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Lottery Participation as a Marker of and Contributor to Gambling-related Problems in College Students

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ABSTRACT *We examined the role of lottery participation in contributing to gambling-related problems, using a sample of 351 college students who self-identified as frequent gamblers, including a sub-sample of 133 frequent lottery gamblers. Participants completed the DSM-IV based Diagnostic Interview for Gambling Severity and two cognitive tasks, the Georgia Gambling Task (GGT) and the Iowa Gambling Task (IGT). Among all individuals, lottery participation predicted gambling-related problems, but this was non-significant among frequent lottery gamblers. Gambling problems were related to number of frequent gambling modalities, but were lessened if one of the modalities was lottery participation and did not relate to the performance measures on the GGT or IGT. We conclude that lottery participation is a marker for gambling-related problems, but that it contributes to gambling problems in only a secondary way and only in the presence of other frequent gambling activity in this population.*

Introduction

More people participate in lotteries than in any other form of gambling (Welte *et al.*, 2004), yet there is not a consensus concerning the contribution of lottery participation to gambling problems. While research has revealed that both lottery participation and gambling-related problems are common among young populations such as adolescents and college students (e.g. Fisher, 1999), the role that lotteries plays in gambling problems is less clear. This is of particular interest because of the repeated finding that lottery participation is accompanied to an unusual degree by other forms of gambling, both in general populations (DeFuentes-Merillas *et al.*, 2003; Rogers and Webley, 2001) and among college students (Browne and Brown, 1994).

To what extent does lottery participation contribute to gambling problems in young populations? Using a sample of college students in Georgia (USA), we sought evidence to address this question along two lines. First, we examined how lottery participation fits among the gambling activities of individuals in the college population who experience gambling-related problems. Second, we investigated whether basic cognitive biases that are associated with gambling problems generally, and with other gambling modalities, are also associated with lottery participation.

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Lottery-related Gambling Problems

A small literature has examined the degree of gambling-related problems that are associated with lottery participation, with mixed conclusions. Some research suggests that the potential for problems arising from participating in lotteries is slight. For example, problem gamblers have been found to buy lottery tickets infrequently within Canadian populations (Cox *et al.*, 2000; Wiebe and Cox, 2001). Also, there are very low rates of pathological gambling reported among lottery scratchcard players in the Netherlands; most frequently, scratchcard players who were pathological gamblers also engaged in other gambling activities, so that the pathology could not be uniquely attributed to lottery participation (DeFuentes-Merillas *et al.*, 2003, 2004). These results have been deployed in support of the conclusion that lotteries 'do not tend to be addictive for adults' (Griffiths, 1999, p. 143) and are not a source of pathological gambling.

However, other research has supported dissimilar conclusions. For example, lottery participation has been cited as a source of increases in per-household gambling expenditures in the UK, leading to an increase in excessive gambling, especially in low-income households (Grun and McKeigue, 2000). The risk associated with lottery participation is related to poor socioeconomic background, heavy involvement in other forms of gambling, and alcohol and marijuana use in a Dutch sample (Hendricks *et al.*, 1997). Moreover, in a US sample of treatment-seeking pathological gamblers, gamblers who primarily played lottery games constituted a major proportion of pathological gambling cases, though a particular association was observed between lottery-related pathological gambling and engaging in multiple gambling activities (Petry, 2003). Lottery gambling has been categorised in one study (Welte *et al.*, 2004) as being among a second tier of gambling activities associated with pathological gambling, along with cards and bingo, behind only casino gambling.

Even if lottery participation leads to gambling-related problems in a smaller proportion of participants than other gambling modalities, lottery gambling could contribute substantially to gambling problems by dint of the far greater numbers of lottery participants than in any other gambling modality. Welte *et al.*, (2004) reported that 80% of a sample of American adults bought lottery tickets within the past year. The next highest figure was for raffles or charity (59%), which is not associated in the literature with gambling problems, followed by casino gambling (32%). With two-and-a-half times more participants than the next most common problem-linked gambling behaviour, the specific contribution of lottery participation to gambling problems warrants further investigation.

Lottery Participation among College Populations

There are several reasons to investigate the association between lottery participation and gambling-related problems among younger populations in particular. First, the rate of pathological gambling is frequently found to be higher among youths and adolescents than among adults (e.g. Shaffer and Hall, 1996; Stinchfield and Winters, 1998). Second, adolescents who are pathological gamblers are significantly more likely to have gambling-related problems later in life (Vitaro *et al.*, 2004), even though pathological gambling is frequently transitory (Slutske *et al.*, 2003). Third, perhaps because of the low absolute losses that are generally associated with lottery participation (Petry, 2003), it is differentially associated with pathological gambling

among lower-income populations primarily (Grun and McKeigue, 2000; Hendricks *et al.*, 1997).

Many people begin participating in lotteries at very young ages, with little apparent impact of legal age restrictions. For example, among a sample of 11–15 year-olds in the UK, all of them barred by law from participating in the National Lottery because of their age, Wood and Griffiths (2004) found that 48% had played the lottery. Fifty-seven per cent of a 12–15 year old UK sample had played lottery scratchcards and 40% the lottery draw, and 5.6% showed gambling problems (Fisher, 1999). Similarly, in an Ontario-based sample of students from 6 to 12 grades, 74% had played lottery games within the past year, including 40% of the 6th–7th graders (mean age 11.3 years, Felsher *et al.*, 2004). Moreover, even with legal age restrictions, underage participants have easy access to lottery participation, whether by means of vendors who do not challenge their ticket purchases (Felsher *et al.*, 2004) or by parents and other relatives purchasing lottery tickets on their behalf (Felsher *et al.*, 2003). Indeed, Felsher *et al.*, (2004) report that among all underage participants, 65% said it was easy to evade legal age restrictions; among underage 12th graders, 83% said it was easy.

Given the mixed literature concerning the role of lottery participation, the goal of this paper is to shed further light on the extent to which lottery participation contributes to gambling-related problems among college students. Although young people participate in lottery games frequently, and also experience pathological gambling at rates higher than those of their elders (Stinchfield and Winters, 1998), there is surprisingly little evidence that speaks directly to the predictive value of lottery participation in the gambling problems of young populations.

Cognitive Processing Differences in Problem Gamblers

A literature is emerging regarding the cognitive mechanisms that underlie the gambling activities of young populations, including lottery participation. For example, betting on sports in which one has previous knowledge from which to draw evokes differential cognitive processes than when betting on random events like lotteries (Ranyard and Charlton, 2006). Likewise, Goodie (2005) found a number of individual differences between frequently gambling college students who were pathological or problem gamblers and those who were non-problem gamblers, using the Georgia Gambling Task (GGT) (Goodie, 2003). Problem and pathological gamblers showed more overconfidence in their knowledge and, when bet value was held constant, more risk acceptance than non-problem gamblers. Further, problem and pathological gamblers distinguished bets based on their own ability from those based on a random event to a lesser degree than did non-problem gamblers. These results confirm the role that perceptions of control play in pathological gambling, along with other cognitive distortions (Ladouceur *et al.*, 2004).

Similarly, Bechara (2001) discussed how risk taking measured through the Iowa Gambling Task (IGT) (Bechara *et al.*, 1994) may relate to the basic cognitive processing that underlies pathological gambling. Noting the similarities between pathological gambling and substance addiction, he argued that pathological gamblers may become so focused on the reward of winning that their judgement becomes obscured. Long-term potential losses are not sufficiently factored into their decision-making processes, which results in greater propensity for risk-taking.

Neither the GGT nor the IGT is designed to measure gambling behaviour *per se*; for example, the points that are won are not exchanged for money. Rather, these

tasks capture individual differences in judgemental biases and risk taking propensities that contribute both to real-world gambling and other risky behaviours (Bechara, 2001; Bechara and Damasio, 2002; Bechara *et al.*, 2002; Goodie, 2005; Hardy *et al.*, 2006; Yechiam *et al.*, 2005). Moreover, this approach has previously been used to elucidate the role of cognitive biases in contributing to gambling pathology within a specific gambling modality. Specifically, the frequency of playing poker or other card games correlates significantly with gambling pathology, even when the range is restricted to include only those who play cards at least monthly (Lakey *et al.*, in press). Even in this restricted sample, GGT and IGT performance, as well as frequency of card playing, all contributed independently to predicting gambling pathology.

We are aware of no research that attempts to link cognitive processing biases, especially those that are known to play a role in gambling problems, with lottery participation. This would be a useful step in illuminating the role that lotteries play in gambling problems. Thus, in addition to examining how lottery participation fits among other gambling modalities in contributing to gambling problems, the present research examined the association of two measures of risk taking and judgemental biases, the GGT and IGT, with lottery participation among college students.

Method

Participants

American students at the University of Georgia ($N = 351$) completed this study for partial fulfilment of psychology course research requirements, after responding to a recruiting message seeking individuals who gamble frequently. One hundred and one of the sample were female (28.8%) and 250 were male (71.2%). This sample included nine individuals who identified as Hispanic or Latino, 14 as Asian or Asian American, 18 as Black or African American and 310 as Caucasian. The ages of participants in the current study ranged from 18 to 25 years ($M = 19.3$ years, SD $= 1.27$). Lottery participation, which is available in both drawings and scratchcard formats, is the only legal form of gambling in Georgia, with a minimum age of 18. In addition to lottery games and illicit forms of gambling, casinos are available in neighbouring states.

For some analyses, we further screened for those who reported participating in lotteries at least monthly, using item 1f ('*Played numbers or bet on the lottery?*') from the Diagnostic Interview for Gambling Severity (DIGS) (Winters *et al.*, 2002) as the basis of selection. One-hundred and thirty-three participants met this criterion, although we cannot discern whether these individuals played exclusively lottery draws, scratchcards, or a mixture of the two. Forty-two of the frequent lottery players were female (31.6%) and 91 were male (68.4%). Their ages ranged from 18 to 25 years ($M = 19.32$ years). This sub-sample included four individuals who identified as Hispanic or Latino, two as Asian or Asian American, three as Black or African American and 123 as Caucasian.

Measures and Procedures

Following informed consent from participants, all measures were computer administered. First, all participants completed a basic demographic questionnaire that asked for age, sex and racial/ethnic self-identification. All participants then completed the DIGS, which was designed using DSM-IV criteria with two

questions relating to each classification criterion. For example, for the criterion of preoccupation with gambling, the related questions are '*Have there been periods in your life when you spent a lot of time thinking about past gambling experiences or thinking about future gambling ventures*?' and '*Have you frequently thought about ways of getting money with which to gamble*?'. Responses to each question were assessed with one of three responses (Very True, Somewhat True, False). A response of *Very True* or *Somewhat True* for either of the two questions referencing a particular DSM-IV criterion was assigned a point. Points on this measure were summed to form the DIGS score, with possible scores ranging from 0 to 10. Reliabilities of the DIGS score have been found to be extremely favourable (Stinchfield, 2003) and empirical research has revealed support for a single factor structure encompassing the 10 criteria (Stinchfield *et al.*, 2005; Winters *et al.*, 2002).

The DIGS also includes questions concerning the frequency (ranging from None At All to Daily) with which participants have engaged in eleven specific gambling modalities (e.g. *Bowled, shot pool, or played golf for money*?; *Bet on the outcome of a sporting event*?). We assigned a literal value to these responses (e.g. Daily $= 365$) and summed them so that higher totals reflect greater total gambling frequency. Following past research (Lakey *et al.*, in press), responses of Monthly or more frequent for each modality were coded as frequent gambling modalities.

After completing individual difference measures for a separate study, participants then completed the GGT and IGT in counterbalanced order across the participant set. In the GGT, participants were asked 100 general knowledge questions with two possible answers, which were adapted from those used by Nelson and Narens (1980). Upon answering for each question, participants provided an assessment of confidence in their response in one of the following categories: 50–52%, 53–60%, 61–60%, 71–80%, 81–90%, 91–97%, or 98–100%. Participants were instructed that, for example, of all questions to which 75% confidence was assigned, 75 out of 100 should prove to be correct. If this standard is met, then the average confidence across all trials would equal the proportion of questions that were correctly answered. If average confidence was greater than overall accuracy, this would reflect overconfidence; likewise, if average confidence was less than overall accuracy, then underconfidence would be reflected. Hence, *overconfidence* was calculated as the difference between average confidence and overall accuracy across all trials (and could take a negative value in the case of underconfidence).

Participants were then offered a bet for points that had negative expected value if participants are overconfident, zero expected value if confidence is well calibrated, and positive expected value if participants are underconfident. Specifically, if the bet on each question was accepted and the answer was correct, then the participant would win 100 points. If the bet was accepted on an incorrect answer, then the participant would lose $100 \times \textit{confidence}/(1 - \textit{confidence})$ points. For example, if the participant expressed 75% confidence in an answer that turned out to be incorrect, he would lose $100 \times 0.75/(1 - 0.75) = 300$ points. Under this system, total points earned are an inverse function of both overconfidence and bet acceptance (Goodie, 2003). Three performance measures were taken: over-confidence, proportion of bets that were accepted and total points earned. All these measures have shown to be related to gambling-related problems among college students who gamble frequently (Goodie, 2005) and among college students who frequently play poker and other card games (Lakey *et al.*, in press).

The IGT is a computerised card sorting task in which there are four simulated decks of cards from which to choose. Each card selection results in either a monetary gain alone, or a monetary gain coupled with a loss. Two of the decks are disadvantageous over the long run because they provide large wins, but occasional, much larger losses, yielding a negative expected value. The other two decks are less risky and more advantageous in that they provide smaller gains, but even smaller occasional losses, yielding a positive expected value. Participants' performance on this task is contingent upon learning over the course of 100 trials to avoid the risky decks and to choose from the safe decks. This implicit learning ordinarily leads individuals to make more advantageous choices from the decks (Bechara *et al.*, 2000). However, several populations showing risky behaviours have shown similar indiscriminate focus on reward on the IGT by failing to learn to choose the safer deck predominantly, including substance addicted patients (Bechara and Damasio, 2002; Bechara *et al.*, 2002) and HIV patients who contracted the disease through intravenous drug use or risky sexual behaviours (Hardy *et al.*, 2006). Performance on the IGT has been specifically related to gambling pathology among college students who play poker and other card games frequently (Lakey *et al.*, in press). In the current investigation, we used the total number of times that participants chose from the risky decks across all 100 trials as the measures of performance on this task, reflecting their myopic focus on reward.

Results

Among the full sample of 351 participants, 124 (35.3%, including 39 women) scored 0–2 on the DIGS. Another 116 participants (33.1%, including 31 women) scored 3–4 on the DIGS. The remaining 111 participants (31.6%, including 31 women) scored 5 or greater. Mean reported lottery participation among the full sample was 18.60 days per year (SD $= 54.75$). They also reported a mean of 106.38 gambling experiences per year across all modalities excluding lottery (SD $= 131.53$).

In the reduced sample of only frequent lottery players, 46 of the 133 (34.6%, including 13 women) scored 0–2 on the DIGS, while 41 participants (30.8%, including 14 women) scored 3–4. The final 46 participants (34.6%, including 15 women) scored 5 or higher on the DIGS. Mean reported lottery participation was 42.86 days per year (SD $= 83.55$). These participants also reported having 136.39 gambling experiences per year across all modalities excluding lottery (SD $= 154.40$). The higher mean level of total gambling experiences reveals that individuals who participate frequently in lotteries also gamble more frequently in other forms of gambling. All gender effects were non-significant, and thus gender is not discussed further as a variable.

Lottery Participation, Gambling Problems and Other Gambling

Using the full data set ($N = 351$), we conducted a regression analysis in which we regressed DIGS score onto lottery participation frequency (Lottery), and the total frequency of all other gambling experiences (Other). The Lottery and Other scores were first centred to remove all non-essential multi-collinearity (Cohen *et al.*, 2003). Both Lottery ($\beta = 0.11$, $t = 2.09$, $p < 0.05$) and Other ($\beta = 0.35$, $t = 6.89$, $p < 0.01$) were significantly related to DIGS scores (as was the model as a whole, $F(2,348) = 28.71$, $p < 0.01$). As such, even after controlling for the total frequency

of gambling experiences, the effects of lottery participation was significantly associated with greater gambling-related problems.

Because this effect could be artificially inflated by the many individuals who do not participate in lotteries, as a more stringent test of the impact of the frequency of lottery participation on gambling severity, we followed the same procedure with the reduced data set of only individuals who participate in lottery games frequently ($N = 133$). This time, the effect of Other remained statistically significant ($\beta = 0.29$, $t = 3.47$, $p < 0.01$), but the effect of Lottery was non-significant ($\beta = 0.09$, $t = 1.01$). Again, the model as a whole was statistically significant ($F(2,130) = 7.29$, $p < 0.01$). These results indicate that among frequent lottery players, participating more frequently did not relate to higher reports of gambling-related problems, although the frequency of non-lottery-related gambling experiences did significantly relate to higher DIGS scores.

Modality Co-occurrence

The numbers of participants who participate frequently in lotteries, and their varying levels of gambling-related problems and participation in other gambling activities, are presented in the top half of Table 1. Among those scoring 0–2 on the DIGS, a participant who participated frequently in lotteries was only 13.0% likely ($6/(6 + 40)$) to participate only in lottery games. Those who scored above 2 (i.e. those with more than two gambling-related problems) *never* participated solely in lottery games. That is, at least one other gambling modality was always involved when gambling-related problems were present.

Number of Modalities and Gambling-related Problems

We analysed the relationship between gambling-related problems and the number of modalities in which frequent (at least monthly) participation was reported, and the results are presented in Figure 1. It can be see that there is a significant correlation between number of modalities and number of gambling problems ($r = 0.52$; $p < 0.01$). Figure 1 also sub-divides groupings of modalities into participants who include lottery participation among their frequent gambling modalities, and those who do not. For seven out of the eight numbers of modalities at which a comparison was possible, there were fewer gambling-related problems if lottery participation was one of the frequent modalities than if

Table 1. Number of participants with varying degrees of gambling-related problems, associated with lottery and cards players

Lottery ($N = 133$)	Lottery only (n)	Lottery and other gambling activities (n)
DIGS score 0–2	6 (4.5%)	40 (30.1%)
DIGS score 3–4	0 (0%)	41 (30.8%)
DIGS score 5–10	0 (0%)	46 (34.6%)
Cards ($N = 221$)	Cards only (n)	Cards and other gambling activities (n)
DIGS score 0–2	20 (9.0%)	37 (16.7%)
DIGS score 3–4	19 (8.6%)	66 (29.9%)
DIGS score 5–10	16 (7.2%)	63 (28.5%)

Note: Cards data are from Lakey *et al.* (in press).

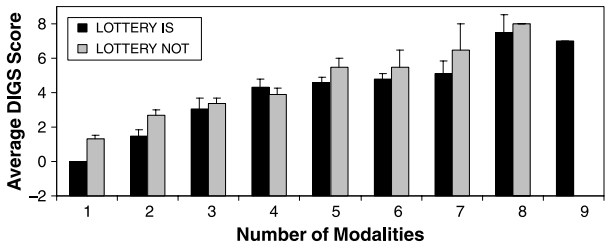

Figure 1. Gambling modalities and gambling-related problems. *Note:* Data are separated by whether or not lottery participation is or is not one of the frequent modalities. Error bars indicate standard error.

it was not. Among participants who engaged in one modality, there were six participants who participated frequently in lottery games and all of them scored 0 on the DIGS. At the level of nine modalities, however, there were no participants who did not participate frequently in lottery games.

To analyse this statistically, we regressed DIGS score onto the number of frequent modalities as one predictor variable, and absence/presence of lottery as a frequent modality as another (dummy coded as 0 and 1, respectively). Indeed, the presence of lottery participation as one of the modalities was associated with *fewer* gambling-related problems ($\beta = -0.26$, $t = -2.12$, $p < 0.05$) when controlling for the number of other frequent gambling activities ($\beta = 0.55$, $t = 4.47$, $p < 0.01$). (The overall model with both of these variables was significant, $F(2,130) = 21.61$, $p < 0.01$.) The results reveal that, given a fixed number of gambling modalities, fewer gambling-related problems are seen if lottery participation is one of the frequent gambling modalities.

Lottery Participation and Cognitive Biases

To test for relations between gambling-related problems and cognitive biases among those who participate frequently in lotteries, we assessed the relations among participants' performance on the IGT and the GGT with Lottery, controlling for the total frequency of the Other category. The frequency of lottery participation only marginally related to GGT overconfidence ($\beta = 0.15$, $t = 1.74$, $p < 0.10$), and so, thus, to GGT points earned ($\beta = -0.16$, $t = -1.80$, $p < 0.10$). The frequency of Other gambling ($\beta = 0.27$, $t = 3.10$, $p < 0.01$), but not Lottery ($\beta = 0.03$, $t = 0.36$), related significantly to bet acceptance on the GGT. Neither Lottery ($\beta = 0.07$, $t = 0.77$) nor Other ($\beta = 0.08$, $t = 0.85$) revealed a statistically significant relation to IGT risky deck choice, indicating that the frequency of lottery participation did not systematically relate to a myopic focus on reward.

Discussion

In order to examine the role of lottery participation in gambling-related problems, we examined the gambling activities and judgemental and decision-making cognitive processes among 351 self-identified frequent gamblers and among a more restricted sample of 133 self-identified frequent lottery players, within a college student population. We measured gambling-related problems using the DIGS, a gambling screen based directly on the DSM-IV pathological gambling criteria, and cognitive processes with the GGT and IGT, both of which measure

judgemental and decision-making biases. In line with previous studies (DeFuentes-Merillas *et al.*, 2003, 2004; Petry, 2003), it seems clear that the vast majority of lottery players do not suffer increased gambling problems as a consequence of this activity alone; indeed, our results provide little evidence that lottery participation contributes greatly to gambling problems. These null or slender effects were evident in three areas: relations of gambling problems with lottery participation within the sub-sample of frequent lottery players, relations of problems with other gambling modalities, and relations of problems with cognitive processing measures.

First, the relation of lottery participation frequency with gambling problems was not evident among the restricted sample of frequent lottery players, as the relation to higher DIGS scores was accounted for by the total frequency of other, non-lottery gambling activities. It is instructive to compare this finding with the parallel finding concerning poker playing as a gambling modality (Lakey *et al.*, in press), where among frequent card players, more frequent card playing significantly and uniquely predicted greater gambling problems.

Second, a similar picture emerged when we examined gambling problems and the co-occurrence of lottery participation and other activities in which individuals gamble frequently. Once again, it is illustrative to compare these results with those we obtained (Lakey *et al.*, in press) with a sample of college students who play poker or other card games frequently. Relevant card-playing data sets are presented in the bottom half of Table 1. Among the 87 frequent lottery players who had more than two gambling-related problems, not a single player (0%) had these problems while solely playing lottery games. This contrasts with frequent card players, 15.8% of whom self-reported gambling problems while playing only cards. Also, the relative rate of having more than two gambling-related problems was lower among the frequent lottery players (65.4%) than among the card players (74.2%).

The results depicted in Figure 1 make evident that, although adding a gambling modality is associated with increased gambling problems, the increase in problems is diminished markedly if the added modality is lottery participation. Consider a gambler who engages in N modalities, none of which is lottery participation. This gambler falls in one of the grey-shaded bars of Figure 1. If this gambler moves to $N + 1$ modalities by adding lottery games to his or her repertoire (moving to the black-shaded bar to the right), the average increment is only 0.14 additional problem symptoms. If the same gambler adds a non-lottery modality (moving to the grey-shaded bar to the right), the average increment is 0.96 symptoms, almost seven times as great as the increment associated with adding lottery participation. Of course, the data reflected in Figure 1 are between subjects; thus any analysis in terms of 'adding modalities' should not be interpreted strictly as the impact on any individual gambler.

Finally, the relationships of lottery participation frequency with various cognitive measures were notably weak. There was a positive but only marginally significant relation between gambling-related problems and the GGT measures of overconfidence and points earned, and a non-significant relation with bet acceptance. Similarly, the relation between gambling problems and IGT performance among frequent lottery players was non-significant. All these findings contrast with significant associations of these variables with number of symptoms in frequent gamblers generally (Goodie, 2005), as well as among frequent poker and other card players (Lakey *et al.*, in press). In the Lakey *et al.*

(in press) study, among frequent card players IGT performance and GGT performance (in both overconfidence and bet acceptance, and consequently in points earned), all predicted number of pathological gambling criteria robustly, independently of poker playing frequency. In short, the findings with regard to lottery participation are generally non-significant, in marked contrast with significant parallel findings with regard to card playing.

We do not mean to suggest that lottery participation is completely benign, especially taking into account the considerable representation of frequent lottery players among gamblers with significant gambling-related problems. Indeed, among this sample of frequent gamblers, there were 87 (65.4%) who were both frequent lottery players and reported more than two gambling-related problems. As such, the population of US college-student problem gamblers who participate frequently in lottery games is not negligible and contrasts with Wiebe and Cox's (2001) conclusion that pathological gamblers seldom play lotteries. Further, among all frequent gamblers, the more often participants played lotteries, the more gambling-related problems were evident. This suggests that, at the level of the general population, the degree of one's lottery participation is a meaningful marker that is correlated with increased likelihood of gambling-related problems.

There are direct implications for the relevance of lotteries in understanding and ameliorating gambling problems. For example, money lost in lottery participation exacerbates the financial harms associated with other gambling activities in problem gamblers (Grun and McKeigue, 2000). Even a small absolute loss can compound the negative personal and financial stresses to an individual with other gambling-related problems. Moreover, because the money spent by each participant on lotteries is relatively little compared with other gambling activities and because lotteries are highly accessible to, and frequently played by, young populations (Felsher *et al.*, 2003, 2004; Fisher, 1999; Wood and Griffiths, 2004), it could serve as an early gateway to other, more primary gambling modalities (Vitaro *et al.*, 2004). There is clear evidence, however, that the role played by lottery participation is less pronounced in this population than that of other gambling activities, such as card playing. Thus, it appears that gambling problems in college students are relatively seldom associated solely with lottery participation, but that gambling problems are, rather, generally a product of lottery participation combined with other gambling activities.

Limitations and Future Research

The conclusions to be drawn from this study have limitations. Our participants had likely been participating in lotteries for some time and so the origins of this behaviour cannot be assessed from this study. Also, it is possible that some problem gamblers were self-excluded in recruiting because they did not self-identify as gambling frequently. Wood and Griffiths (2004) report data to suggest that a substantial minority of lottery players do not believe this activity to be gambling. To the extent that individuals who play only lotteries self-excluded for this reason, this study would under-report problem gambling based on lottery participation. Being college students, our participants were at the highest education level that is possible at their age. Educational level has been repeatedly shown to relate inversely to rates of problem gambling (e.g. MacDonald *et al.*, 2004; Petry and Mallya, 2004; Wong and So, 2003). It is possible that the broader college-*age* population has a higher rate of gambling-related problems associated

with lottery participation. As such, another potential avenue for future research is to examine the impact of lottery participation on gambling problems in college-*aged*, non-student samples. Finally, the DIGS scores reflect direct counts of DSM-IV criteria, such that a score of 5 or above would be expected to closely track participants who experience pathological gambling. However, because the DIGS is measured using self-reports rather than a clinical interview, the scores should not be interpreted strictly as diagnoses of pathological gambling.

Conclusion

This study shows that lottery participation is associated with gambling-related problems among individuals who gamble frequently, but not among the restricted sample of only frequent lottery players. Rather, gambling-related problems among frequent lottery players seems more a function of the frequency with which individuals gamble in other modalities, and not a result of biases of judgement and decision making, as evidenced by the minimal relations between gambling problems and cognitive measures assessed by the GGT and IGT. Taken together, these results support the contention that lottery playing can serve as a marker of gambling problems among college students, but that its unique contribution to gambling problems is secondary to frequent gambling in other modalities.

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