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# Is gambling involvement a confounding variable for the relationship between Internet gambling and gambling problem severity?

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## **Abstract**

Internet gamblers have more problems gambling than land-based gamblers, but recent studies showed that Internet gamblers are involved in a higher number of gambling activities, which may confound the relationship between Internet gambling and gambling problems. The present study aimed to test whether the relationship between Internet gambling and gambling problems persisted when including variables related to gambling involvement as predictors, namely time spent gambling and diversity of gambling formats. Data from a large sample of French adolescents (n=9,910) were used. Associations between disordered gambling/money spent gambling with Internet gambling were performed using generalized linear models, not controlling and controlling for diversity of gambling formats and time spent gambling. The results showed that Internet gamblers had significantly more problems than land-based gamblers. The relationship decreased when diversity of gambling formats and time spent gambling were controlled separately, and became non-significant when they were both included in the model. To conclude, time spent gambling and diversity of gambling formats rather than Internet gambling should be considered a detrimental gambling behavior. They seemed to capture different aspects of gambling patterns. This study was a step forward in changing the conceptual model of problem gambling, with gambling involvement as a main variable.

**Keywords:** Addiction; Adolescents; Diversity of gambling formats; Internet gambling; Time spent gambling.

## **Highlights:**

- Time spent gambling and diversity of gambling formats predicted problem gambling.
- Internet gambling did not predict problem gambling above gambling involvement.
- Gambling involvement was a main variable to understand problem gambling.

Is time spent gambling a confounding variable for the relationship between Internet gambling and gambling problem severity?

## **1. Introduction**

Disordered gambling is a major health concern with several detrimental health correlates (Gainsbury, Wood, Russell, Hing, & Blaszczynski, 2012; Jiménez-Murcia, et al., 2011; Wardle, Moody, Griffiths, Orford, & Volberg, 2011). Understanding how people gamble is therefore essential, and many studies have investigated associations of disordered gambling with game-specific engagement, such as types of games played and Internet versus land-based gambling. Traditionally, certain types of gambling have been described as more addictive than others (Jiménez-Murcia, et al., 2011; LaPlante, Nelson, LaBrie, & Shaffer, 2011). For example, slot machines are associated with higher levels of disordered gambling than other types of gambling (Desai, Maciejewski, Dausey, Caldarone, & Potenza, 2004), and Internet gamblers are more likely to report disordered gambling than are land-based gamblers (e.g., (Gainsbury, et al., 2012; Jiménez-Murcia, et al., 2011; Wardle, et al., 2011).

Recent studies reported that gambling involvement such as the number of gambling formats and time spent gambling should be taken into account when studying the relationship between game-specific engagement and disordered gambling (LaPlante, Nelson, & Gray, 2014). Indeed, both the number of gambling formats and time spent gambling are predictive of gambling problem severity and thus may be confounders. Recently, some studies showed that when controlling for these variables, the relationship between game-specific engagement and disordered gambling disappeared or decreased (LaPlante, et al., 2014; Philander & MacKay, 2014). Thus, the conception of risky gambling is changing, shifting from specific-game engagement to gambling involvement as the dominant risk factor (LaPlante, et al., 2014; LaPlante, et al., 2011).

However, research investigating time spent gambling and Internet versus land-based gambling is scarce, even if recent studies highlighted that Internet gamblers are more heavily involved in gambling (Wood & Williams, 2011). For example, LaPlante et al. (LaPlante, et al., 2014) investigated associations of types of gambling formats with disordered gambling with and without controlling for the frequency with which individuals gambled. They concluded that the number of gambling formats has a greater detrimental association with problem gambling than the gambling frequency. However, the authors did not focus on the difference between Internet versus land-based gambling. Other studies (Canale, Griffiths, Vieno, Siciliano, & Molinaro, 2016; Philander & MacKay, 2014) investigated the association of Internet/land-based gambling with disordered gambling, but they controlled for the number of gambling formats and not for the time spent gambling. The results were inconsistent, since one study reported a non-significant relationship between Internet gambling when the number of gambling formats is controlled for (Philander & MacKay, 2014) whereas the other reported a significant relationship (Canale, et al., 2016). Other studies controlled for modes of accessing Internet gambling (Gainsbury, Liu, Russell, & Teichert, 2016) and use of multiple gambling accounts (Gainsbury, Russell, Blaszczynski, & Hing, 2015) and showed that these patterns were associated with subsequent harms. However, again, time spent gambling was not taken into account. Therefore, it is unclear whether the findings provided information about Internet gambling, diversity of gambling formats or time spent gambling.

This study aims to fill in this gap and includes both diversity of gambling formats and time spent gambling as confounders to investigate the relationship between Internet gambling and gambling problem severity, measured with disordered gambling and money spent gambling. In accordance with the recent change in conception of risky gambling (LaPlante, et al., 2014), we hypothesized that controlling for time spent gambling and diversity of gambling formats, the relationship between Internet gambling and gambling problem severity would not persist.

The objective of the study was to show that Internet gambling is not necessarily an harmful gambling pattern in itself, and to achieve a better understanding of gambling behaviors and associated harms. The study focused on a population-based sample of adolescents, because research on this population is needed (Canale, et al., 2016). Adolescents are concerned with excessive use of entertainment technologies (computer and video games, Internet), which may be related to online gambling. Additionally, gambling is becoming a popular pastime among adolescents (Derevensky, 2012). However, data are scarce in this age group.

## **2. Methods**

### *2.1. Participants and procedures*

Data were collected in the seventh ESCAPAD survey (Survey on Health and Behavior), a cross-sectional survey designed to estimate drug use prevalence in France (March 2011), conducted by the French Monitoring Centre for Drugs and Drug Addiction in association with the National Service Department (Spilka, Le Nézet, & Tovar, 2012). It took place during the compulsory one-day session providing all 17-year-old French adolescents (boys and girls) with civil and military information (i.e., the national defense preparation day) in all the civilian and military centers across the metropolitan and overseas territories. The survey was approved by the National Council for Statistical Information and the ethics commission of the National Data Protection Authority. In 2011, a total of 32,249 French adolescents were surveyed, with a response rate exceeding 98%. The final sample comprised 27,402 French adolescents aged 17 living in metropolitan France. This study focused on the 10,156 teenagers who had gambled during the previous 12 months (37.1% of the total sample). Missing values were listwise deleted, which left a final sample of  $n=9,910$  (97.6% of the gamblers).

### *2.2. Measures*

*Disordered gambling.* Disordered gambling was assessed using the Problem Gambling Severity Index (PGSI) (Ferris & Wynne, 2001), including nine questions on a four-point scale and for the period of the previous 12 months. A sum-score has been computed, with a higher score indicating more gambling problems.

*Money spent gambling.* Participants were asked how much money they had spent the last time they gambled (in euros). This measure was used as an indicator of gambling problem severity.

*Diversity of gambling formats.* The diversity of gambling formats was recorded by counting the number of gambling formats, ranging from 1 to 4, according to the four distinct dimensions listed to assess time spent gambling.

*Time spent gambling.* Participants were asked how much time they had spent gambling during the previous 12 months. They answered with regard to four distinct dimensions: 1) lottery games, e.g., scratch lottery, numbers games; 2) sport betting and pool games; 3) casino games and gambling machines, e.g., poker, roulette, slot machines; and 4) “other.” In each of these, answers were collected on a six-point closed-ended scale: “never,” “one time per month or less,” “2-3 times per month,” “about one time per week,” “2-6 times per week,” and “every day.” A total number of days spent gambling was determined by summing the four dimensions, using never=0, one time per month or less=12, 2-3 times per month=30, 2 about one time per week=52, 2-6 times per week=208, and every day=365.

*Internet gambling.* Participants were asked whether they had gambled on Internet or not for each of the four above dimensions (lottery games, sport betting and pool games, casino games and gambling machines, and others) at least one time during the previous 12 months. Participants who answered “yes” in at least one dimension were recorded as Internet gamblers, whereas the others were recorded as land-based gamblers.

*Covariates.* Age in years, gender, and parental occupational status (“higher and intermediate”, “lower”, and “other”: jobless parents and unknown occupational status) were assessed.

### *2.3. Statistical analyses*

First, descriptive statistics and bivariate associations between Internet/land-based gambling and outcomes were computed. Mann-Whitney tests and chi-squares were used according to the distribution of the variables. Then, generalized linear models (GLM) were computed using Internet gambling as a predictor of disordered gambling (model 1a) and money spent gambling (model 1b). These models were computed controlling for covariates (age, gender, and parental occupational status). These GLM models were then computed controlling for diversity of gambling formats (models 2a and 2b), time spent gambling (models 3a and 3b), and with both diversity of gambling formats and time spent gambling (models 4a and 4b). Quasi-Poisson regressions were used. All analyses were performed using R version 3.3.1.

### **3. Results**

Descriptive statistics and bivariate associations are reported in Table 1. Participants had gambled 42.56 days on average during the previous 12 months, and they scored 8.36 on the PGSI. On average, they had spent 10.27€ the last time they gambled and had gambled on 1.39 different gambling formats. A total of 10.5% of the participants were Internet gamblers; i.e., they had gambled online at least one time during the previous 12 months. Bivariate associations showed that Internet gamblers had significantly higher levels of disordered gambling, spent more money gambling, spent more time gambling, and reported a higher diversity of gambling formats than land-based gamblers.

Insert Table 1 about here

Multivariate associations are summarized in Table 2. Models including only Internet gambling (models 1) displayed significant associations with disordered gambling and money spent gambling. Internet gamblers had higher scores of disordered gambling and spent more money gambling than land-based gamblers (e.g., for disordered gambling:  $b = 0.053$ ,  $p < .001$ ). When the diversity of gambling formats (models 2) and time spent gambling (models 3) were controlled for separately, these associations were lower but still significant (e.g., for disordered gambling:  $b = 0.027$ ,  $p < .001$  for the diversity of gambling formats;  $b = 0.010$ ,  $p = .019$  for time spent gambling). When the diversity of gambling formats and time spent gambling were included together in the model (models 4), Internet gambling became non-significant (for disordered gambling:  $b = 0.005$ ,  $p = .235$ ). The diversity of gambling formats and time spent gambling were significantly associated with higher level of disordered gambling and more money spent gambling in all models ( $p < .001$ ). All associations were higher for the models using time spent gambling as the outcome variable.

Insert Table 2 about here

## **4. Discussion**

### *4.1. Main findings*

This study aimed to investigate whether diversity of gambling formats and time spent gambling were confounders of the relationship between Internet gambling and gambling problem severity, measured with disordered gambling and money spent gambling.

First of all, among the sample of 17 years old adolescents, 37.1% had gambled in the previous 12 months. Gambling activities by those under 18 years of age are not allowed in France, and thus this prevalence rate is a worrying one. Therefore, prevention of risky gambling should

include youths even if they are not allowed to gamble. Few of them gambled online; 10.5% of the participants reported having gambled via the Internet.

The associations of Internet gambling with gambling problem were replicated in both bivariate and multivariate associations (i.e.; controlling for gender, age, and family variable) (Gainsbury, et al., 2012; Jiménez-Murcia, et al., 2011; Wardle, et al., 2011). Indeed, Internet gamblers had more problems than land-based gamblers did, including higher levels of disordered gambling and more money spent gambling. Moreover, Internet gamblers were highly involved in gambling, spending more time gambling and having a higher diversity of gambling formats than land-based gamblers (Wood & Williams, 2011). Therefore, in line with previous studies, Internet gamblers seemed more engaged in gambling activities than land-based gamblers (LaPlante, et al., 2014).

After controlling separately for the diversity of gambling formats and time spent gambling, the relationship between Internet gambling and gambling problem severity decreased. When the model controlled for both the diversity of gambling formats and time spent gambling, the relationship between Internet gambling and gambling problem severity even disappeared. Therefore, the higher level of engagement in gambling, the less Internet gambling was important to explain gambling problem severity. These results were replicated with disordered gambling and money spent gambling as outcome variables. Thus, Internet gambling did not appear inherently addictive, and omitting gambling involvement may lead to spurious correlations and fallacious conclusions. This study's results confirmed the recent change in the conception of risky gambling (LaPlante, et al., 2014), switching from game-specific engagement to gambling involvement. Indeed, gambling involvement appeared to be more important than game-specific engagement, and the study of the association between Internet gambling and gambling problem severity should include gambling involvement variables such as diversity of gambling formats and time spent gambling as covariates for a better

understanding. Health planning and healthcare should focus on gambling involvement as a risk factor of problem gambling rather than on Internet gambling. Additionally, boys were more likely to be Internet gamblers than land-based gamblers. Therefore, gender should also be taken into account in health planning and healthcare, since boys may be more likely to share addictive patterns of Internet gambling.

However, it is unclear whether gambling involvement confounds the relationship between Internet gambling and gambling problem severity, or whether it is a mediator. Indeed, it is possible that Internet gambling leads to increased gambling involvement, which in turn results in higher levels of gambling problems. On the contrary, high-involved gamblers may be using Internet to gamble because it is convenient and easily accessible. Longitudinal designs are needed in order to assess the causal paths between variables, but this study is a first step to take into account the role of gambling involvement and especially time spent gambling in gambling research.

This study also adds to the recent debate on use over time should be a key criterion for addictive behaviors (Baggio, et al., 2016; Kraus, 2015; Rehm, et al., 2013; Rehm, Probst, Kraus, & Lev-Ran, 2014), being correlated with measures of addiction (Sassen, et al., 2011). Indeed, recent studies suggested that heavy use over time should be a reliable indicator of addictive behaviors. This study's findings highlighted that gambling involvement and time spent gambling, which is a measure of use over time, were important to understand addictive behaviors, and even more than gambling patterns such as the mode of gambling (Internet/land-based).

It seemed that diversity of gambling formats and time spent gambling capture distinct aspects of gambling involvement, as already highlighted by LaPlante et al. (2014). Indeed, it was only when the two variables were entered in the model that Internet gambling was confounded. This result may explain why previous studies found inconsistent results, with sometimes non-

significant (Canale, et al., 2016; Philander & MacKay, 2014) and significant (Canale, et al., 2016; Philander & MacKay, 2014) associations between Internet gambling and gambling problem severity when diversity of gambling formats was controlled for, but not time spent gambling.

#### *4.2. Limitations*

This study's have some limitations. First, this was a cross-sectional study that did not allow testing the causal paths between Internet gambling, gambling involvement, and severity of problem gambling. Longitudinal studies are needed to achieve a better understanding of the causality. Second, most of the participants were not heavy gamblers. Further studies with subsamples of heavy gamblers are needed to investigate the importance of time spent gambling. Another shortcoming was that in this study, "Internet gamblers" included individuals who played both online and offline. Groups of only-Internet gamblers, exclusively land-based gamblers, and both Internet and land-based gamblers should be assessed in further studies to investigate whether there were differences between being only an Internet gambler or using both the Internet and land-based venues. Finally, a last limitation was that this study used self-reported assessments. More specifically, self-reported addiction scales may be unreliable because young people misunderstand questions (Karriker-Jaffe, Witbrodt, & Greenfield, 2015; Mewton, Slade, Teesson, Memedovic, & Krueger, 2014; Slade, Teesson, Mewton, Memedovic, & Krueger, 2013; Wakefield & Schmitz, 2014). Studies including clinical assessment of disordered gambling may be used in further studies, as well as more precise measures of number of gambling formats and time spent gambling.

#### *4.3. Conclusion*

To conclude, this study was a step further in the change in the conception of risky gambling, from game-specific engagement to gambling involvement. Diversity of gambling formats and time spent gambling seemed to be important variables to understand gambling problem severity, and they should be included together in the analyses to avoid confounding effects.

**Declaration of competing interest:** The authors report no conflict of interest.

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Table 1. Descriptive statistics for gambling and comparisons of Internet/land-based gamblers

	Overall (n=9,910)	Internet gamblers 10.5% (n=1,043)	Land-based gamblers 89.5% (n=8,867)
Age <sup>1</sup>	17.4 (0.01)	17.4 (0.01)	17.4 (0.01)
Sex <sup>2</sup>			
Boys	56.6 (5,605)	69.0 (720) <sup>***</sup>	55.1 (4,885)
Girls	43.4 (4,305)	31.0 (323)	44.9 (3,982)
Parental occupational status <sup>2</sup>			
Higher and intermediate	49.0 (4,850)	48.2 (503)	49.0 (4,347)
Lower	47.1 (4,671)	48.9 (510)	46.9 (4,161)
Jobless/unknown	3.9 (389)	2.9 (30)	4.1 (359)
Disordered gambling (9-36) <sup>1</sup>	8.36 (1.29)	8.80 (2.07) <sup>***</sup>	8.31 (1.15)
No. of gambling formats (0-4) <sup>1</sup>	1.39 (0.61)	1.86 (0.74) <sup>***</sup>	1.34 (0.56)
Time spent gambling (frequency per year) <sup>1</sup>	42.56 (86.07)	95.86 (153.29) <sup>***</sup>	36.29 (71.73)
Money spent gambling (€) <sup>1</sup>	10.27 (42.41)	16.66 (40.55) <sup>***</sup>	9.52 (42.52)

<sup>1</sup> Means and standard deviation are given; comparison of Internet/land-based gamblers performed using a Mann-Whitney test.

<sup>2</sup> Percentage and n are given; comparison of Internet/land-based gamblers performed using a chi-square test and column percentages are reported.

<sup>\*\*\*</sup> p < .001 for comparison between Internet versus land-based gamblers.

Table 2. Associations of disordered gambling and money spent gambling with Internet gambling

DV	IV	Model 1	Model 2	Model 3	Model 4
Disordered gambling	Internet gambling	0.053***	0.027***	0.010*	0.005
	No. of gambling formats	-	0.054***	-	0.014***
	Time spent gambling	-	-	0.001***	0.001***
Money spent gambling	Internet gambling	0.302***	0.072*	0.185***	0.045
	No. of gambling formats	-	0.444***	-	0.380***
	Time spent gambling	-	-	0.002***	0.001***

DV: dependent variable, IV: independent variable.

Quasi-Poisson regressions were performed. Unstandardized beta estimates are reported.

Model 1 did not control for diversity of gambling formats and time spent gambling, model 2 controlled for diversity of gambling formats, model 3 controlled for time spent gambling, and model 4 controlled for both.

\*  $p < .05$ , \*\* \*\*\*  $p < .001$ .

All analyses were performed controlling for gender, age, and parental occupational status.