

JGI Scholar's Award, Category B

Mobile Gambling Among Youth: A Warning Sign for Problem Gambling?

Yaxi Zhao,¹ Loredana Marchica,¹ Jeffrey L. Derevensky,¹ & William Ivoska²

¹International Centre for Youth Gambling Problems and High-Risk Behaviors, McGill University, Montreal, Quebec, Canada

²Alcohol, Drug Addiction and Mental Health Services Board of Wood County Ohio, Bowling Green, Ohio, United States

Abstract

With the rapid development of technology in the gambling industry, underage mobile gambling has become a growing concern. The present study investigated the prevalence of adolescent mobile gambling and the relationship between frequency of mobile gambling and gambling-related problems. A survey assessing past-year gambling behavior, gambling problems, perceived risk for gambling, and parental and peer disapproval of gambling was completed by 6,818 junior/senior high school students aged 10 to 19. A descriptive analysis demonstrated a 5% prevalence of mobile gambling, and regular mobile gambling (at least monthly) was associated with a higher risk of developing a gambling problem and engagement in other forms of gambling. A hierarchical logistic regression revealed that being female, younger, and perceiving higher parental disapproval of gambling is related to less past-year mobile gambling. Perceived risk of gambling-related harms and peer disapproval were not significant predictors after controlling for other factors. The results suggest that underage mobile gambling may serve as one warning sign of adolescent problem gambling. Given that mobile gambling accessibility is increasing, the results provide valuable information for early intervention and prevention.

Keywords: mobile gambling, adolescents, at-risk gambling, perceived parental disapproval

Résumé

Avec le développement rapide de la technologie dans le secteur du jeu, le jeu sur appareil portable chez les personnes mineures devient une préoccupation croissante. La présente étude a examiné la prévalence du jeu sur portable chez les adolescents et la relation entre la fréquence des jeux de hasard sur portable et les problèmes liés au jeu.

Un sondage évaluant le comportement de jeu au cours de l'année précédente, les problèmes de jeu, le risque perçu de jeu et la désapprobation des parents et des pairs a été effectué auprès de 6 818 élèves du secondaire, âgés de 10 à 19 ans. Une analyse descriptive a démontré une prévalence de 5 % du jeu sur portable, et le jeu régulier sur portable (au moins une fois par mois) était associé à un risque plus élevé de développer un problème de jeu et de s'engager dans d'autres formes de jeu. Une régression logistique hiérarchique a révélé que le fait d'être une femme, d'être plus jeune et de percevoir une grande désapprobation parentale à l'égard des jeux de hasard a donné lieu à moins de jeu sur portable au cours de l'année écoulée. Le risque perçu de méfaits liés au jeu et la désapprobation par les pairs n'étaient pas des prédicteurs significatifs, après neutralisation d'autres facteurs. Les résultats montrent que le jeu sur appareil portable chez les mineurs peut constituer un signe d'avertissement du jeu problématique chez les adolescents. Étant donné que l'accessibilité au jeu sur portable augmente, les résultats fournissent des données précieuses pour l'intervention précoce et la prévention.

Introduction

The past decade has witnessed a rapid rise in remote technology within the gambling industry (King, Delfabbro, & Griffiths, 2010). With the proliferation of online gambling sites, as well as mobile applications (including social casino type games), individuals no longer have to be physically present at land-based gambling venues to wager for money. This ease of accessibility has an accompanying problem specifically for youth, as many online gambling websites maintain only inadequate age and credit card verification practices. This limitation is of concern for policy makers and clinicians working with underage gamblers (Derevensky, 2012; King et al., 2010). Without verification procedures that go beyond voluntary self-reported age checks, it is extremely easy for adolescent problem gamblers to deceive operators about their true age (Poulin, 2000). In fact, past three month and past year gambling prevalence rates have revealed that adolescents around the world are frequently able to engage in online gambling despite being underage (9% in the U.S. and Canada, 24% in Iceland, 16% in Italy and 4% in Hong Kong) (Canale, Griffiths, Vieno, Siciliano, & Molinaro, 2016; Elton-Marshall, Leatherdale, & Turner, 2016; Olason et al., 2010; Potenza et al., 2011; Wong & So, 2013). It is important to note that, despite the current relatively low prevalence of adolescent online gambling in the U. S., and unlike in many other jurisdictions, online gambling is actually generally prohibited. This is the case in most states, except New Jersey, Nevada, and Delaware (Kelly, 2015). Additionally, ample evidence suggests that the prevalence rates of problem gambling among adolescents remains high, often 2–4 times that of adults (Canale et al., 2016; Derevensky, 2015; Elton-Marshall et al., 2016; Volberg, Gupta, Griffiths, Ólason, and Delfabbro, 2010). Finally, individuals with gambling related problems often experience a host of economic, social, personal, academic, mental health,

familial and legal problems (Derevensky, 2015), making online gambling a significant issue for policy makers and clinicians.

Mobile devices (e.g., smart phones and tablets) are one of the most convenient Internet surfing platforms, and have become one of the fastest-growing revenue streams for gambling operators. The vast majority of adolescents, the millennial generation, have easy access to a mobile device and the Internet, especially among older adolescents (Lenhart 2015a, 2015b). It has been suggested that compared to adults, youths are more likely to engage in mobile gambling activities as they have greater familiarity with digital technologies and these modern forms of gambling, many of which resemble videogames (Delfabbro, King, Lambos, & Puglies, 2009; King et al., 2010). King and Delfabbro (2016) surveyed 814 adolescents ($M_{age} = 14$) and reported that, despite the illegality of online gambling, and despite their enjoying only limited access to credit cards, 3.1% of adolescents had placed a wager via their smartphone. Evidence also exists that local bookmakers have established their own websites for wagering, especially in jurisdictions where they are prohibited (primarily for sports betting). Traditionally, mobile gambling has maintained an emphasis on sports betting (Griffiths, 2007); however, with the development of new technologies and the growth of mobile gambling, casino games, lottery, and poker have also increased their market share to over 21% for each (James, O'Malley, & Tunney 2017).

Beyond computer-based online gambling, mobile devices allow individuals access to gambling websites/apps anywhere and anytime, and to gamble as an adjunct to other daily activities (Griffiths, 2007). The private nature of mobile device use and the intermittent periods of engagement with a mobile app further increase the risk for developing habitual gambling behaviors, a development which might in turn lead to a gambling-related problem (James et al., 2017).

Gambling engagement among youth has been found to be associated with numerous risk and protective factors (see Derevensky, 2015, for a review). The most consistent findings suggest that female adolescents gamble less and report fewer gambling problems than male adolescents (Derevensky & Gupta, 2004; Volberg et al., 2010). Parental and peer disapproval of gambling has also been shown to be associated with lower gambling frequency among high school students (Delfabbro & Thrupp, 2003; Leeman et al., 2014). In addition, higher perceived risk of harm has been found to predict fewer adolescent problem behaviors and fewer gambling behaviors among college students overall (Halpern-Felsher, Biehl, Kropp, & Rubinstein, 2004; Wickwire et al., 2007). However, the predictive effect of perceived risk of harm on gambling behavior among adolescents needs further investigation.

The current study sought to examine the prevalence of mobile gambling among adolescents, its association with problem gambling, and other forms of gambling. This research also sought to investigate the predictive effects of perceived parental and peer disapproval of gambling and perceived risk of harm related to mobile gambling behavior. Since mobile gambling provides adolescents greater availability and accessibility of gambling opportunities, it was hypothesized that greater use and

frequency of mobile gambling would be associated with more gambling problems. It was further hypothesized that higher perceived parental and peer disapproval of gambling would be a protective factor resulting in lower mobile gambling use.

Method

Participants

Participants were recruited by the Wood County Alcohol, Drug Addiction, and Mental Health Services Board (ADAMHS) and completed the annual Wood County Youth Survey examining a wide range of mental health and addictive behaviors. This sample included 6,818 representative participants (3,341 males; 3,224 females, 253 unspecified) from Grades 7 through 12, in 10 public school districts in Wood County, Ohio. The age of participants ranged from 10 to 19 years ($M = 14.90$, $SD = 1.77$ years). A vast majority of the participants identified themselves as White (79%), followed by Latino (4%), Multicultural (3%), Black or African American (2%), Asian (2%), and Other (3%), with 7% of youth failing to respond to their question.

Participants with detectable insincere responding (e.g., responding to a fake drug question, and indicating use of all substances on a daily basis) or inconsistent responses (e.g., reporting to have used a substance during the past month but not during the past year) were excluded from the analyses. Students who reported engaging in all gambling activities on a daily basis were similarly excluded. Excluded students represented less than 5% of the total sample.

Measures

Past-Year Mobile Gambling and Other Forms of Gambling. Past year frequency of mobile gambling and other forms of gambling was assessed by 11 items related to gambling using a 4-point Likert scale (0 = *Daily*, 1 = *About once a week*, 2 = *About once a month*, 3 = *Less than once a month*, 4 = *Not at all*). A sample question involved “in the last year, how often did you place a bet using your mobile device or smart phone”.

Gambling problems. Gambling problems were assessed using the three-item NORC DSM-IV Screen for Gambling Problems-Loss of Control, Lying, and Pre-occupation (NODS-CLiP) (Toce-Gerstein, Gerstein, & Volberg 2009). This scale is shown to have high sensitivity and specificity of the construct in the NODS, a more comprehensive 17-item measure of the severity of gambling problems (Toce-Gerstein et al., 2009). The three NODS items include: (1) Have there ever been periods lasting 2 weeks or longer when you spent a lot of time thinking about your gambling experiences or planning out future gambling ventures or bets? (2) Have you ever tried to stop, cut down, or control your gambling? (3) Have you ever lied to family members, friends, or others about how much you gamble or how much money you lost on gambling? Each of the items requires a dichotomous response (i.e., *yes* or *no*). If the respondent endorses one or more questions, further clinical assessment is advised.

In the current study, respondents endorsing one or more items were categorized as potentially being “at-risk gamblers.”

Perceived Risk of Harm Related to Gambling. Participants’ perception of risk of harm for gambling was measured by a single self-reported-item using a 4-point Likert scale (0 = *No Risk*, 1 = *Slight Risk*, 2 = *Moderate Risk*, 3 = *Great Risk*). Participants were asked “how much they think people risk harming themselves physically or in other ways if they gamble or make bets for money.”

Perceived Peer and Parental Disapproval of Gambling. Perceived peer and parental disapproval of gambling were assessed by a single item for each variable (i.e., How wrong do your friends/parents feel it would be for you to gamble or make bets for money?). Responses were on 4-point Likert scales, ranging from 0 (*Not at all wrong*), 1 (*A little bit wrong*), 2 (*Wrong*) to 3 (*Very wrong*).

Results

Prevalence of Gambling and Mobile Gambling

Overall, 31% of the adolescents reported engaging in some form of gambling during the past year, with 5% reporting having gambled via a mobile device (gambling being defined as wagering money to win money). To investigate more closely past-year mobile gambling involvement, prevalence by gender and grade was analyzed and is presented in Table 1. Males were 3.7 times more likely to gamble and use their mobile device for gambling than females, $\chi^2(2, N = 6171) = 109.27, p < .001, OR = 3.70, 95\% CI [2.79, 4.91]$. Moreover, an age/grade effect was also found to be significant, $\chi^2(2, N = 6133) = 34.74, p < .001$. While younger youth (Grades 7–9) were associated with lower mobile gambling involvement, older students Grades 10–12) were 1.93 times more likely to engage in this activity, $OR = 1.93, 95\% [1.50, 2.49]$.

Table 1
Prevalence of past-year mobile gambling frequency by gender and grade level

Demographic information	Gambling Frequency			χ^2
	\geq Monthly	< Monthly	Not at all	
Gender				
Male	161 (5%)	79 (3%)	2864 (92%)	109.27***, $N = 6171$
Female	28 (1%)	40 (1%)	2999 (98%)	
Grade level				
7-9	53 (2%)	47 (2%)	2917 (97%)	34.74***, $N = 6133$
10-12	128 (4%)	72 (2%)	2916 (94%)	

*** $p < .001$.

Table 2
Frequency (percentage) of adolescents engaged in mobile gambling by gambling severity

Gambling severity	Mobile gambling frequency		
	Not at all	< Monthly	≥ Monthly
Not at risk	5420 (96.4%)	102 (1.8%)	101 (1.8%)
At risk	349 (76.5%)	18 (4.0%)	89 (19.5%)
Overall	5769 (94.9%)	120 (2.0%)	190 (3.1%)

At-Risk Gambling

Overall, 7.5% of the adolescents were identified as at-risk of gambling-related problems, with 5.9% endorsing one item, 1.2% endorsing two items, and 0.5% endorsing all three items. Males exhibited higher incidence of being at-risk for gambling problems than females, $\chi^2(1, N = 5872) = 85.82, p < .001, OR = 2.65, CI = [2.13, 3.30]$. No difference in at-risk status by grade (age) was detected, $\chi^2(5, N = 5829) = 5.17, p = .40$.

Association of Mobile Gambling and At-Risk Gambling

An omnibus χ^2 test indicated that past-year mobile gambling frequency was significantly associated with at-risk gambling, $\chi^2(2, N = 6079) = 451.06, p < .001$. Participants gambling on mobile devices equal to or greater than once a month were significantly more likely to be identified as at-risk gamblers than youth who engaged in mobile gambling less frequently, $\chi^2(1, N = 6079) = 437.49, p < .001, OR = 13.26, CI = [9.67, 18.17]$ (Table 2). To investigate further differences, mobile gambling frequency was dichotomized into two categories—“less than monthly” and “monthly or more” in the following analyses.

Mobile Gambling Association with Other Forms of Gambling

A logistic regression using a forced entry method was conducted to investigate the relationship between mobile gambling and multiple forms of gambling. Past-year mobile gambling was entered as the dependent variable (DV) and other forms of gambling were entered as independent variables (IVs). As previously noted, all variables were treated as binary, namely “less than monthly” and “monthly or more.” The model was found to be statistically significant, $\chi^2(10, N = 6312) = 1065.91, p < .001, Nagelkerke \text{ pseudo } R^2 = .68$. Mobile gambling at least monthly was significantly correlated with a higher frequency of most questioned forms of gambling behavior, except for playing cards for money, buying scratch-offs, and betting money on Keno, when controlling for the predictive effects of the other predictors (Table 3). It is important to note that whether the students used mobile devices to gamble on specific types of games listed in the questionnaire (e.g., online poker, bingo, fantasy sports, etc.) was unknown.

Table 3

Prevalence of other forms of gambling during past year and relationship with mobile gambling

	Prevalence		Mobile gambling		
	< Monthly	≥ Monthly	Exp(B)	p	95% CI
Played cards for money	6079 (95.2%)	305 (4.8%)	0.88	.74	[0.42, 1.85]
Bet money on games of personal skill like pool, golf, or bowling	6013 (94.2%)	369 (5.8%)	1.95	.06	[0.98, 3.89]
Bet money on sports teams	5973 (93.6%)	408 (6.4%)	2.30	.02	[1.16, 4.53]
Bought lottery tickets	6134 (96.1%)	249 (3.9%)	2.86	.01	[1.26, 6.49]
Bought scratch-offs	6064 (94.9%)	327 (5.1%)	1.82	.13	[0.84, 3.95]
Played poker online	6212 (97.2%)	179 (2.8%)	13.20	<.01	[6.67, 26.12]
Played bingo for money	6206 (97.2%)	182 (2.8%)	2.94	.01	[1.34, 6.43]
Bet money on Keno	6213 (97.3%)	170 (2.7%)	1.17	.69	[0.54, 2.56]
Bet money on fantasy sports or games	6117 (95.8%)	268 (4.2%)	4.37	<.01	[2.07, 9.20]
Bet money on daily fantasy sports	6151 (96.3%)	236 (3.7%)	6.59	<.01	[3.25, 13.37]

Notes. Exp(B) = odds ratio; CI = confidence interval

Table 4

Correlations between sex, grade, past-year mobile gambling, risk of harm in gambling, parental and peer disapproval towards gambling, and mobile gambling

	1	2	3	4	5	6
1. Sex	-	0.02	.04**	.16**	.18**	-.12**
2. Grade		-	-.03*	-.13**	-.21**	.07**
3. Rhgamb			-	.33**	.29**	.08**
4. Pdgamb				-	.64**	-.19**
5. Fdgamb					-	-.15**
6. Mobile Gambling						-

Notes. Rhgamb = Risk of harm in gambling; Pdgamb = Parental disapproval of gambling; Fdgamb = Peer (friends) disapproval of gambling. Sex coded as 1 for female and 0 for male. This correlation used all participants.

* $p < .05$; ** $p < .01$, two-tailed.

Predictive Effect of Perceived Risk of Harm, Parental and Peer Disapproval

The average perceived risk of harm in gambling was 1.53 (SD = 1.03), indicating that adolescents perceived gambling as a slight to moderate risk behavior. Students perceived greater disapproval of gambling from their parents than peers, $t(6403) = 34.94$, $p < .001$; with average perceived disapproval from parents being 2.30 (SD = 0.96; *wrong to very wrong*), and 1.9 (SD = 1.16; *a little bit wrong to wrong*) from peers, each on a 4-point Likert scale (0–3). Spearman correlations between sex, grade, past-year mobile gambling, perceived risk of harm in gambling, parental and friend disapproval towards gambling are presented in Table 4. A hierarchical logistic regression was performed to further examine the predictive effect of gender, grade, perceived risk of harm in gambling,

Table 5

Summary of hierarchical logistic regression for variables predicting past-year mobile gambling

	<i>B</i>	S.E.	Wald	<i>df</i>	<i>P</i>	Exp(<i>B</i>)	95% CI
Step 1							
Sex	-1.78	0.21	70.85	1	<.001	0.17	0.11-0.26
Grade	0.27	0.05	31.03	1	<.001	1.31	1.19-1.43
Step 2							
Sex	-1.41	0.22	42.85	1	<.001	0.24	0.16-0.37
Grade	0.18	0.05	12.65	1	<.001	1.20	1.08-1.32
Rhgamb	-0.03	0.09	0.10	1	>.05	0.97	0.82-1.16
Pdgamb	-0.81	0.10	71.76	1	<.001	0.44	0.37-0.54
Fdgamb	-0.13	0.09	2.09	1	>.05	0.88	0.73-1.05

Notes. *B*=Parameters; Exp(*B*) = odds ratio; CI = confidence interval; Rhgamb = Risk of harm in gambling; Pdgamb = Parental disapproval of gambling; Fdgamb = Peer (friends) disapproval of gambling. Sex coded as 1 for female and 0 for male. Effective *N* = 6024.

and parental and peer disapproval of gambling on mobile gambling frequency in the preceding year. Past-year mobile gambling engagement was entered as the dichotomous DV with gender and grade entered as IVs in the first block. Risk of harm in gambling, parental disapproval of gambling, and peer disapproval of gambling were entered in the second block. The first model with only gender and grade as IVs was significant, $\chi^2(2, N = 6024) = 129.41, p < .001$, Nagelkerke pseudo $R^2 = .09$ (Table 5) suggesting that student gender and grade explained 9% of the variance in the frequency of past-year mobile gambling. Tests of the second block and the full model were also significant; for the second block, $\chi^2(3, N = 6024) = 166.57, p < .001$, and for the full model, $\chi^2(5, N = 6024) = 295.99, p < .001$. Nagelkerke pseudo R^2 indicated that the final model accounted for 21% of the variance in past-year mobile gambling, adding 12% of the variance to the first model. After controlling for age and gender, parental and peer disapproval and perceived risk of harm still significantly predicted past-year mobile gambling frequency. Overall, 97.1% of the cases were successfully predicted using the model. Specially, males are 4.16 times more likely than females to report gambling with their mobile device on a monthly basis or more (OR = 0.17, CI = [0.11, 0.26]). Age (grade) was also found to be a significant predictor, with the odds of mobile gambling more than once a month being 1.31 times greater for every increase in grade year. Among factors in block 2, only parental disapproval of gambling was found to be a significant predictor of past-year mobile gambling engagement, with one unit of increase in parental disapproval decreasing the odds of mobile gambling on a monthly basis or more by 2.27 times (OR = 0.44, CI = [0.37, 0.54]).

Discussion

The current research provides preliminary evidence of the prevalence of mobile gambling among adolescents and the relationship between mobile gambling and problem gambling. Further this study also investigated the relationship between

mobile gambling and other forms of gambling. Lastly, the present study examined the predictive effect of perceived risk of harm, and parental and peer disapproval of gambling on past-year mobile gambling frequency.

Adolescents in the current study reported an overall prevalence rate of 5% for mobile gambling. This prevalence is relatively low compared to overall adolescent gambling rate. For one, online gambling is illegal in Ohio, thus it might be less popular or more difficult for individuals to gamble via the Internet. Further, adolescents have limited access to credit cards (the most frequently used method for online and mobile gambling), which likely serves as a protective factor. However, the mobile gambling rate in this study is approximately 2% higher than the rate that King and Delfabbro (2016) reported where online gambling is both legal and commonplace. Even though the prevalence of adolescent mobile gambling currently is relatively low, this platform of mobile devices for gambling is rapidly growing (B. I. Intelligence, 2016). Moreover, there are already three U.S. states allowing some form of online gambling, with numerous international jurisdictions already permitting online gambling. As more and more states legalize online gambling, mobile gambling platforms among adolescents may similarly increase. As such, strict age-related identity checks and rigid verification procedures need to be adopted.

Although the overall prevalence rate of mobile gambling is low, regular mobile gamblers (at least once a month) are 13 times more likely than non-regular gamblers to be at risk of experiencing a gambling problem. This finding is consistent with research suggesting higher prevalence rates of disordered gambling among Internet gamblers and is suggestive of even higher prevalence rates for those engaged in mobile gambling (Petry & Gonzalez-Ibanez, 2013; Petry & Weinstock, 2007). The accessibility and privacy of mobile gambling further removes the potential scrutiny and oversight from parents and significant others. Little doubt can be found that this millennial generation spends inordinate amounts of time on their portable mobile devices. Regular mobile gambling has also been shown to co-occur with forms of gambling already popular among adolescents (e.g., e-poker; daily fantasy sports). McCormack, Shorter, and Griffiths (2013) have suggested that online problem gamblers typically participate in more diverse gambling activities (both online and land-based) than non-problem online gamblers. Underage mobile gambling may thus serve as an early warning sign of potential adolescent gambling problems for parents, educators and clinicians.

As previously noted, regular mobile gambling was found to be highly associated with regular engagement of multiple forms of gambling, especially with online poker, daily fantasy sports, and fantasy sports. For one, mobile devices provide more convenient outlets for teenagers to engage in multiple types of gambling given many different gambling activities can be engaged in, thus the overlap of platform use may also lead to the high co-occurrence of mobile and other forms of gambling. As one of the earliest types of online and mobile gambling, online poker has been highly attractive to American youth, with most of the winners of the World Series of Poker being under age 25 during the past decade. In spite of legal prohibitions in most

U.S. jurisdictions, the U.S. represents the largest online poker market in the world with nearly \$1 billion in revenue (Kelly, 2015; Philander & Fiedler, 2012). Further, it is also possible that regular mobile gamblers are more likely to have gambling-related problems and in turn, these gamblers tend to participate in various types of gambling.

Adolescent fantasy sports engagement via mobile devices is a more complicated issue to address since in many jurisdictions Fantasy Sports is not as of yet legally considered a gambling activity but rather a game of skill. Fantasy sports and daily fantasy sports each have gained revenues exceeding \$3 billion annually, with 32% of teenagers playing in the United States alone (Catania & Kelly, 2016; Fantasy Sports Trade Association, n.d.; Kelly, 2015). Yet, under certain conditions, fantasy sports wagering under the Unlawful Internet Gambling Enforcement Act (UIGEA) has actually been exempted from federal prohibition (Kelly, 2015). It is worth noting that initiating gambling at an earlier age (before 15) has been reported to be associated with various other psychological disorders compared to later-onset gambling (Burge, Pietrzak, & Petry, 2006).

Not surprisingly, gender remains a significant factor associated with adolescent mobile gambling (Derevensky, 2015; Derevensky & Gupta, 2004; Volberg et al., 2010) with more males engaged in using this platform than females. Similarly, younger adolescents tend to be less involved in mobile gambling than their older peers, as older adolescents typically have increased access to their own personal mobile devices (although this is rapidly changing with younger adolescents and children now beginning to have their own smart phones as well), more expendable money, and increased credit card use which increases potential opportunities for mobile gambling. Among those relatively controllable variables assessed, only higher parental disapproval of gambling was found to predict less mobile gambling engagement. This discovery is in line with the findings examining other adolescent high risk behaviors. Sargent and Dalton (2001) suggest that parental disapproval of smoking was significantly more influential in decreasing adolescent smoking than peer disapproval, even when the parents smoked themselves. Moreover, Reifman, Barnes, Dintcheff, Farrell, and Uhteg (1998) reported that heavy drinking among adolescents was found to be most often associated with peer heavy drinking and low parental monitoring. While it is commonly accepted that group and peer modelling plays an important role in shaping an adolescent's behavior, parental attitudes and monitoring behaviors are also essential in preventing and reducing adolescent risky behaviors. Further, when controlling for grade, gender, parental and peer disapproval of gambling, the level of perceived risk of harm did not predict mobile gambling frequency. Adolescents, as a group, are typically prone to risk-taking and reward-seeking (Steinberg, 2010), thus educational programs by themselves targeting increase awareness of harm may not be the best approach to reduce underage mobile gambling. For prevention and intervention programs for adolescent mobile gambling to be effective, parental and familial input may be necessary.

The current study has a number of limitations. The sample in the present study uses self-report data from only one region in the U.S., thus the generalization of the

results necessitates further examination. Further, because of a low proportion of frequent mobile gamblers among adolescents, the prediction success (97.1%) might be inflated. Nevertheless, we recruited more than 6,800 representative participants in the study, which has compensated the limitation of the nature of the sample (King & Zeng, 2001). It is plausible that adolescents engage in other forms of mobile gambling behavior as well, such as online casinos or slot machines via apps. Finally, as the current research was part of a larger scale study, only single-item measures of perceived risk of harm in gambling, perceived parental and peer disapproval of gambling were incorporated. Future research on risk and protective factors of adolescent mobile gambling should further examine the predictive effects with well-established multi-item scales.

In spite of the limitations noted, the results suggest that underage mobile gambling may serve as a warning sign of at-risk gambling although these findings require replication. A growing concern exists over social media casino games which simulate actual gambling activities yet are played using a freemium model and not for money (Derevensky & Gainsbury, 2016). Little doubt can be found that age verification procedures for gambling sites should be significantly improved to protect underage gamblers, especially with the legalization of online gambling across the U.S. and the development of new gambling technologies. Finally, parental education and awareness about youth gambling could go a long way in minimizing youth gambling involvement.

References

- B. I. Intelligence. (2016, June 7). Mobile advertisers are enticed by online and mobile gambling. Retrieved from: <http://www.businessinsider.com/mobile-advertisers-are-enticed-by-online-and-mobile-gambling-2016-6>
- Burge, A. N., Pietrzak, R. H., & Petry, N. M. (2006). Pre/early adolescent onset of gambling and psychosocial problems in treatment-seeking pathological gamblers. *Journal of Gambling Studies*, 22, 263–274. doi:10.1007/s10899-006-9015-7
- Canale, N., Griffiths, M. D., Vieno, A., Siciliano, V., & Molinaro, S. (2016). Impact of Internet gambling on problem gambling among adolescents in Italy: Findings from a large-scale nationally representative survey. *Computers in Human Behavior*, 57, 99–106. doi:10.1016/j.chb.2015.12.020
- Catania, F., & Kelly, J. (2016). Daily fantasy sports. *Gaming Law Review and Economics*, 20, 378–384. doi:10.1089/gltre.2016.2056. Retrieved from: <http://online.liebertpub.com/doi/pdf/10.1089/gltre.2016.2056>
- Delfabbro, P., King, D. L., Lambos, C., & Puglies, S. (2009). Is video-game playing a risk factor for pathological gambling in Australian adolescents? *Journal of Gambling Studies*, 25(3), 391–405. <https://doi.org/doi:10.1007/s10899-009-9138-8>

- Delfabbro, P., & Thrupp, L. (2003). The social determinants of youth gambling in South Australian adolescents. *Journal of Adolescence*, *26*, 313–330. doi:10.1016/S0140-1971(03)00013-7
- Derevensky, J. L. (2012). *Teen gambling: Understanding a growing epidemic*. New York, NY: Rowman & Littlefield.
- Derevensky, J. (2015). Youth gambling problems: Cause for concern. In Y. Kaminer (Ed.), *Youth substance abuse and co-occurring disorders* (pp. 307–336). Washington, D.C.: American Psychiatric Press.
- Derevensky, J. L., & Gainsbury, S. M. (2016). Social casino gaming and adolescents: Should we be concerned and is regulation in sight? *International Journal of Law and Psychiatry*, *44*, 1–6. doi:10.1016/j.ijlp.2015.08.025
- Derevensky, J., & Gupta, R. (2004). Adolescents with gambling problems: A synopsis of our current knowledge. *Journal of Gambling Issues*, *10*, 119–140. doi:10.4309/jgi.2004.10.3 Retrieved from: <http://jgi.camh.net/index.php/jgi/article/view/3647/3607>
- Elton-Marshall, T., Leatherdale, S. T., & Turner, E. N. (2016). An examination of Internet and land-based gambling among adolescents in three Canadian provinces: Results from the Youth Gambling Survey (YGS). *BMC Public Health*, *16*, 277. doi:10.1186/s12889-016-2933-0. Retrieved from: <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-2933-0>
- Fantasy Sports Trade Association. (n.d.). Industry demographics. Retrieved from: <http://fsta.org/research/industry-demographics>
- Griffiths, M. (2007). Mobile phone gambling. In D. Taniar (Ed.), *Encyclopedia of mobile computing and commerce* (pp. 553–556). Hershey, Pennsylvania: IGI Global
- Halpern-Felsher, B. L., Biehl, M., Kropp, R. Y., & Rubinstein, M. L. (2004). Perceived risks and benefits of smoking: Differences among adolescents with different smoking experiences and intentions. *Preventive Medicine*, *39*, 559–567. doi:10.1016/j.ypmed.2004.02.017
- James, R. J. E., O'Malley, C., & Tunney, R. J. (2017). Understanding the psychology of mobile gambling: A behavioural synthesis. *British Journal of Psychology*, *108*, 608–625. doi:10.1111/bjop.12226. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1111/bjop.12226/full>
- Kelly, J. M. (2015). U.S. online gaming conference: States and stakeholders in I-gaming regulation. *Gaming Law Review and Economics*, *19*, 279–288. doi:10.1089/glre.2015.1947. Retrieved from: <http://online.liebertpub.com/doi/pdf/10.1089/glre.2015.1947>

- King, D. L., Delfabbro, P., & Griffiths, M. (2010). The convergence of gambling and digital media: Implications for gambling in young people. *Journal of Gambling Studies*, *26*, 175–187. doi:10.1007/s10899-009-9153-9
- King, D. L., & Delfabbro, P. H. (2016). Adolescents' perceptions of parental influences on commercial and simulated gambling activities. *International Gambling Studies*, *16*, 424–441. doi:10.1080/14459795.2016.1220611
- King, G., & Zeng, L. (2001). Logistic regression in rare events data. *Political Analysis*, *9*, 137–163. doi:10.1093/oxfordjournals.pan.a004868. Retrieved from: <https://gking.harvard.edu/files/0s.pdf>
- Leeman, R. F., Patock-Peckham, J. A., Hoff, R. A., Krishnan-Sarin, S., Steinberg, M. A., Rugle, L. J., & Potenza, M. N. (2014). Perceived parental permissiveness toward gambling and risky behaviors in adolescents. *Journal of Behavioral Addictions*, *3*, 115–123. doi:10.1556/JBA.3.2014.012. Retrieved from: <http://pubmedcentralcanada.ca/pmcc/articles/PMC4117283>
- Lenhart, A. (2015a, April 9). A majority of American teens report access to a computer, game console, smartphone and a tablet. Retrieved from: <http://www.pewinternet.org/2015/04/09/a-majority-of-american-teens-report-access-to-a-computer-game-console-smartphone-and-a-tablet>
- Lenhart, A. (2015b, April 9). Teens, social media & technology overview 2015. Retrieved from: <http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015>
- McCormack, A., Shorter, G. W., & Griffiths, M. D. (2013). An examination of participation in online gambling activities and the relationship with problem gambling. *Journal of Behavioral Addictions*, *2*, 31–41. doi:10.1556/JBA.2.2013.1.5
- Olason, D. T., Kristjansdottir, E., Einarsdottir, H., Haraldsson, H., Bjarnason, G., & Derevensky, J. L. (2010). Internet gambling and problem gambling among 13 to 18 year old adolescents in Iceland. *International Journal of Mental Health and Addiction*, *9*, 257–263. <https://doi.org/10.1007/s11469-010-9280-7>
- Petry, N. M., & Gonzalez-Ibanez, A. (2013). Internet gambling in problem gambling college students. *Journal of Gambling Studies*, *31*, 397–408. doi:10.1007/s10899-013-9432-3
- Petry, N. M., & Weinstock, J. (2007). Internet gambling is common in college students and associated with poor mental health. *American Journal on Addictions*, *16*, 325–330. doi:10.1080/10550490701525673
- Philander, K., & Fiedler, I. (2012). Online poker in North America: Empirical evidence on its complementary effect on the offline gambling market. *Gaming Law Review and Economics*, *16*, 415–423. doi:10.2139/ssrn.2021993

- Potenza, M. N., Wareham, J. D., Steinberg, M. A., Rugle, L., Cavallo, D. A., Krishnan-Sarin, S., & Desai, R. A. (2011). Correlates of at-risk/problem Internet gambling in adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*, 150–159.e3. doi:10.1016/j.jaac.2010.11.006
- Poulin, C. (2000). Problem gambling among adolescent students in the Atlantic provinces of Canada. *Journal of Gambling Studies, 16*, 53–78. doi:10.1023/A:1009431417238
- Reifman, A., Barnes, G. M., Dintcheff, B. A., Farrell, M. P., & Uhteg, L. (1998). Parental and peer influences on the onset of heavier drinking among adolescents. *Journal of Studies on Alcohol, 59*, 311–317. doi:10.15288/jsa.1998.59.311
- Sargent, J. D., & Dalton, M. (2001). Does parental disapproval of smoking prevent adolescents from becoming established smokers? *Pediatrics, 108*, 1256–1262. doi:10.1542/peds.108.6.1256
- Steinberg, L. (2010). A dual systems model of adolescent risk-taking. *Developmental Psychobiology, 52*, 216–224. doi:10.1002/dev.20445. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1002/dev.20445/epdf>
- Toce-Gerstein, M., Gerstein, D. R., & Volberg, R. A. (2009). The NODS-CLiP: A rapid screen for adult pathological and problem gambling. *Journal of Gambling Studies, 25*, 541–555. doi:10.1007/s10899-009-9135-y
- Volberg, R. A., Gupta, R., Griffiths, M. D., Ólason, D. T., & Delfabbro, P. (2010). An international perspective on youth gambling prevalence studies. *International Journal of Adolescent Medicine and Health, 22*, 3–38. doi: 10.1515/IJAMH.2010.22.1.3 Retrieved from: <https://pdfs.semanticscholar.org/f39d/938f1af59aaaf3c8a642e6963444ddec527e.pdf>
- Wong, I. L. K., & So, E. M. T. (2013). Internet gambling among high school students in Hong Kong. *Journal of Gambling Studies, 30*, 565–576. doi:10.1007/s10899-013-9413-6
- Wickwire, E. M., Whelan, J. P., West, R., Meyers, A., McCausland, C., & Leullen, J. (2007). Perceived Availability, Risks, and Benefits of Gambling among College Students. *Journal of Gambling Studies, 23*, 395–408. doi: 10.1007/s10899-007-9057-5

Submitted December 21, 2016; accepted November 5, 2017. This article was peer reviewed. All URLs were available at the time of submission.

For correspondence: Yaxi Zhao, M. A., International Centre for Youth Gambling Problems and High-Risk Behaviors, McGill University, Montreal, QC, H3A 1Y2.
E-mail: yaxi.zhao@mail.mcgill.ca

Competing interests: None declared (all authors).

Ethics approval: “Not required. This study used secondary de-identified data.”

Acknowledgements: The authors would like to thank the reviewers for their constructive feedback and the journal editors and staff for their encouragement.