also risen in the UK after a law change, from 234,000 ads in 2007 to 1.39 million ads in 2012 (Sweney 2013).

The basic idea of any kind of marketing and advertising is that expenditures will pay off in the future by increasing revenues. While this is an accepted practice for most products of daily life, issues with advertising arise if a product has a limited market (e.g., age restrictions, prescriptions), because of evident potential negative effects on consumer health. Advertising for these kinds of products is usually justified by suggesting that advertising does not affect the actual size of the market, but only the size of the shares of different companies in a fixed market. However, this statement is based on theoretical assumptions, not on empirical evidence. From the perspective of public health and safety it is therefore important to study the effects of advertising for restricted products on the overall volume of consumption.

In the case of gambling advertising there is only little research on the effects of marketing on gambling attitudes and behavior. A study by Felsher and colleagues found among adolescents that those who recalled seeing ads for lottery tickets, 39 % believed that seeing the ad made it more likely that they would buy a lottery ticket (Felsher et al. 2004). Lee et al. (2008) reported that frequent exposure to poker advertising was associated with more positive attitudes towards gambling advertising, and that people with more positive attitudes towards gambling ads also reported stronger intentions to gamble in the future compared to people with less positive attitudes. The opposite was found in one other study, where participants disagreed that gambling ads had impacts on themselves but believed that other adults and children were affected (Youn et al. 2000). An online survey of 131 Australian adolescents indicated that a strong predictor of sports betting intention were more positive attitude to gambling sponsors and their promotions during televised sport (Hing et al. 2014b). A recent Norwegian study also reported an impact of gambling ads on problem gamblers' involvement, knowledge, and awareness (Hanss et al. 2015). Results from studies with adult populations indicate that problem gamblers may perceive gambling ads as a trigger for continued gambling participation (Binde 2007; Grant and Kim, 2001; Hing et al. 2014a). Only two previous studies examined if gambling advertising exposure is related to actual gambling behavior. In a sample of youth between the ages of 12–19 years, Derevensky et al. (2010) found that an advertising-behavior association was evident in individuals currently experiencing a gambling problem. The other study with Israeli adolescents also found a relationship between advertising exposure and problem gambling, but also with gambling behavior in general (Gavriel-Fried et al. 2010).

In sum, there are indications that people believe that gambling ads affect gambling attitudes and intentions, but only little knowledge exists regarding the relation to actual gambling behaviors. With the current cross-sectional study we test the hypothesis that exposure to gambling advertisements is positively associated to a variety of gambling outcomes, including gambling frequency and problematic gambling. We test this hypothesis in a large sample of German adolescents and young adults.

Methods

Study Approval and Data Assessment

Study implementation was approved by the Ministry of school and vocational education of Schleswig-Holstein. Ethical approval was obtained from the Ethical Committee of the

German Psychological Association. Data were collected through anonymous self-completed questionnaires, administered either by class teachers or own research staff. All data collection administrators were instructed that questionnaires need to be placed in an envelope and sealed in front of the class after completion of the survey to emphasize confidentiality. Students were assured that none of the questionnaires would be seen by parents, companies or school administrators.

Sample Selection

The sample was recruited from vocational and secondary schools ("Gymnasium") in two German federal states, Schleswig-Holstein and North Rhine-Westphalia. In Schleswig-Holstein schools were eligible for participation if they were state-funded, offered 3 years of higher secondary or vocational education, did not yet participate in other studies, and had a minimum of 10 classes that could potentially participate in the current study. Twenty-six of 132 vocational schools and 38 of 258 secondary schools fulfilled these requirements. In North Rhine-Westphalia, all state-funded vocational schools with more than 1000 apprentices were invited. These were 232 of 373 vocational schools, some of which also offered higher secondary education. A total of 38 schools with 278 classes and 5789 students agreed to participate in the study. Seventy-six minor students (1.3 %) were excluded because they had no parental consent, 506 students (8.7 %) were absent on the day of the survey, 124 students (2.1 %) chose not to participate, and in 130 cases the reasons for not participating in the study could not be further specified (2.2 %). In seven school classes the questionnaires were not distributed by the class teacher due to a lack of time (137 students, 2.4 %). For the present analysis, students were excluded if they reported an age above 25 years (199 students, 3.4 %), resulting in a final sample of 4617 students (79.8 % of the students from the recruited classes).

Measures

Student self-reports included (1) outcome measures (gambling behavior), (2) advertising exposure measures, and (3) potential covariates.

Gambling Behavior

The questions on gambling behavior exclusively referred to commercial gambling behavior (i.e., gambling in a commercial setting). Lifetime prevalence of gambling was determined through the question: *Have you ever participated in commercial gambling for money (e.g., state lottery, sportsbooks, gambling machines)?* 12-month prevalence of gambling was assessed by asking: *During the last 12 months, did you participate in commercial gambling for money (e.g., state lottery, sportsbooks, gambling machines)?* Response alternatives were *yes* and *no* for both items. Current gambling was assessed by asking the participants how often they currently participated in different kinds of gambling opportunities (e.g., state lottery, sportsbooks, gambling machines). The 8-point scales ranged from 0 = *never* to 7 = *every day*. When a person indicated to participate in at least one of the listed gambling opportunities at least once a week, this person received a "yes-score" for current gambling. Probable pathological gambling was assessed with the South Oaks Gambling Screen (SOGS), which is a 20-item paper-and-pencil instrument used to screen for pathological gambling (Stinchfield 2002). The score of a person is determined

by summing up the number of items endorsed. A score of 5 and more indicates probable pathological gambling (Lesieur and Blume 1987). For the multivariate analysis in the current study SOGS scores were divided into "no probable pathological gambling" (SOGS < 5) and "probable pathological gambling" (SOGS ≥ 5).

Exposure to Gambling Advertisements

We approximated individual exposure to gambling advertising by examining contact frequency and brand recall for specific gambling advertisements. This method has been used to examine the effects of the exposure to cigarette ads on youth smoking behavior (Hanewinkel et al. 2011), and on the effect of the exposure to alcohol ads and on youth drinking (Morgenstern et al. 2011). For that purpose ten colored images of gambling advertisings were provided with all brand-identifying content digitally removed. These were either still pictures of television ads or images of newspaper/magazine, internet, and billboard advertisings.

Advertisements were selected by ad pressure, choosing the most frequently shown gambling advertisements in Germany for the period November 2012 to April 2013, stratified by Internet, TV and billboards. The advertising data were provided by *AdVision Digital*. A total of 32 advertisements were selected for a pretest with 121 students. Item characteristic were calculated for each image. The 10 images with the highest corrected item-scale correlation were selected.

For each ad image students were asked to rate on a 4-point scale how often they had seen the advertisement (0 = *never*, 1 = *1 to 4 times*, 2 = *5 to 10 times* and 3 = *more than 10 times*). The values were dichotomized (0 = *never seen*, 1 = *seen at least once*). In addition, students were asked to name the brand or the product which was advertised (open format). Correct brand names were post coded as "1" and all other answers as "0" (misspellings of correct brands were coded as "1"). Because contact frequency and cued brand recall were highly internally consistent, the two measures were combined into a single scale named "gambling ad exposure" (Cronbach's alpha = 0.78). For the multivariate analysis, gambling ad exposure was parsed into quartiles, with the first quartile representing the reference category.

Covariates

A number of factors have been empirically associated with adolescent gambling and gambling problems, e.g., sociodemographic factors (Sassen et al. 2011; Scholes-Balog et al. 2014; Walther et al. 2012), social factors (King et al. 2010; Winters et al. 1993), and personality factors (Liu et al. 2013; Nower et al. 2004; Wong et al. 2013). Some of these factors (e.g., age, gender, sensation seeking, television screen time) are assumed to be also associated with advertising exposure (Hanewinkel et al. 2011; Morgenstern et al. 2011). All of these variables were assessed and included in the statistical models to receive estimates for the exposure-behavior association after keeping other influencing factors constant.

Sociodemographic Factors Age, gender, federal state (Schleswig-Holstein vs. North Rhine-Westphalia), migration background, monthly income, and highest school degree were included as sociodemographic factors. Migration background was operationalized by asking the students in which countries their father and mother were born (response

categories: *Germany* vs. *other country*). Answers were recoded as follows: 0 = *both parents born in Germany (no migration background)*, 1 = *at least one parent born in another country (migration background)*. In addition, students' monthly income (6-point scale from 0 = *up to 399 €* to 5 = *more than 1500 €*) and their highest school degree (6-point scale from 1 = *no school degree* to 6 = *university-entrance diploma*) were determined. The answers for monthly income and highest school degree were recoded into three levels of socioeconomic status (low, medium, high).

Social Factors Gambling in the family was assessed with two items (8-point scale from 0 = *never* to 7 = *daily*): mother's gambling (*When you think back to your childhood: How often did your mother participate in games in which she could win money?*) and father's gambling (*When you think back to your childhood: How often did your father participate in games in which he could win money?*) An additional answering option was 8 = *I don't know*, which was subsequently recoded as "never". Social network was assessed with two items (*How many close friends do you have?/How many of these friends (if any) have you had seen or at least talked to during the last* 2 weeks*?*). Response alternatives ranged from 0 to *more than* 7 (Spearman Brown = 0.89). Gambling in the family was hypothesized to be a potential risk factor, whereas the "social network" was seen as a potential protective factor (King et al. 2010; Winters et al. 1993).

Personality Factors Urgency (quick and unconsidered actions), perseverance (being able to finish a task), premeditation (thinking before acting), and sensation seeking (search for intense and risky experiences/feelings) were assessed via an 8-item scale based on the UPPS-approach (Whiteside and Lynam 2001). According to this approach, the four constructs are different dimensions of impulsivity which is strongly related to gambling behavior (Walther et al. 2012). Response categories were: *does not apply at all*, *does apply a little bit*, *does apply a bit*, does *apply rather well*, and *does apply very well* (Spearman Brown: urgency = 0.72, perseverance = 0.62, premeditation = 0.81, and sensation seeking = 0.87). Social anxiety was an additional personality factor that was expected to be of importance. It was measured via 6 items extracted from the Social Interaction Anxiety Scale and the Social Phobia Scale (Mattick and Clarke 1998). Response categories were: *does not apply at all*, *does apply a little bit*, *does apply a bit*, *does apply rather well*, and *does apply very well* (Cronbach's alpha = 0.83).

As a potential protective factor participants' emotion-oriented coping style was measured via two items extracted from the Coping Inventory for Stressful Situations (Endler and Parker 1990) (*When I come into a difficult and stressful situation, I blame myself, that I got into that situation./When I come into a difficult and stressful situation, I become very tense.*). The inventory was designed to measure multiple dimensions of coping in response to a stressful situation. Emotion-oriented coping is one of four assessed dimensions. Response categories were: *does not apply at all, applies rather not, applies rather well*, and *applies very well* (Spearman Brown = 0.69).

Screen Times Also included as covariates were average TV screen time and average computer gaming time: *How many days per week do you usually watch TV?* (response alternatives: 0/1/2/3/4/5/6/7 days)/*How often do you play computer games?* (response alternatives: *never, less than once a month, once a month,* 2-3 *times a month, once a week,* 2–3 *times a week, 4–5 times a week, every day*) and *How many hours per day do you usually watch TV?/play computer games?* (response alternatives: *none, up to* 1 h, 1–2 h,

2–4 h, 4–8 h, *more than* 8 h). These two items were recoded posthoc to represent hours per day for both, average TV screen time and average computer gaming time.

Statistical Analysis

Statistical analyses were conducted with Stata 13.1. Due to the skewed distribution of the gambling outcomes, all outcomes were dichotomized. χ^2-tests were used to evaluate the unadjusted associations between covariates and gambling behavior. To determine the relationship between exposure to gambling advertising and gambling behavior, separate multilevel mixed-effects logistic regression analyses were calculated with exposure and all covariates as fixed effects. Random intercepts were included for the school and the class level. As the school level effect was not significant, this level was omitted in the final models. An interaction term "ExposureXAge" tested for all four outcomes if the relation between exposure and behavior differed by age. After testing the interaction as a multiplication of the continuous measures of exposure and age (mean centered), the test was repeated using a median split for age for illustration purposes.

Results

Sample Description

The total sample consisted of 4617 students with 55.2 % being male. The age ranged from 13 to 25 years, with a mean of 18.7 years (SD = 2.2 years). The majority of 78 % had an age between 17 and 21 years. Seventy-one percent of the students attended vocational school classes, 28.9 % attended grammar school classes. A migration background was reported by 22.8 % of the students.

Gambling Behavior

Gambling at least once in their lifetime was reported by 65.4 % of all students. Gambling during the last 12 months was reported by 42.2 % of the students. Gambling at least once a week ("current gambling") was reported by 6.9 % of the students. A total of 2.8 % of the sample reached a SOGS-score ≥ 5 in the South Oaks Gambling Screen and were therefore classified as probable pathological gamblers.

Univariate Associations Between Gambling Behaviors and Assessed Variables

Table 1 shows the frequencies of lifetime, 12-month, current, and probable pathological gambling, dependent on all assessed variables. Gambling ad exposure was strongly associated with gambling behaviors; for example the percentage of probable pathological gambling was 1.4 in the first gambling ad exposure quartile and more than three times higher in quartile four (5.5 %). The fact that each covariate was associated with at least one of the outcome variables, justifies their inclusion into the analyses. The covariates that showed consistent associations with all four outcome variables were age, gender, monthly income, gambling father, urgency, premeditation, sensation seeking, and social anxiety. The results show that gambling students were predominantly 18 years and older, male, had a higher monthly income, a father who gambled at least once a week during their

Table 1 Relationships between gambling behaviors and assessed variables

	Lifetime gambling		12-month gambling		Weekly gambling		Probable pathological gambling (SOGS ≥ 5)	
	%	χ^2 df, value	%	χ^2 df, value	%	χ^2 df, value	%	χ^2 df, value
Gambling ad exposure								
Quartile 1	55.2	3, 138.5***	30.5	3, 204.6***	3.3	3, 159.2***	1.4	3, 40.0***
Quartile 2	61.3		35.8		3.4		1.7	
Quartile 3	68.5		46.2		6.7		3.4	
Quartile 4	78.5		59.2		15.6		5.5	
Sociodemographic factors								
Age								
< 18	54.6	1, 140.6***	33.1	1, 93.6***	3.2	1, 57.5***	1.3	1, 20.7***
≥ 18	71.9		47.7		9.1		3.6	
Gender								
Female	61.7	1, 23.6***	32.4	1, 149.1***	1.2	1, 190.0***	0.5	1, 72.1***
Male	68.5		50.4		11.6		4.6	
Federal state								
Schleswig-Holstein	65.1	1, 0.1	40.3	1, 7.6**	5.3	1, 21.3***	2.3	1, 4.8*
North Rhine-Westphalia	65.6		44.4		8.7		3.3	
Migration background								
No	66.3	1, 4.8*	42.5	1, 0.3	6.0	1, 19.0***	1.9	1, 45.1***
Yes	62.6		41.6		10.0		5.7	
Monthly income								
Low	57.3	2, 87.5***	34.2	2, 75.9***	3.7	2, 52.1***	1.5	2, 19.7***
Medium	71.3		47.4		8.4		3.4	
High	70.0		50.4		14.0		5.6	
Highest school degree								
Low	47.9	2, 14.8**	38.0	2, 0.5	18.1	2, 32.8***	4.1	2, 19.9***
Medium	64.1		42.3		8.4		3.8	
High	67.3		42.4		5.1		1.7	
Social factors								
Gambling father								
< once a week	64.8	1, 15.0***	41.6	1, 13.3***	6.1	1, 60.3***	2.5	1, 14.0***
≥ once a week	76.5		53.0		18.6		6.4	
Gambling mother								
< once a week	65.3	1, 2.7	42.2	1, 0.1	6.7	1, 4.8*	2.7	1, 3.1
≥ once a week	72.9		43.9		12.2		5.6	
Social network[a]								
Low	64.1	1, 6.8**	39.5	1, 23.3***	5.5	1, 21.5***	2.4	1, 3.1
High	67.9		46.8		9.0		3.3	

Table 1 continued

	Lifetime gambling		12-month gambling		Weekly gambling		Probable pathological gambling (SOGS ≥ 5)	
	%	χ^2 df, value	%	χ^2 df, value	%	χ^2 df, value	%	χ^2 df, value
Personality factors								
Urgency[a]								
Low	63.1	1, 23.1***	39.6	1, 26.5***	5.6	1, 19.8***	1.5	1, 54.6***
High	70.4		47.8		9.2		5.4	
Perseverance[a]								
Low	66.2	1, 1.7	41.8	1, 0.4	6.4	1, 1.1	3.4	1, 9.7**
High	64.4		42.7		7.2		1.9	
Premeditation[a]								
Low	67.5	1, 12.3***	43.5	1, 4.4*	7.6	1, 7.6**	3.5	1, 12.5***
High	62.4		40.4		5.5		1.7	
Sensation seeking[a]								
Low	60.4	1, 54.7***	36.2	1, 71.4***	3.4	1, 86.5***	1.4	1, 32.1***
High	70.8		48.7		10.4		4.2	
Social anxiety[a]								
Low	67.0	1, 5.4*	44.7	1, 12.0**	7.5	1, 3.9*	2.2	1, 5.3*
High	63.7		39.6		6.0		3.3	
Emotion-oriented coping[a]								
Low	65.4	1, 0.1	43.7	1, 10.0**	7.5	1, 13.0***	2.5	1, 1.5
High	65.8		38.4		4.5		3.2	
Screen times								
Average TV screen time[a]								
Low	63.5	1, 11.9**	40.8	1, 6.3*	6.2	1, 4.6*	2.7	1, 0.1
High	68.6		44.6		7.9		2.6	
Average computer gaming time[a]								
Low	66.7	1, 4.2*	41.2	1, 2.3	6.0	1, 5.9*	2.9	1, 0.3
High	63.8		43.5		7.8		2.6	

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

[a] Dichotomized by median split

childhood, scored high on urgency and sensation seeking but low on premeditation and social anxiety. One exception was probable pathological gambling as probable pathological gamblers scored predominantly high on social anxiety. To account for these differences, we adjusted for the variables in the multivariate analyses.

Exposure to Gambling Advertisements

Table 2 provides contact frequency (how often the student had seen the advertisement) and brand recall (how often the student correctly identified the brand) rates for all ten gambling

Table 2 Contact frequency and brand recall rates for all 10 gambling advertisements

Gambling advertisement	Ad seen at least once %	Correct brand recall %
Bwin 1 (online gambling company)[a]	56.5	23.1
Fernsehlotterie (television lottery)[a]	39.5	0.2
Bwin 2[b]	27.5	3.6
Lotto 1 (national lottery)[c]	36.3	20.3
Lotto 2[c]	30.5	24.2
Glücksspirale (additional game of the German lottery)[a]	29.7	4.8
Gameduell (cross-platform games community)[d]	24.9	0.1
Tipico 1 (international provider of sports betting and casino games)[d]	16.9	7.1
Tipico 2[b]	16.5	8.5
Bet at home (online gambling and sports betting company)[b]	16.4	1.9
Mean	29.5	9.4

[a] Ad was shown on TV

[b] Ad was printed in a newspaper/magazine

[c] Ad was printed on a billboard

[d] Ad was shown in internet

Table 3 Relationships between exposure to gambling advertisements and lifetime prevalence of gambling, 12-month prevalence of gambling, current gambling, and probable pathological gambling

Gambling ad exposure	Adjusted[a] OR (95 % CI)
Lifetime prevalence of gambling	
Quartile 1	Reference
Quartile 2	1.28 (1.05, 1.55)
Quartile 3	1.63 (1.34, 1.97)
Quartile 4	2.34 (1.85, 2.94)
12-month prevalence of gambling	
Quartile 1	Reference
Quartile 2	1.18 (0.97, 1.44)
Quartile 3	1.75 (1.45, 2.12)
Quartile 4	2.36 (1.91, 2.92)
Current gambling (at least once a week)	
Quartile 1	Reference
Quartile 2	0.93 (0.55, 1.57)
Quartile 3	1.73 (1.09, 2.74)
Quartile 4	3.51 (2.25, 5.46)
Probable pathological gambling (SOGS $\geq$ 5)	
Quartile 1	Reference
Quartile 2	1.13 (0.50, 2.57)
Quartile 3	2.64 (1.31, 5.35)
Quartile 4	3.23 (1.60, 6.54)

OR Odds ratio, *CI* confidence interval

[a] Adjusted for age, gender, federal state, migration background, monthly income, highest school degree, mother's gambling, father's gambling, social network, urgency, perseverance, premeditation, sensation seeking, social anxiety, emotion-oriented coping style, average TV screen time, average computer gaming time

advertisements. For all brands, at least one time contact frequency rates were higher than cued recall rates. The highest contact frequencies were found for *Bwin and for* lottery ads, the lowest rates were found for *Bet at home* (Print)—merely 16.4 % of the students reported to have seen this ad at least once. The most often recalled brand was "Lotto" with a billboard advertising as the cue, 24.2 % of the students recalled this brand correctly. One point 2 % of the students had seen all ten gambling advertisements, and 16.5 % reported not to have seen any of the ads. The average frequency that one of the selected ads had been seen at least once was 29.5 %, the average brand recall rate was 9.4 %.

Association Between Exposure to Gambling Advertising and Gambling Behavior

There was a bivariate association between exposure to gambling advertisements and all gambling behavior measures. After adjustment for confounding, multilevel mixed-effects logistic regressions revealed that compared with quartile one gambling ad exposure, the adjusted odds ratios (AOR) for quartile four were 2.34 (95 % confidence interval (CI): 1.85, 2.94) for lifetime gambling, 2.36 (95 % CI 1.91, 2.92) for 12-month gambling, 3.51 (95 % CI 2.25, 5.46) for weekly gambling, and 3.23 (95 % CI 1.60, 6.54) for probable pathological gambling (Table 3).

A moderator analysis revealed significant interactions between exposure and age for the lifetime ($p < 0.001$) and the 12-month ($p > 0.05$) gambling outcomes. The lifetime gambling AOR for quartile four versus quartile one exposure was 2.4 times higher for participants older than 18 compared to the younger age group. Similarly, for the prevalence of gambling in the last 12 months, the AOR for quartile four versus quartile one exposure was 1.5 times higher in the older group.

Discussion

To our knowledge, this is the first study that tried to examine the association between exposure of adolescents and young adults to gambling advertisements and actual gambling behaviors. After adjustment for a number of confounding factors, we found a strong and consistent association between the exposure to gambling ads and several gambling behaviors, including a more probable pathological behavior pattern. Odds ratios of the highest exposure quartile compared to the lowest quartile varied between 2.34 and 3.51, depending on the outcome. A secondary finding of the study was that even if there are higher restrictions on gambling advertising in Germany than for most other products (including alcohol), there was substantial exposure in this sample of adolescents and young adults: The average frequency that one of the selected ads had been seen was 30 % and some of the respondents were also highly familiar with the brands and products advertised. The absolute total number of gambling companies that significantly advertise in Germany is still low. But recent changes in gambling laws of the German federal states aimed at legalizing online gambling sites and offline sites for sports betting, which might also affect the amount of advertising, especially online advertising for gambling.

The results extend previous research on gambling advertising by studying a more proximate gambling outcome. Prior studies have only examined desires and intentions to gamble which might not or not immediately be related to actual behaviors (Derevensky et al. 2010). However, the used frequency measures were very broad and did not

differentiate between different forms of gambling and also did not consider potential effects of advertising on the size of the stakes. It can therefore be questioned if the present study really examined a significant public health outcome. From this perspective it seems telling that there also was a significant association between exposure to gambling advertising and the South Oaks Gambling Screen. While it is known that the screen produces a high number of false positives in the diagnosis pathological gambling (Goodie et al. 2013), it is an indicator of the quality rather than the frequency of gambling.

There are several limitations to the current study, the most important one being the cross-sectional design. Cross-sectional data do not inform about the temporal sequence of events, i.e., if the measured exposure preceded the gambling outcomes. Does advertising lead to gambling or does gambling lead to higher attention of advertising? Temporal antecedence of exposure would be one important indication of a causal relationship (Hill 1965). Second, the implemented method did not use a representative sample of all gambling ads and used masked material, therefore it does neither allow for an accurate estimation of the total amount of gambling ad exposure of German young people nor the advertising market shares of specific brands. Third, pathological gambling has a low prevalence which can bias the estimates, also the reduction of variance through dichotomization. Fourth, as with any observational study, the results may be biased by unmeasured confounding; that is, an unmeasured risk or protective factor could alter the estimates reported for the association between gambling advertising and gambling behavior. Fifth, the use of a non-clinical sample does not allow valid conclusions about pathology. Finally, it should be pointed out that the data was obtained by students' self-reports. As the validity of this data was not further evaluated, response biases cannot be ruled out entirely.

In sum, notwithstanding the above mentioned design limitations, the results add support to the hypothesis that gambling advertising is an independent risk factor for gambling in young people. Replication studies, and studies with an improved design, e.g., longitudinal studies, should be conducted to confirm the initial findings of the current research that exposure to gambling ads increases the likelihood of gambling in general.

Compliance with Ethical Standards

Conflicts of interest The authors declare that they have no conflict of interest.

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