

review

Market Cannibalization Within and Between Gambling Industries: A Systematic Review

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Abstract

In economics, cannibalization refers to a process in which a new product or service partly or completely substitutes for those in existing markets. This systematic review analyses the existing evidence on cannibalization within gambling markets to determine whether such substitution takes place between different types of gambling. The analysis shows that new gambling products substitute to a certain extent for existing gambling products. The sector in which the evidence is most convincing is the casino industry, which cannibalizes lotteries and pari-mutuel racing. There is also evidence that casinos substitute for other casinos and for non-casino electronic gaming machines. Lotteries substitute for casinos, other lotteries, sports betting, and pari-mutuel or racing industries. In other cases, the evidence is less conclusive and sometimes non-existent, or industry relationships are more complicated. This review also found that even in cases where substitution does occur, it is incomplete, and thus the introduction of new products tends to expand the overall gambling market. We discuss these market dynamics and identify gaps in the available research.

Keywords: gambling, cannibalization, substitutionary effects, economic impacts, review

Résumé

En économie, on entend par cannibalisation un processus par lequel un nouveau produit ou service se substitue partiellement ou complètement à des produits ou services existants. Cet examen systématique analyse les données dont on dispose sur la cannibalisation dans les marchés du jeu pour déterminer si une telle substitution a lieu entre différents types de jeux de hasard. L'analyse montre que les nouveaux produits de jeux de hasard remplacent, dans une certaine mesure, certains produits de jeu existants. La preuve la plus convaincante est celle portant sur le secteur du casino qui cannibalise les loteries et les courses de pari mutuel. Il est également

prouvé que les casinos accaparent légèrement le marché d'autres casinos et d'appareils de jeu hors casino. Les loteries s'approprient une part de marché des casinos, d'autres loteries, de paris sportifs et mutuels ou des secteurs de la course. Dans d'autres cas, les preuves sont moins concluantes, voire inexistantes, ou les relations entre les divers secteurs sont plus compliquées. Cet examen a également révélé que, même dans les cas où il y a un accaparement du marché, il n'est pas total et, par conséquent, le lancement de nouveaux produits tend plutôt à élargir le marché global du jeu. Nous abordons ces dynamiques de marché et cernons les lacunes dans la recherche disponible.

Introduction

Several research papers have considered whether the introduction of new games or the expansion of existing games have a “substitutionary” or “complementary” relationship with other gambling markets. Although in economics these terms refer to cross-price elasticities (Farrell & Forrest, 2008), in the literature on market substitution, they are used to describe the level of replacement or reduction in sales or market share that occurs when a new commodity enters the market. Market substitution is also called displacement or cannibalization. This systematic review analyses the available evidence on whether substitution takes place in gambling markets. Cannibalization can occur between gambling products or between gambling and other industries. The focus of this paper is on the former, also known as intra-industry substitution.

Substitution in gambling markets can occur either between different gambling sectors or within the product range of the same gambling provider. Srinivasan, Ramakrishnan, and Grasman (2005) distinguished between intra-product cannibalization and inter-product cannibalization. In the case of intra-product cannibalization, two different products with similar functionalities compete for the same market share, as would be the case with two state lotteries competing for the same business. Inter-product cannibalization can occur when two products within the same product group compete for market share. This is the case when, for example, casino gambling competes with lotteries or pari-mutuel gambling.

There is currently no unanimity on whether cannibalization occurs in the gambling sector. The discussion is also coloured by ideological positions related to the potential economic benefits of gambling. Gambling can have benefits to societies as well as to individuals (e.g., American Gaming Association, 2014; Basham & Luik, 2011; Collins, 2003), but the economic benefits of all forms of gambling are not the same. Casinos and racing are labour intense, although the value for the economy of the often low-paid, part-time jobs that are associated with these industries has been questioned (Grinols, 2004; Kendall, 2011). Automated forms of gambling, such as electronic gaming

machines (EGMs) or online gambling, require less personnel and do not have a positive impact on employment (Williams, Rehm, & Stevens, 2011). Lotteries are not major job providers, but increase government budgets and benefit charitable causes. In comparison, casinos, particularly Native American casinos, pay less or no tax to state governments, although they may reduce the need for state subsidies (Gordon, 2010).

Two previous reviews that have considered market substitution between and within gambling industries have also come to contradictory conclusions. The Swiss Institute of Comparative Law (2006) conducted a comprehensive review of the relationships between different gambling industries from existing empirical evidence at the time and found that most gambling sectors cannibalize each other. A more recent but less comprehensive review by Philander and Bernhard (2012) concluded that the available evidence does not support claims of cannibalization in the casino sector. The most comprehensive empirical study on the substitution effects between gambling products was conducted by Walker and Jackson (2008). The authors modelled gambling market relationships in all 50 U.S. states from 1985 to 2000. Results indicated that some industries do indeed cannibalize each other, whereas other industries have no impact on one another.

This finding suggests that gambling industry relationships are complicated and depend on several factors, which is why a systematic review of all intra-industry relationships is even more important. This is the research task of the current review. First, we introduce the methodology and inclusion criteria of studies considered for the systematic review. Second, we present detailed results of all forms of cannibalization within the gambling industries that have been addressed in previous research. Third and finally, we discuss these industry relationships and the issue of market expansion.

Method

The review was conducted by systematically searching scientific article databases. The keywords used were the following, as well as corresponding search words in French: gambling/gaming/lottery/casino/betting/poker/wager/pari-mutuel/online gambling AND substitution/cannibalisation/displacement/complementary.

We searched the following databases:

- EBSCOhost
- ProQuest
- Scopus
- Web of Science
- Google Scholar
- Cairn.info (for French-language references)

In addition, we searched Google for possible grey literature and reports, and we used a snowballing method by browsing the lists of references of all articles that we had found for possible additional papers.

Only articles that were consistent with our inclusion criteria were selected in this review. These criteria were as follows: (1) The article presented original empirical evidence on the topic of substitution between gambling industries. Previous reviews and articles that were hypothetical or theoretical were excluded from this review. (2) The article had to focus on inter-industry cannibalization between gambling types, not on substitution between gambling and other industries. This form of cannibalization will be analysed separately in another (forthcoming) paper. (3) The article had to be published between 1978 and 2017. Other researchers have noted that the bulk of research on the economic and social impacts of gambling dates back only to the 1990s (Walker & Sobel, 2016), but we hypothesized that the introduction of casinos in Atlantic City in 1978 may have drawn interest to the subject matter, at least in the United States. (4) The article had to be in English or French because of our linguistic limitations. Most references found were in English, and only two original empirical articles were found in French. (5) We had to be able to find the original text of the article for proper analysis. In particular, some studies from the 1980s and early 1990s were not available through our institutional channels or were out of print.

The final sample consisted of 61 articles, of which we were unable to locate the original research text of three, bringing the final sample to 58 articles. Of these, 20 studies considered two or more types of substitution between different types of gambling. The results of some studies were therefore included under several types of cannibalization analysed for this review, bringing the total number of observations to 102.

Table 1 details the frequencies of observations on different types of intra-industry substitution considered in this review.

We noted the following information about each paper: reference, gambling type analysed (the impact of gambling X on gambling Y), research context, research data, results, and quality of the study. The quality of each study was assessed from four metrics: First, we considered the quality of the statistical analysis, including whether the study considered other variables, conducted statistically robust checking,

Table 1
Frequencies of Study Observations Describing Types of Intra-Industry Cannibalization

Type of gambling	Casinos	Lotteries	Pari-mutuel/ racing	EGMs	Sports betting	Online gambling	Bingo
Casinos	11	2	1	2	0	3	0
Lotteries	8	19	4	1	0	2	1
Pari-mutuel/racing	6	10	7	5	0	1	0
EGMs	5	0	3	1	0	1	0
Sports betting	1	4	0	0	0	0	0
Online gambling	1	1	0	0	0	0	0
Bingo	0	2	0	0	0	1	0

Note. EGM = electronic gaming machine.

or controlled for bias. Second, we checked whether the study was longitudinal as opposed to cross-sectional, preference being given to longitudinal studies. Third, we looked at whether the study included comparative observations from locations with no change as opposed to a simple before/after analysis in one research context. Preference was given to comparative studies, rather than before/after models that cannot account for the counterfactual. Fourth, we considered generalizability, meaning whether the study included many states or countries, or focused on one location only. Preference here was given to studies with more locations that allowed wider generalizability of the results. The quality of the studies reviewed was given a score out of 4 points in the analysis.

In the following sections, the results of this review are presented, with more weight given to studies that were ranked as the best quality. We did not conduct a meta-analysis on the actual levels at which cannibalization takes place. Rather, we focused on the issue of whether studies found a substitution or not. This is because studies have used widely varying statistical methods that are not possible to compare within the scope of this review, although such a task would be of importance in future studies on the topic.

Results

The bulk of studies that considered intra-gambling industry cannibalization were conducted in the United States, but some evidence was also available from other contexts. Results were inconclusive and diverse, suggesting that the substitutionary effects between gambling products depend on the type of gambling and the socio-cultural and economic environment in which they are introduced (see Paton & Vaughan Williams, 2013).

Table 2 summarizes the available evidence on intra-gambling industry cannibalization. In most cases, gambling industries seemed to cannibalize each other and even themselves, but this does not mean that money simply transferred from one gambling sector to another. The gambling sector also has the potential to grow, and even though different types of gambling may cannibalize each other, the aggregate revenue of the industry and the aggregate tax revenue to governments can still grow.

Casinos

Market relationships between casinos and other types of gambling are relatively well researched, and there is plenty of evidence for possible intra-product and inter-product substitution. However, all existing evidence found for this review comes from the United States or Canada, and more studies are needed in other contexts. Table 3 summarizes the findings related to the impacts of casinos on other gambling services that were considered for this review.

Impact of casinos on casinos. The impact of new casinos on existing casino gambling is one of the best researched types of intra-industry cannibalization in

Table 2

Summary of Relationships Between Gambling Sectors Based on Previous Research

Gambling game	Casinos	Lottery	Pari-mutuel/ racing	EGMs	Sports betting	Online gambling	Bingo
Casinos	-	-	+ *	+	Unknown	+	Unknown
Lottery	--	-	+/-	-*	Unknown	+/-	+ *
Pari-mutuel/racing	--	-	+/-	--	Unknown	+/-*	Unknown
EGMs	-	Unknown	+	--*	Unknown	+ *	Unknown
Sports betting	--*	---	Unknown	Unknown	Unknown	Unknown	Unknown
Online gambling	+ *	+/-*	Unknown	Unknown	Unknown	Unknown	Unknown
Bingo	Unknown	+ *	Unknown	Unknown	Unknown	+ *	Unknown

Note. EGM = electronic gaming machine;
 - cannibalization;
 -- significant cannibalization;
 --- very significant cannibalization;
 + complementary relationship;
 +/- evidence inconclusive or both cannibalization and complementary;
 * limited evidence.

gambling markets, although evidence comes only from the United States and might therefore not apply to other country contexts.

Seven of these 10 studies found that casinos substitute for other casinos, measured notably as decreases in gross gambling revenue (GGR), patronage, and admissions (Eadington, Wells, & Gossi, 2010; Gallagher, 2014; McGowan, 2009; Nichols, 1998; Shonkwiler, 1993; Thalheimer & Ali, 2003; Walker & Jackson, 2008; Walker & Nesbit, 2014). Three studies found either a complementary relationship or no impact (Geisler & Nichols, 2016; Hunsaker, 2001; Walker & Jackson, 2008). These contradictory results can be partly explained by the study method used. The two studies that found a complementary effect examined the impacts of casino development from a nationwide perspective, whereas the studies that reported market substitution focused on local-level markets. The results indicate that cannibalization occurs at the local level but substitution is only partial. Thus, as aggregate casino markets grow, there may be a complementary relationship at the nationwide level.

This analysis is in line with the results of a study conducted by Gallagher (2014), who showed that two processes of cannibalization in fact take place in situations where two casinos compete against one another: First, a patronage effect occurs when a competing casino influences the patronage levels of another casino, and second, a spending effect occurs when a competing casino influences the levels of spending at another casino. Gallagher (2014) found that new casinos tend to cannibalize existing casinos primarily through the patronage effect, but within a 25-mile (40-kilometre) radius. The spending effect was less significant. This finding indicates that although cannibalization takes place, overall spending on casino gambling rises following the introduction of new opportunities. Evidence would therefore suggest that market

Table 3
Substitution Impacts of Casinos on Other Gambling Products

Product impact	Study	Context and data years	Result	Quality
Casinos on casinos	Eadington, Wells, & Gossi (2010)	USA (California and Nevada), 1994–2009	Cannibalization: 10% increase at a California casino decreases GGR in Reno area by 2.3%	2/4
Casinos on casinos	Gallagher (2014)	USA (Illinois), 1994–2006	Cannibalization: No loss of revenue but loss of patronage in 25-mile area	3/4
Casinos on casinos	Geisler & Nichols (2016)	USA (Riverboat states), 1984–2009	No impact found from casino from a neighbouring county	3/4
Casinos on casinos	Hunsaker (2001)	USA (Riverboat states, Atlantic City, and Las Vegas), 1978–1998	Complementary: 1 million USD increase in riverboat GGR corresponds to 0.61 million USD increase in Las Vegas GGR. No impact on Atlantic City GGR	3/4
Casinos on casinos	McGowan (2009)	USA (Pennsylvania and New Jersey), 2000–2007	Cannibalization: Decrease of 5.7% in New Jersey GGR after the introduction of a casino in Pennsylvania	2/4
Casinos on casinos	Nichols (1998)	USA (Iowa and Illinois), 1991–1996	Cannibalization: Introduction of riverboat gambling in Iowa decreased GGR and admissions in Illinois. An estimated 30% of GGR and 41% of admissions in Iowa substitution for Illinois	2/4
Casinos on casinos	Shonkwiler (1993)	USA (Las Vegas and Atlantic City), 1969–1991	Cannibalization: Atlantic City had reduced Las Vegas GGR by 10–12% by 1985	2/4
Casinos on casinos	Thalheimer & Ali (2003)	USA (Illinois, Iowa, and Missouri), 1991–1998	Cannibalization: EGM gambling at a subject casino decreases with competition from other casinos in the area	4
Casinos on casinos	Walker & Jackson (2008)	USA, 1985–2000	Complementary: Indian casinos increase GGR of other casinos	3/4
Casinos on casinos	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Cross-state casinos decrease casino GGR	3/4
Casinos on casinos	Walker & Nesbit (2014)	USA (Missouri), 1997–2010	Cannibalization: 10% increase in EGMs in other casinos decreases casino GGR by 5.7%. 10% increase in table games in other casinos increases casino GGR by 1.7%	2/4

Table 3 Continued.

Product impact	Study	Context and data years	Result	Quality
Casinos on lotteries	Cummings, Walker, & Coffi (2017)	USA (Maryland), 1990–2014	Cannibalization: Estimated impact of casinos on all lottery GGR of -103 million dollars. Aggregate lottery sales decline more near casinos	3/4
Casinos on lotteries	Economopoulos & Stolle (2012)	USA (Pennsylvania), 2004–2010	Cannibalization: State lottery GGR reduced by 5–10 cents for each dollar gained in casino GGR	4
Casinos on lotteries	Elliott & Navin (2002)	USA, 1989–1995	Cannibalization: 1 USD spent on casinos declines lottery spending by 1.38 USD. Corresponds to a loss of 0.83 USD in state revenue	2/4
Casinos on lotteries	Fink & Rork (2003)	USA, 1988–2000	Cannibalization: 1 USD increase in state casino tax revenue reduces net lottery proceeds by \$0.56	3/4
Casinos on lotteries	Room, Turner, & Ialomiteanu (1999)	Canada (Ontario), 1995/1996, 1997	Cannibalization: Spending on lotteries and instant lotteries decreased after the opening of Niagara Falls casinos	2/4
Casinos on lotteries	Siegel & Anders (2001)	USA (Arizona), 1993–1998	Cannibalization: 10% increase in number of EGMs at Indian casinos is associated with declines of 2.8% for lottery games and 3.7% for lotto	2/4
Casinos on lotteries	Steinnes (1998)	USA (Minnesota), 1988–1993	Cannibalization: Introduction of Indian casinos reduced lottery revenue by less than 2%	3/4
Casinos on lotteries	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Decreases in casino revenue increase lottery revenue	3/4
Casinos on pari-mutuel/racing	Ali & Thalheimer (1997)	USA (New Jersey), 1960–1988	Cannibalization: Introduction of casinos decreased pari-mutuel wagering by 32%	2/4
Casinos on pari-mutuel/racing	Prybylski, Felsenstein, Freeman, & Littlepage (1998)	USA (Indiana) and Israel, 1997	No impact found in Indiana; analysis on Israel was not based on empirical data and was not considered in this review	1/4
Casinos on pari-mutuel/racing	Siegel & Anders (2001)	USA (Arizona), 1993–1998	No impact found	2/4
Casinos on pari-mutuel/racing	Ray (2001)	USA (Greyhound racing states), 1991–1998	Cannibalization: Presence of casino significantly reduces greyhound handle	3/4
Casinos on pari-mutuel/racing	Thalheimer (2012)	USA (Iowa), 1993–2006	Cannibalization: Pari-mutuel wagering fell by 16% after the introduction of table games at the racino	2/4

Table 3 Continued.

Product impact	Study	Context and data years	Result	Quality
Casinos on pari-mutuel/racing	Walker & Jackson (2008)	USA, 1985–2000	Complementary: Increases in casino GGR connected to increases in horse racing GGR	3/4
Casinos on pari-mutuel/racing	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Decrease in casino GGR increases dog racing GGR	3/4
Casinos on EGMs	Marfels (1997)	USA and Canada (South Dakota, Manitoba, and Nova Scotia), 1990–1996	No impact: Introduction of casinos did not cause long-term drop in VLT revenue in any context	3/4
Casinos on EGMs	Room, Turner, & Ialomiteanu (1999)	Canada (Ontario), 1995/1996, 1997	Cannibalization: No impact on GGR, but frequency of gambling on VLTs decreased when visits to casino increased	2/4
Casinos on EGMs	Thalheimer (2012)	USA (Iowa), 1993–2006	Cannibalization: EGM wagering fell 8% after the introduction of table games	2/4
Casinos on EGMs	Thalheimer & Ali (2003)	USA (Illinois, Iowa, and Missouri), 1991–1998	Cannibalization: EGM revenue was 13% lower at casinos that had table games than at racinos with no table Fgames	4
Casinos on EGMs	Thalheimer & Ali (2008)	USA (Illinois, Iowa, and Missouri), 1991–1998	Cannibalization: EGM wagering fell by 11.5% in the presence of 40 table games (average in the sample)	2/4
Casinos on sports betting	Room, Turner, & Ialomiteanu (1999)	Canada (Ontario), 1995/1996, 1997	Cannibalization: Decreases in GGR and frequency of sports betting after the opening of Niagara Falls casino	2/4
Casinos on online gambling	Philander & Fiedler (2012)	USA and Canada, 2010	Complementary: 1 million USD in casino GGR corresponds to an increase of 2,700 USD in online GGR	3/4

Note. EGM = electronic gaming machine; GGR = gross gambling revenue; VLT = video lottery terminal.

cannibalization between casinos occurs, but that it is only partial and mainly focused on the local level.

Impact of casinos on lotteries. The impact of casinos on lotteries can be of interest to national and state governments from a revenue perspective. A substitution for state lotteries has the potential to impact on state tax revenue if the declining and increasing forms of gambling are taxed at different levels. The evidence is conclusive, as studies on this topic have found that the introduction of casinos cannibalizes lottery revenue.

All eight studies found cannibalization of lottery products from casinos (Cummings, Walker, & Cotti, 2017; Economopoulos & Stolle, 2012; Elliott & Navin, 2002; Fink & Rork, 2003; Room, Turner & Ialomiteanu, 1999; Siegel & Anders, 2001; Steinnes, 1998; Walker & Jackson, 2008), but the estimated degree of this substitution varied. The highest figure was obtained by Elliott and Navin (2002), who found that the introduction of a casino corresponded to an 83-cent decline in state lottery revenues for each dollar played. The results of this study were later questioned by Fink and Rork (2003), whose calculations, based on a revised methodology, showed only a 56-cent decline in lottery revenue for each dollar increase in casino tax. More conservative estimations have landed at around a 5–10% decline (Economopoulos & Stolle, 2012; Walker & Jackson, 2008). Economopoulos and Stolle (2012) found that cannibalization of lottery revenues is mainly local, as half of this substitution takes place in counties in which a casino is located. A recent study by Cummings et al. (2017) noted that aggregate lottery sales decline when they occur closer to casinos. In this study, the impact was strongest on lotteries played on monitors, which resemble EGM play. It appears that the cannibalization of lotteries by casinos has an impact, particularly on state finances, because of the lower taxation of casinos, but the situation may be attenuated by the fact that the substitution is only partial, and aggregate gambling markets grow with new gambling opportunities.

Impact of casinos on pari-mutuel or race betting. Pari-mutuel betting has been declining in many Western contexts for a long time. Some authors have attributed this decline to the cannibalizing effects of the expansion of casino gambling and state lotteries since the 1980s (e.g., Thalheimer, 1998), and the available evidence seems to support this view.

We found seven studies that dealt directly with the issue of casinos cannibalizing horse racing and one study that dealt with the impacts of introducing casino games at the race tracks to create racinos (race tracks with casino games), four of which found substitution (Ali & Thalheimer, 1997; Ray, 2001; Thalheimer, 2012; Walker & Jackson, 2008). Evidence from New Jersey (Ali & Thalheimer, 1997) estimated that the level of cannibalization is about 32%, and a study on racinos (Thalheimer, 2012) estimated that pari-mutuel wagering fell by 16% after the introduction of casino table games at the venue. Two studies found no impact (Prybylski, Felsenstein, Freeman, & Littlepage, 1998; Siegel & Anders, 2001), but the study by Prybylski et al. (1998) concluded that there was no impact because the pari-mutuel industry financially benefits from riverboat casinos, not because casinos would not substitute for

parimutuel markets. One study (Walker & Jackson, 2008) found a complementary relationship between casinos and horse racing but a negative relationship between casinos and greyhound racing.

It is likely that the decline of the racing industry cannot solely be attributed to cannibalization from casinos, but there appears to be an impact. From the available evidence, casinos seem to cannibalize the racing industries to some extent.

Impact of casinos on EGMs. Five studies considered the impacts of casinos on EGMs. We have included both non-casino EGMs and EGMs at the same venue as table games in this category.

Two of these studies focused on the impacts of casinos on video lottery terminals (VLTs, a type of non-casino EGM that resembles lotteries; Marfels, 1997; Room et al., 1999). The results appear contradictory: The study by Marfels (1997) found no impact, whereas Room et al. (1999) reported a relationship of substitution. However, according to Gallagher (2014), it is possible that cannibalization takes place through the patronage effect rather than through the spending effect. The study by Marfels (1997) considered only the spending effect, whereas that by Room et al. (1999) considered both effects and found that although there was no impact on GGR, the frequency of gambling on VLTs decreased. This result indicates that casinos cannibalize non-casino EGM gambling, but not revenue.

The three remaining studies considered the impact of EGMs on table games at the same venue (Thalheimer, 2012; Thalheimer & Ali, 2003, 2008). These studies found substitution in EGM revenue and wagering of about 10% following the introduction of or in the presence of table games. This evidence shows that other casino games partly cannibalize EGM gambling.

Impact of casinos on sports betting. Only one study considered the impact of casinos on sports betting. The results of the study by Room et al. (1999) indicated that casinos cannibalize both the GGR and the frequency of sports betting. Although this is a high-quality study, the finding was linked to only one location, and more studies are needed to confirm the result.

Impact of casinos on online gambling. The rise of online gambling is a relatively recent development in gambling markets, and there have not been many studies on its impact on the established gambling market, let alone the impact of land-based gambling on online forms of gambling. One study nevertheless considered the impact of land-based casinos on online gambling. The findings of this study by Philander and Fiedler (2012) suggest a small complementary relationship based on GGRs. More research is, however, needed to confirm the result.

Lotteries

Lotteries have received the most research attention of all the categories of gambling considered in this review. Most studies again come from the United States,

but evidence is also available from other country contexts, particularly the United Kingdom. This is probably not a coincidence, because the expansion of state lotteries in the United States in the 1980s (first introduced in the state of New Hampshire in 1964) and in the United Kingdom in 1994 sparked interest in how they would impact on other gambling industries. The studies focusing on the impact of lotteries on other forms of gambling are detailed in Table 4.

Impact of lotteries on casinos. Surprisingly little evidence is available on the impact of lotteries on casinos, with only two studies dealing directly with the question. Both studies were also conducted in the United States, leaving room for more analysis, particularly in other contexts. Results were nevertheless convincing. We have already noted that casinos appear to cannibalize lotteries, but the relationship seems to go both ways. Both studies (Shonkwiler, 1993; Walker & Jackson, 2008) found that state lotteries have a negative impact on casino revenues, although substitution is relatively small. This result suggests that although state lotteries may slightly cannibalize casino revenue, their introduction also significantly increases total GGR.

Impact of lotteries on lotteries. The impact of new lottery products, either cross-border or in the same jurisdiction, on existing lotteries has been the most widely researched type of cannibalization reported in the literature.

Of the 19 study observations analysed, 13 indicated substitution (Brown & Rork, 2005; Farrell & Forrest, 2008; Fink & Rork, 2003; Forrest, Gulley, & Simmons, 2004; Garrett & Marsh, 2002; Grote & Matheson, 2006; Mikesell & Zorn, 1987; Roger & Chabi, 2009; Stover, 1990; Tosun & Skidmore, 2004; Walker & Jackson, 2008), two found a complementary relationship (Forrest & McHale, 2007; Purfield & Waldron, 1999), and four found no impact (Farrell & Forrest, 2008; Forrest et al., 2004; Gulley & Scott, 1993; Lin & Lai, 2006). This result indicates that intra-product cannibalization (Srinivasan et al., 2005) is common in the lottery markets. However, the deconstruction of these results shows that certain types of lotteries may be more prone to cannibalization than others.

Three different types of substitution processes can take place between lottery products. First, cross-state lotteries can potentially cannibalize contiguous state lotteries. Six of the studies considered in this review had studied this type of substitution, and all of them found that cross-state lotteries substitute for state lotteries. Reasons for cross-border lottery purchases included lower prices of tickets, better jackpots, and convenience (Garrett & Marsh, 2002), but the introduction of new cross-state lotteries can also have a negative impact if a state or country loses its tourist players (Fink & Rork, 2003). There appears to be less substitution when the same products are available on both sides of the border.

Second, multistate or multinational lotteries may impact on national or state lotteries. Here the evidence is more contradictory, with some studies showing substitution and others claiming a complementary relationship. For example, the European

Table 4
Substitution Impacts of Lotteries on Other Gambling Products

Product impact	Study	Context and data years	Result	Quality
Lotteries on casinos	Shonkwiler (1993)	USA (Atlantic City, Nevada, and California), 1969–1991	The introduction of California state lottery impacted Nevada casino proceeds by -3%	2/4
Lotteries on casinos	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Decreases in lottery revenue increase casino revenue	3/4
Lotteries on lotteries	Brown & Rork (2005)	USA, 1967–2000	Cannibalization: A 10% increase in payout rates in neighbouring states forces states to increase payout rates by 4%	3/4
Lotteries on lotteries	Farrell & Forrest (2008)	Australia, 1982–2002	Cannibalization: Other lotteries significantly reduce lottery GGR	3/4
Lotteries on lotteries	Farrell & Forrest (2008)	Australia, 1982–2002	No impact	4
Lotteries on lotteries	Farrell & Forrest (2008)	Australia, 1982–2002	Cannibalization: Keno sales impact lottery sale turnover negatively	4
Lotteries on lotteries	Fink & Rork (2003)	USA, 1988–2000	Cannibalization: Cross-state lotteries have a negative impact on state lotteries	3/4
Lotteries on lotteries	Forrest, Gullely, & Simmons (2004)	UK, 1997–2000	Cannibalization: A 10% increase in Thunderball lottery sales is associated with 0.025% decrease in lotto sales. No impact the other way around	3/4
Lotteries on lotteries	Forrest, Gullely, & Simmons (2004)	UK, 1997–2000	No impact: Increases in sales of Thunderball lottery game showed no impact on scratch-card sales	2/4
Lotteries on lotteries	Forrest, Gullely, & Simmons (2004)	UK, 1997–2000	Cannibalization: 10% increase in scratch-card sales is associated with a 1.07% decrease in National Lottery sales. No impact on Thunderball lottery sales	2/4
Lotteries on lotteries	Forrest & McHale (2007)	UK, 1999–2007	Complementary: Multistate Euromillions lottery is associated with 5.45% increase in National Lottery sales	2/4
Lotteries on lotteries	Garrett & Marsh (2002)	USA (Kansas area), 1998	Cannibalization: Cross-state lotteries have a -10 million USD negative impact on Kansas lottery	3/4
Lotteries on lotteries	Grote & Matheson (2006)	USA (Colorado, New Jersey, and Ohio), 1990–2004	Cannibalization: State lottery sales fell by 50% after a multistate lottery was introduced	3/4

Table 4 Continued.

Product impact	Study	Context and data years	Result	Quality
Lotteries on lotteries	Gulley & Scott (1993)	USA (Kentucky, Ohio, and Massachusetts), 1990–1991; 1987–1990 and 1984–1990; 1989–1990	No impact found	2/4
Lotteries on lotteries	Lin & Lai (2006)	Taiwan, 2004	No impact found	2/4
Lotteries on lotteries	Mikesell & Zorn (1987)	USA, 1983–1985	Cannibalization: New games come at the expense of existing ones	3/4
Lotteries on lotteries	Purfield & Waldron (1999)	Ireland, 1993–1994	Complementary: Larger lotto sales associated with larger sales in Lucky Numbers game	2/4
Lotteries on lotteries	Roger & Chabi (2009)	France, 2002–2008	Cannibalization: Multistate Euromillions game substituted for sales in the National Lottery	2/4
Lotteries on lotteries	Stover (1990)	USA, 1984–1985	Cannibalization: Contiguous state lotteries are substitutes	2/4
Lotteries on lotteries	Tosun & Skidmore (2004)	USA (West Virginia), 1987–2000	Cannibalization: Cross-state lotteries and new games in state substitute for existing lottery sales	2/4
Lotteries on lotteries	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Cross-state lotteries substitute for state lotteries	3/4
Lotteries on pari-mutuel/racing	Forrest, Gulley, & Simmons (2010)	UK, 1996–2001	No impact	2/4
Lotteries on pari-mutuel/racing	Gulley & Scott (1989)	USA, 1976–1980	Cannibalization: An additional 1 USD spent on the lottery decreases pari-mutuel spending by 0.18 USD	2/4
Lotteries on pari-mutuel/racing	Kaplan (1990)	USA and Canada, previous research	No impact: Decline of pari-mutuel industry is not associated with the lottery but with other factors	0/4
Lotteries on pari-mutuel/racing	Mobilla (1992)	USA, 1950–1987	Cannibalization: Lotteries negatively impact attendance at tracks but no significant impact on real handle per attendee	3/4
Lotteries on pari-mutuel/racing	Miers (1996)	UK, 1995	Cannibalization: Horse racing companies report losses since the introduction of the National Lottery	0/4
Lotteries on pari-mutuel/racing	Simmons & Sharp (1987)	USA, 1982	Cannibalization: Lotteries decrease horse racing handle by 10%	3/4

Table 4 Continued.

Product impact	Study	Context and data years	Result	Quality
Lotteries on pari-mutuel/racing	Thalheimer & Ali (1995c)	USA (Kentucky), 1986–1990	Cannibalization: The introduction of a state lottery negatively impacted the handle of race tracks	2/4
Lotteries on pari-mutuel/racing	Thalheimer & Ali (1995a)	USA (A multistate market area), 1960–1987	Cannibalization: The introduction of state lotteries is associated with significant losses in attendance and handle at race tracks	2/4
Lotteries on pari-mutuel/racing	Vasche (1990)	USA (California), 1970–1989	Cannibalization: Additional 1 USD spent on lottery is associated with a decline of 0.26 USD in pari-mutuel wagering	3/4
Lotteries on pari-mutuel/racing	Walker & Jackson (2008)	USA, 1985–2000	Complementary: Increases in lottery revenue increase horse racing revenue	3/4
Lotteries on pari-mutuel/racing	Walker & Jackson (2008)	USA, 1985–2000	Complementary: Increases in lottery revenue increase dog racing revenue	3/4
Lotteries on sports betting	Forrest (1999)	UK, 1993–1997	Cannibalization: Three years after the introduction of the National Lottery, football pool sales had declined by 60%	1/4
Lotteries on sports betting	Forrest & Perez (2011)	Spain, 1970–2007	Cannibalization: Cumulative impact of the introduction of two lottery draws on football pool sales was 86.6%	2/4
Lotteries on sports betting	Miers (1996)	UK, 1995	Cannibalization: Initial impact but ensuing relaxations on football pool regulations made it very small	0/4
Lotteries on sports betting	Forrest, Gulley, & Simmons (2010)	UK, 1996–2001	Cannibalization: National Lottery associated with significant substitution for soccer betting when there is a good draw	2/4
Lotteries on online gambling	Philander & Fiedler (2012)	USA and Canada, 2010	No impact	3/4
Lotteries on bingo	Miers (1996)	UK, 1995	Complementary: Introduction of lottery had a positive impact on bingo	0/4

Note. GGR = gross gambling revenue.

multinational Euromillions lottery was found to be complementary to the National Lottery in the United Kingdom (Forrest & McHale, 2007), but substitutionary for the National Lottery in France (Roger & Chabi, 2009). Grote and Matheson (2006) suggested that multistate lotteries cannibalize some of the sales from state lotteries, but that the overall benefit for lottery companies is positive.

Third, a lottery provider's own product range may include several types of lotteries, including instant lotteries, that may substitute sales for each other. Evidence regarding this type of substitution is inconclusive. It is likely that some level of cannibalization of older games by new games takes place, but only to a degree that is acceptable to the organization. This type of substitution is even necessary to keep up consumer interest in the product range (Mikesell & Zorn, 1987). It is possible that only certain types of lottery games substitute for others. For example, the comprehensive Australian study by Farrell and Forrest (2008) found that although other lotteries and a Keno game substituted for national lotteries, scratch cards did not. Similarly, Forrest et al. (2004) found that although scratch cards substituted for the National Lottery, they did not cannibalize the Thunderball lottery game. Hence, lottery providers design their product range carefully to maintain acceptable levels of substitution, while increasing overall sales and maximizing related tax revenue (see also Grote & Matheson, 2013; Gulley & Scott, 1993).

Impact of lotteries on pari-mutuel or race betting. The impact of lotteries on pari-mutuel or race betting is another well-documented type of substitution in previous research, with evidence available from the United States, the United Kingdom, and Canada.

As was the case with studies on the substitutionary impacts of casinos on pari-mutuel and race betting, lotteries have also been argued to be partially responsible for the decline of racing industries (Thalheimer, 1998). The available evidence seems to support this suggestion, as most studies have found that lotteries cannibalize pari-mutuel and racing wagers both by a patronage effect and by a spending effect (Gulley & Scott, 1989; Miers, 1996; Mobilla, 1992; Simmons & Sharp, 1987; Thalheimer & Ali, 1995a, 1995b; Vasche, 1990). Studies have reported losses in pari-mutuel GGR of around 10–20% following the introduction of lotteries (Gulley & Scott, 1989; Simmons & Sharp, 1987; Vasche, 1990), but despite this substitution, net state revenue is positive (Vasche, 1990).

Other studies have nevertheless found a complementary relationship or no impact (Forrest, Gulley, & Simmons, 2010; Kaplan, 1990; Walker & Jackson, 2008). It is therefore possible that there are direct local-level cannibalization effects between lotteries and the racing industry, but that at a national level, the rise of lotteries may not have more than a coincidental impact on the racing industry. The studies that have found no impact have tended to be those that analysed larger nationwide data sets. Kaplan (1990) suggested that the difficulties of the pari-mutuel industry are not a result of cannibalization, but of difficulties inherent in pari-mutuel betting itself and its governmental regulation. However, more research is needed to establish whether this is the case.

Impact of lotteries on sports betting. The impact of lotteries on sports betting has been studied in Europe, where attention has been paid to the substitution of a traditional form of gambling known as football pools. Football pools are a type of sports betting that flourished in Europe from around the 1940s to the 1980s, with little competition from other forms of gambling (Forrest, 1999). Higher quality studies (Forrest, 1999; Forrest & Perez, 2011) indicate that lotteries almost completely cannibalized football pools, whereas one lower quality study (Miers, 1996) found a smaller level of cannibalization. One study (Forrest et al., 2010) also considered the impact of lotteries on other sports betting and found a significant substitution. We therefore conclude that lotteries appear to cannibalize sports betting.

Impact of lotteries on online gambling. One study considered the impact of lotteries on online gambling, more specifically on online poker. The study, by Philander and Fiedler (2012), found no relationship between these two types of gambling. This is probably not surprising, as population surveys have shown that players of lottery and online poker tend to have different socio-demographic characteristics and therefore represent different population segments (e.g., Costes, Eroukmanoff, Richard, & Tovar, 2015; Wardle, Moody, Griffiths, Orford, & Volberg, 2011). However, more research is needed to establish this link.

Impact of lotteries on bingo. Finally, one study considered whether lotteries have a substitutionary impact on bingo (Miers, 1996). It found a complementary relationship, but the quality of the evidence was not ranked as high, and therefore these results should be interpreted with caution. There is a need for more research to verify the validity of this outcome.

Pari-Mutuel or Race Betting

The impact of pari-mutuel or race betting on other gambling industries has been less studied than have the impacts of other types of gambling on this form of wagering. This is not surprising, as pari-mutuel and race betting have been a declining form of gambling for some time, whereas new gambling opportunities, such as casinos, lotteries, and online games have been increasing. The decline of the racing industry appears to be a particular worry in the United States, where all the research evidence for this review originated. The studies on the impacts of the racing and pari-mutuel industries on other types of gambling are detailed in Table 5.

Impact of pari-mutuel or race betting on casinos. Although the impact of casinos on pari-mutuel betting has been extensively studied, we found only one study that investigated the relationship in the opposite direction. Walker and Jackson (2008) found a complementary relationship, with horse racing increasing casino revenues, indicating an opposite relationship to the case of the negative impact of casinos on the horse racing industry, as discussed earlier. The result may also be due to the growth of racino markets in the United States at the time of the study. Although this is a high-quality study, more research is needed to confirm the result.

Table 5
Substitution Impacts of *Pari-Mutuel/Race Betting on Other Gambling Products*

Product impact	Study	Context and data years	Result	Quality
Pari-mutuel/racing on casinos	Walker & Jackson (2008)	USA, 1985–2000	Complementary: Horse racing increases casino GGR	3/4
Pari-mutuel/racing on lotteries	Elliott & Navin (2002)	USA, 1989–1995	Cannibalization: Pari-mutuel completely substitutes for lotteries and causes losses for states. 1 USD of state revenue from pari-mutuel betting decreases lottery revenue by 2.55 USD	2/4
Pari-mutuel/racing on lotteries	Garrett & Marsh (2002)	USA (Kansas area), 1988	No impact	3/4
Pari-mutuel/racing on lotteries	Davis, Filer, & Moak (1992)	USA, 1982–1991	Cannibalization: Expected per capita lottery revenues are 29% lower in states with pari-mutuel	4
Pari-mutuel/racing on lotteries	Siegel & Anders (2001)	USA (Arizona), 1993–1998	No impact	2/4
Pari-mutuel/racing on lotteries	Walker & Jackson (2008)	USA, 1985–2000	Complementary: Increases in dog or horse racing increase lottery revenue	3/4
Pari-mutuel/racing on pari-mutuel/racing	Ray (2001)	USA, 1991–1998	Cannibalization: Availability of horse racing significantly reduces greyhound racing handle	3/4
Pari-mutuel/racing on pari-mutuel/racing	Thalheimer & Ali (1992)	USA (Kentucky), 1970–1988	Cannibalization: Introduction of telephone betting reduced betting at tracks by 22%	2/4
Pari-mutuel/racing on pari-mutuel/racing	Thalheimer & Ali (1992)	USA (Kentucky), 1970–1988	Cannibalization: Competition from other tracks resulted in a 16% decrease in race track handle	2/4
Pari-mutuel/racing on pari-mutuel/racing	Thalheimer & Ali (1995b)	USA (New Jersey and Kentucky), 1971–1987	Inconclusive: Exotic (multi-horse) wagers decline straight (one-horse) wagers, but increase overall GGR if exotic wagers are on two horses. Overall GGR declines with three- or four-horse exotic wagers	2/4
Pari-mutuel/racing on pari-mutuel/racing	Thalheimer & Ali (1995c)	USA (Kentucky), 1986–1990	Complementary: Inter-track betting increased total handle of race tracks, but betting at tracks did not decline significantly	2/4
Pari-mutuel/racing on pari-mutuel/racing	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Decreases in horse racing revenue increase greyhound racing revenue	3/4

Table 5 Continued.

Product impact	Study	Context and data years	Result	Quality
Pari-mutuel/racing on pari-mutuel/racing	Walker & Jackson (2008)	USA, 1985–2000	Cannibalization: Decreases in greyhound racing revenue increase horse racing revenue	3/4
Pari-mutuel/racing on EGMs	Thalheimer (1998)	USA (West Virginia), 1989–1991	Complementary: Presence of pari-mutuel racing increases EGM gambling	2/4
Pari-mutuel/racing on EGMs	Thalheimer (2008)	USA (West Virginia), 1994–2002	Complementary: Presence of pari-mutuel racing increases EGM gambling	2/4
Pari-mutuel/racing on EGMs	Thalheimer (2012)	USA (Iowa), 1993–2006	Complementary: EGM gambling increased by 13% in the presence of live horse racing and 14% in the presence of simulcast horse racing	2/4
Pari-mutuel/racing on EGMs	Thalheimer & Ali (2003)	USA (Illinois, Iowa, and Missouri), 1991–1998	Cannibalization: Access to pari-mutuel betting has a statistically insignificant negative impact on EGM revenue	4

Note. EGM = electronic gaming machine; GGR = gross gambling revenue.

Impact of pari-mutuel or race betting on casinos. We found five studies that focused on whether pari-mutuel or race betting substitutes for lottery revenue. Results were contradictory, with some research studies reporting that the relationship is insignificant (Garrett & Marsh, 2002; Siegel & Anders, 2001) or complementary (Walker & Jackson, 2008) and others finding that the presence of pari-mutuel betting in a state diminishes the profitability of the lottery (Davis, Filer, & Moak, 1992; Elliott & Navin, 2002). The work by Elliott and Navin (2002) used cross-sectional time series dating from 1989 to 1995 to study the impacts that casinos and pari-mutuel betting have on state lottery revenue. Results suggested that pari-mutuel betting cannibalizes state lotteries so strongly that states may even suffer net revenue losses. As there is not much difference in the quality of these studies, we cannot reliably determine the impact of pari-mutuel or racing on lotteries from this evidence. In any case, states that have both lotteries and racetracks have been found to have a higher overall tax revenue (Gulley & Scott, 1989), suggesting that if there is substitution, it is only partial.

Impact of pari-mutuel or race betting on pari-mutuel or race betting. The pari-mutuel industry may also cannibalize itself. Inter-product (Srinivasan et al., 2005) cannibalization within the pari-mutuel or racing industries can take place through two different processes. First, different types of racing products or competition from other tracks may have an impact each other. Studies have found that horse racing and greyhound racing cannibalize each other (Ray, 2001; Walker & Jackson, 2008) and that competition from other tracks cannibalizes racing revenue (Thalheimer & Ali, 1992). The second process is related to new betting options. In the United States, the decline of pari-mutuel betting following competition from state lotteries and casinos has led legislators to allow the introduction of new wagering interfaces to draw in players. Evidence suggests that these new betting options, such as telephone betting and inter-track betting, can cannibalize older forms of betting, but tend to increase overall GGR (Thalheimer & Ali, 1992; 1995b, 1995c). We therefore conclude that inter-product relationships in the pari-mutuel industry can be both substitutionary and complementary depending on the type.

Impact of pari-mutuel or race betting on EGMs. The final type of impact that previous studies on pari-mutuel or race betting have researched is on EGMs. The four studies that we identified have notably focused on how the presence of pari-mutuel betting at racinos impacts on EGM gambling.

Like the new betting options described earlier, the introduction of EGMs at race tracks has been a way for tracks to boost visitation and revenue. Studies have been conclusive and evidence suggests that the presence of pari-mutuel racing, live or simulcast, increases EGM gambling (Thalheimer, 1998, 2008, 2012). One study (Thalheimer & Ali, 2003) found a negative impact on EGM revenue, but the relationship was statistically insignificant. We can therefore conclude that the impact of pari-mutuel or race betting on EGM gambling is complementary.

EGMs

This category includes the impacts of various types of non-casino EGMs or in-venue EGMs on other games in the same venue. Non-casino EGMs have been of particular interest outside the United States, more specifically in Australia and the United Kingdom, where EGM venues and convenience EGM gambling are common. In the United States, most research has examined the relationships between EGMs and other games at the same venues. Table 6 details the studies that were included in this section.

Impact of EGMs on casinos. We found only two studies that considered whether non-casino EGM gambling has an impact on casino GGR or whether in-casino EGMs have an impact on other casino games. Although results are preliminary, as both studies have a limited scope, there does not appear to be significant cannibalization.

In-casino EGMs substitute for other casino games (Levitzky, Assane, & Robinson, 2000), and this finding is in line with previous research showing that the importance of EGMs to casino revenue has steadily increased (see, e.g., Schüll, 2012; Young, Tyler, Lamb, & Stevens, 2008). Nevertheless, total casino GGR has risen despite this development, as casino corporations are careful to maintain their profits.

Marfels (1997) examined the relationship between casinos and VLTs in Canada and the United States and found no case in which casino revenue would have declined because of the introduction of VLTs. It would therefore appear that EGMs and casino gambling are complementary products.

Impact of EGMs on lotteries. Only one Australian study has considered the impacts of EGMs on lotteries. It found that EGMs are associated with a small negative impact on lottery GGR (Farrell & Forrest, 2008). The result seems reliable because although we were able to find only one study observation of this type of substitution, the result is in line with that reported by Siegel and Anders (2001), who found that the number of EGMs in casinos had a negative impact on lottery revenues.

Impact of EGMs on pari-mutuel or race betting. As racing tracks across the United States have become racinos, the impact of these new casino-type gambling opportunities on traditional race wagering has received some research attention.

All three studies on this topic found cannibalization (Thalheimer, 1998, 2008, 2012). According to this evidence, EGMs at race tracks reduced pari-mutuel betting by over 20% (Thalheimer, 1998, 2012), while the combined effects of various relaxations on EGM regulations at race tracks reduced the pari-mutuel handle by 49% (Thalheimer, 2008). However, despite these significant levels of substitution, the overall profits of race tracks increased, as the revenue from EGMs more than made up for any losses in race betting (Thalheimer, 1998, 2008).

Table 6
Substitution Impacts of EGMs on Other Gambling Products

Product impact	Study	Context and data years	Result	Quality
EGMs on casinos	Levitzky, Assane, & Robinson (2000)	USA (Nevada), 1988–1995	Cannibalization: EGMs are generating increasing amounts of casino GGR. The importance of table games is decreasing	2/4
EGMs on casinos	Marfels (1997)	USA and Canada (South Dakota, Nova Scotia, and Manitoba), 1990–1996	No impact in any context. Non-casino EGMs did not negatively impact on casino GGR	2/4
EGMs on lottery	Farrell & Forrest (2008)	Australia, 1982–2002	Cannibalization: EGMs associated with a small negative impact on lottery GGR	4
EGMs on pari-mutuel/racing	Thalheimer (1998)	USA (West Virginia), 1989–1991	Cannibalization: EGMs at race tracks reduced pari-mutuel betting	2/4
EGMs on pari-mutuel/racing	Thalheimer (2008)	USA (West Virginia), 1994–2002	Cannibalization: The combined effect of deregulations on the number, location, and maximum bet on EGMs at race tracks reduced pari-mutuel handle by 49%	2/4
EGMs on pari-mutuel/racing	Thalheimer (2012)	USA (Iowa), 1993–2006	Cannibalization: Pari-mutuel horse race wagering fell 21% after EGMs were introduced	2/4
EGMs on EGMs	Paton & Vaughan Williams (2013)	UK, 2001–2006	Cannibalization: FOBT machines directly substituted for older EGMs at betting shops, but no statistically significant substitution in other locations	4

Note. EGM = electronic gaming machines; GGR = gross gambling revenue; FOBT = fixed-odds betting terminal.

Impact of EGMs on EGMs. One study investigated the possible substitution of older types of EGMs with new EGM models. In this UK study, Paton and Vaughan Williams (2013) investigated whether the introduction of fixed-odds betting terminals (FOBTs), a type of EGM found more often in betting shops than in casinos, affected the number of traditional non-casino gambling machines. They found that overall FOBT-type gambling increased the available gambling offer and spending, but in the case of licensed betting offices, FOBTs directly substituted for older machines.

Sports Betting

No studies have investigated the impacts of sports betting on other forms of gambling, and this is an area in need of future research attention.

Online Gambling

Online environments have created new threats to existing land-based businesses. Online gambling is particular in comparison to the more traditional gambling markets, as online environments often merely offer a new medium in which to gamble by using existing games. Research evidence is limited for the time being, and all relationships between offline and online gambling are not yet known. Some land-based gambling providers, such as the Las Vegas Sands Corporation and its founder and chairman, have been opposed to all online gambling and have feared that it would directly compete with established offline venues. However, empirical evidence has been less conclusive, and other gambling operators have been more open towards the online gambling market. Table 7 details the available research evidence on the impacts of online gambling on other forms of gambling.

Impact of online gambling on casinos. Three studies have focused on whether online gambling cannibalizes land-based casino gambling.

In one study, Philander (2011) used data on online gambling volumes in the United States before the Unlawful Internet Gambling Enforcement Act of 2006 (UIGEA) was enforced. Results showed that online gambling was a gross substitute for offline casino gambling. The author further estimated that one dollar spent on online gambling cannibalizes around 27 to 30 cents of casino revenue. However, the author brings up concerns about the quality of the study in his paper, particularly the fact that it took place before the UIGEA. Two more recent studies (Philander, Abarbanel, & Repetti, 2015; Philander & Fiedler, 2012) instead found that participation in online and land-based casino gambling were complementary. The results of the study by Philander et al. (2015) were based on self-reported data from the British Gambling Prevalence Survey, which may not be completely reliable, but the Philander and Fiedler (2012) study is of high quality. We can therefore cautiously conclude that the relationship between online gambling and land-based casino gambling may be complementary, although more research is still needed.

Table 7
Substitution Impacts of Online Gambling on Other Gambling Products

Product impact	Study	Context and data years	Result	Quality
Online gambling on casinos	Philander (2011)	USA, 1999–2006	Cannibalization: Before UIGEA, 1 USD bet on online gambling reduced land-based casino GGR by 27 to 30 cents.	2/4
Online gambling on casinos	Philander, Abarbanel, & Repetti (2015)	UK, 2010	Complementary: Positive correlation of 0.088 between online gambling and land-based casino participation rates	1/4
Online gambling on casinos	Philander & Fiedler (2012)	USA and Canada, 2010	Complementary: 1 million USD in casino GGR corresponds to an increase of 2,700 USD in online GGR	3/4
Online gambling on lotteries	Philander & Fiedler (2012)	USA and Canada, 2010	No impact	3/4
Online gambling on lotteries	Trucy (2011)	France, 2010	No impact: National lottery revenue did not decline after the introduction of licensed online gambling markets	0/4
Online gambling on pari-mutuel/racing	Trucy (2011)	France, 2010	No impact: Pari-mutuel revenue did not decline after the introduction of licensed online gambling markets	0/4
Online gambling on EGMs	Philander, Abarbanel, & Repetti (2015)	UK, 2010	Complementary: 1-unit increase in gambling frequency on online EGMs was related to a 2.5-unit increase in land-based EGM gambling frequency	1/4
Online gambling on bingo	Philander, Abarbanel, & Repetti (2015)	UK, 2010	Complementary: Positive correlation of 0.191 between online bingo and land-based bingo participation rates	1/4

Note. EGM = electronic gaming machine; GGR = gross gambling revenue; UIGEA = Unlawful Internet Gambling Enforcement Act of 2006.

Impact of online gambling on lotteries. Two studies evaluated the impact of online gambling on lotteries, neither of which found an interaction between these two forms of gambling (Philander & Fiedler, 2012; Trucy, 2011). Philander and Fiedler (2012) suggested that this is because the population groups participating in these two games are different, which appears to be true based on population surveys (e.g., Costes et al., 2015; Wardle et al., 2011). Studies have furthermore not found cannibalization of online gambling by lotteries, as discussed earlier.

Impact of online gambling on pari-mutuel or race betting. One French study considered the impact of online gambling on the French pari-mutuel industry (Trucy, 2011). It found no impact on pari-mutuel revenue after the introduction of online gambling markets. However, this result is based on only one country context, and the study did not present any statistical analysis of the relationship. Furthermore, it did not consider the fact that the opening of licensed online gambling markets also allowed the national pari-mutuel company to expand its operations online to new games, which may have had an impact on this result. It is therefore necessary to conduct more studies to confirm the result.

Impact of online gambling on EGMs. One study focused on whether online EGM play has an impact on land-based EGM gambling (Philander et al., 2015). It found a complementary relationship. However, this finding is again based on self-reported data obtained from the British Gambling Prevalence Survey, leaving room for more studies that use actual gambling data.

Impact of online gambling on bingo. Finally, one study focused on whether online bingo substitutes for land-based bingo. The study by Philander et al. (2015) found a complementary relationship from a positive correlation in participation rates. However, this study is again based on self-reported data, and the same caution applies to this finding as described earlier.

Bingo

Bingo is a form of gambling that has been largely ignored in previous gambling studies, perhaps because of its small-scale nature and history as a form of charity gambling (Bedford, Alvarez-Macotella, Casey, Kurban Jobin, & Williams, 2016). There is also a real paucity of research evidence on whether bingo gambling substitutes for other forms of gambling, and the only observation that we found for this review concerned the impacts of bingo on lotteries (see Table 8).

Impact of bingo on lotteries. One Australian study considered the relationship between bingo sales and lottery. The study (Farrell & Forrest, 2008) found a complementary relationship, with bingo sales correlating positively with lotto sales. However, although this is a high-quality study, little research has been done on the topic, which is understandable, given the nature of bingo as a charity game.

Table 8
Substitution Impacts of Bingo on Other Gambling Products

Product impact	Study	Context and data years	Result	Quality
Bingo on lotteries	Farrell & Forrest (2008)	Australia, 1982–2002	Complementary: Bingo sales correlate positively with lotto sales	4

Discussion and Conclusion

In this study, we reviewed the available evidence on whether gambling games cannibalize other games. We can draw five conclusions from this analysis.

First, few examples of complete or near-complete substitution between gambling games exist. The only one that we could identify is the European football pool industry. This type of gambling was highly popular around Europe until the early 1990s (Forrest, 1999; Forrest & Perez, 2011), but by 2010, pools had become almost non-existent, with less than 3% of UK gamblers participating. The launch of FOBTs in the early 2000s and the UK National Lottery in 1994 are the likely cause (Forrest & Perez, 2011). This type of near-complete cannibalization, also called positive displacement (Farrell & Forrest, 2008), may be a sign of a normal market environment, in which less interesting products are replaced by new and more attractive gambling services. However, it may also be problematic in that new economic activity is created by substituting services from other sectors. This does not produce net economic benefits, particularly when less labour-intensive gambling sectors such as online gambling or EGMs substitute for sectors that provide more jobs or government revenue, such as casinos, racing tracks, or lotteries. Such a development can be seen in the case of EGMs substituting for traditional table games in casinos (Levitzky et al., 2000; Schüll, 2012, 2013). This type of substitution does not reduce the total win of casinos, but it may reduce employment opportunities in the industry.

Second, in most cases, there appears to be partial cannibalization, also known as negative displacement (Farrell & Forrest, 2008). In these situations, gambling industries substitute for each other and themselves, but not completely. Instead, the overall markets tend to grow. This appears to particularly true in wider national markets, whereas on the local level, impacts of cannibalization can be stronger. A so-called agglomeration effect (Philander & Bernhard, 2012) has taken place, which refers to a situation in which the presence of more gambling may cause some substitution, but leads to overall increases in activity in the entire sector. It is possible that there is a point of saturation for gambling markets, as was recently proposed by Barrow, Borges, and Meister (2016). However, the authors considered only inter-product cannibalization in casino markets, and it is possible that even if one type of gambling market is saturated, there is still room for other types of gambling products. The studies analysed in this review indicate that most gambling industries

cannibalize themselves, but they can still be complementary to other forms of gambling.

Third, and as further evidence of the agglomeration effect, some industry relationships appear to be complementary. This is particularly the case with online gambling, which according to available evidence seems to be mainly complementary to existing gambling products. This leads to more overall growth for the gambling market. Increased gambling opportunities can offer advantages to consumers, governments, and businesses (Basham & Luik, 2011; Williams et al., 2011; Zheng & Wang, 2014), but they can also have negative social and individual consequences, including harm to families (Dowling, Rodda, Lubman, & Jackson, 2014), gambling-related crime (Williams et al., 2011), and socio-economic inequality (Bol, Lancee, & Steijn, 2014); they can also contribute to health inequalities (Barnes, 2013). According to total consumption theory, these problems increase with increased gambling participation (Fong, Fong, & Li, 2011; Govoni, 2000; Grun & McKeigue, 2000; Hansen & Rossow, 2008, 2012; Lund, 2008), and they affect not only problem gamblers, but also moderate and low-risk gamblers (Browne et al., 2016). Other authors have suggested that populations will adapt to an increased gambling offer (LaPlante & Shaffer, 2007; Shaffer, 2005), but there is currently no conclusive evidence that adaptation occurs (Abbott et al., 2015; Orford, 2012). Although these social consequences of gambling were not the main interest of this review, they are important to bear in mind when considering the overall impacts of the growth of the gambling market described herein.

The fourth conclusion that we draw is that the relationships between gambling sectors are not always straightforward and may be different even between two games, depending on which way around we consider them. For example, EGMs have a negative impact on pari-mutuel betting and casino gambling, whereas the presence of pari-mutuel or casino gambling has a positive impact on EGM gambling. Overall, horse race and pari-mutuel betting, as well as online gambling, appear to be complementary to other forms of gambling, whereas casinos, lotteries, and EGMs appear to cannibalize other sectors more strongly. Conversely, horse race betting, sports betting, and lotteries appear to be the victims of cannibalization more often than casinos, EGMs, and online gambling. This finding suggests that industry relationships also depend on the increasing form of gambling in the market.

Fifth, a significant number of inter-industry relationships are yet unknown. This is particularly the case with sports betting and bingo, which have been largely overshadowed by studies on other types of gambling. Research on these topics might offer other examples of both complete and partial substitution or complementary relationships and provide more insight into issues such as the agglomeration effect and saturation.

This study focused on reviewing the existing evidence on whether market cannibalization takes place. Its main weaknesses were that we searched only English and French references, leaving out a possibly large number of studies conducted in other languages.

We also focused only on whether cannibalization takes place between types of gambling, leaving the possibility of conducting a meta-analysis for future studies. From the conclusions of this study, we recommend that future studies also consider the cannibalization impacts between industries that have received little or no attention in the literature and that more research be done on the relationships between cannibalization and adaptation, saturation, market growth, and the social impacts of gambling. There is also a need to review cannibalization between gambling and other industries to answer the question: At the expense of what other consumption does the gambling industry grow? This systematic review has nevertheless analysed a large body of literature and introduced a comprehensive analysis of gambling industry market relationships that will form the basis for further discussion on the topic.

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The Influence of Locus of Control and Sensation Seeking Among Undergraduate Texas Hold'em Players

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Abstract

Texas Hold'em poker has become increasingly popular on university and college campuses. However, not much is known about personality correlates of engaging in Hold'em, which is commonly seen as more skill-based compared to other forms of gambling. The current study sought to determine where, how much, and which students are playing Hold'em, and to further distinguish these patterns among gamblers. The current study describes Canadian university students' Hold'em-specific behaviour and beliefs, as well as determines whether locus of control and sensation seeking traits independently correlate with and predict gambling behaviour among a university sample. Undergraduate students ($N = 96$) completed an online questionnaire containing Rotter's Internality-Externality scale (I-E), the Zuckerman Sensation Seeking Scale (SSS) and the South Oaks Gambling Screen (SOGS). Participants played a round of Hold'em in lab and answered a survey about their perception of Hold'em and of the game they played. Sensation seeking and external locus of control were significantly positively correlated with gambling pathology. Participants overestimated the number of hands played and the time spent playing Hold'em. There was a significant positive correlation between gambling pathology and gambling success. The I-E and boredom susceptibility sensation seeking subscale significantly predicts some problem/pathological gambling. The current study suggests that more pathological gamblers display higher levels of sensation seeking and a more external locus of control than non-problem gamblers, and that the type of gambling activity and setting in which gambling occurs should be considered in future research looking at personality characteristics of certain problem/pathological gamblers.

Keywords: Gambling, Texas Hold'em, poker, sensation seeking, locus of control

Résumé

La version de poker Texas *Hold'em* fait de plus en plus d'adeptes sur les campus. On ne connaît cependant pas grand-chose sur les corrélats de personnalité qui entrent

en jeu dans le *Hold'em*, mais ils semblent généralement plus axés sur les compétences par rapport aux autres formes de jeux de hasard. Cette étude a cherché à déterminer les lieux, le nombre et le genre d'étudiants qui jouent au *Hold'em* et à caractériser plus en profondeur ces modèles parmi les joueurs. L'étude décrit le comportement et les croyances propres aux étudiants universitaires canadiens et détermine si le locus de contrôle et les caractéristiques de recherche de sensation sont en corrélation et prédisent indépendamment le comportement du jeu dans un échantillon universitaire. Pour l'étude, les étudiants de premier cycle (N = 96) ont rempli un questionnaire en ligne contenant l'échelle de Rotter (I-E) sur l'internalité-externalité, l'échelle de Zuckerman sur la recherche de sensation et le *South Oaks Gambling Screen* (SOGS). Les participants ont joué une partie de *Hold'em* en laboratoire et ont répondu à un sondage sur leur perception du *Hold'em* et de la partie qu'ils ont jouée. La recherche de sensations et le lieu de contrôle externe ont été corrélés positivement et substantiellement à la pathologie du jeu. Les participants ont surestimé le nombre de mains jouées et le temps consacré à jouer la partie. Il y a eu corrélation positive importante entre la pathologie du jeu et la réussite du jeu. L'échelle sur l'internalité-externalité et la sous-échelle de la disposition à l'ennui prédisent de manière significative certains problèmes ou pathologies liés au jeu. L'étude actuelle suggère que plus de joueurs pathologiques affichent des niveaux plus élevés de recherche de sensation et un locus de contrôle plus externe que les joueurs sans problème, et que ce type d'activité de jeu et le contexte dans lequel le jeu se produit devraient être pris en compte dans les recherches futures sur les caractéristiques de la personnalité de certains joueurs compulsifs/pathologiques.

Introduction

Poker—specifically Texas Hold'em poker—is one of the most popular forms of gambling worldwide (Caswell, 2006; Hardy, 2006). The rise in popularity occurred in 2000 and is likely attributable to the development of the online poker industry (Wood, Griffiths, & Parke, 2007) and the game's appearance in mainstream media. Parallel with the increasing popularity in the gambling industry, Texas Hold'em poker (hereafter referred to as Hold'em) has become increasingly widespread on university and college campuses. Many undergraduates play Hold'em (Hardy, 2006) and are directly targeted as such by advertisers (Woodyard, 2004). Importantly, university student status is an established risk factor for problem gambling behaviours, particularly on the Internet (Griffiths & Barnes, 2008; Petry & Weinstock, 2007; Wood & Williams, 2009). Approximately 5–9% of university-aged males are problem gamblers—a rate that is more than double that seen in the general adult population (e.g., Nowak & Aloe, 2014; Stinchfield, Hanson & Olson, 2006; Williams, Connolly, Wood & Nowatzki, 2006).

The increased exposure to gambling increases both the rate of gambling and gambling-related problems in those persons who are university aged (Jacques, Ladouceur, &

Ferland, 2000; Room, Turner, & Ialomiteanu, 1999). Understanding which personality characteristics of university-aged individuals are related to a higher relative likelihood of playing Hold'em and a higher relative likelihood to be problem gamblers is therefore critical. However, despite the increasing popularity and increasing risk of Hold'em in university populations, research specifically among Hold'em players is scarce (Hopley, Dempsey, & Nicki, 2012).

From a broader perspective, previous research has attempted to delineate personality factors that distinguish between problem and non-problem gamblers (e.g., Lesieur & Blume, 1987; Parke, Griffiths, & Irwing, 2004; Stinchfield et al., 2006) and differing gambling behaviours in university populations (e.g., Buckle, Dwyer, Duffy, Brown, & Pickett, 2013; MacLaren, Best, Dixon, & Harrigan, 2011). Two commonly studied personality traits which have been found to be associated with gambling are locus of control and sensation seeking.

Locus of control is the extent to which individuals believe that their own actions or skills control the events in their lives, as opposed to chance, luck, or other uncontrollable circumstances in the environment (Rotter, 1966). An individual who has a high external locus of control would attribute the outcomes of events in their lives to external forces (e.g., luck) compared to an individual with a high internal locus of control who would attribute the outcomes of events in their lives to their own internal forces (e.g., perceived skill).

In contrast to slot machines, lotteries, and bingo, which can be viewed as games of pure chance such that any perception of skill is an unrealistic expectance of personal success (Cabot, Light, & Rutledge, 2009) or an illusion of control (Dykstra & Dollinger, 1990; Langer, 1975; Martinez, Le Floch, Gaffié, & Villejoubert, 2011), Hold'em is often conceptualized and viewed as a sport or even career, in which players can control the outcome through motivation, strategy, and skill (McMullan & Kervin, 2011). Undergraduate students tend to spend more money on games in which skill is perceived as an important factor in comparison to those games perceived to be more dependent on chance (Kairouz, Paradis, & Monson, 2015). The illusion of control thus refers to an overestimation of the impact of skill on the outcome of the game.

The relationship between locus of control and gambling behaviours is inconsistent in the literature: early studies support that pathological and heavy gamblers score higher on external locus of control (Moran, 1970), whereas other studies found no differences in locus of control between heavy gamblers, light gamblers, and non-gamblers (Kusyszyn & Rutter, 1985). Recent research continues to support an equivocal relationship between locus of control and gambling (Clarke, 2004; de Stadelhofen, Aufrère, Besson, & Rossier, 2009). Importantly, these studies were conducted among participants playing games of "pure chance," such as slot machines. Hopley et al. (2012) found that an internal locus of control was associated with pathological gambling among online Hold'em players. These studies demonstrate that game type and the setting in which the game is played (e.g., online,

friend's home) may moderate the relationship between locus of control and problem gambling.

Sensation seeking is one of the most studied personality traits in the gambling literature (Fortune & Goodie, 2010; Gupta, Derevensky, & Ellenbogen, 2006; Hardoon & Derevensky, 2002; Nower, Derevensky & Gupta, 2004; Zuckerman, 1979). Zuckerman defined sensation-seeking as the seeking of "varied, novel, and complex sensations and experiences, and the willingness to take physical and social risks for the sake of such experience" (Zuckerman, 1979, p. 89).

As gambling involves a high degree of sensory and mental stimulation, problem gamblers report elevated levels of sensation seeking in both youth and adult populations (Nower et al., 2004; Gupta et al., 2006; Hardoon & Derevensky, 2002). Similar to locus of control, studies looking at the association between sensation seeking and pathological gambling have yielded mixed results. Numerous studies have found higher sensation seeking behaviours for pathological gamblers compared to non-pathological gamblers and non-gamblers (e.g., Gupta et al., 2006; Kuley & Jacobs, 1988; Powell, Hardoon, Derevensky, & Gupta, 1999). High sensation seekers exhibit greater risk-taking behaviours, yet do not necessarily view high-risk situations as such (Fortune & Goodie, 2010). This lack of awareness of risk may facilitate pathological gambling behaviours.

Contrarily, Blaszczynski, Wilson, and McConaghy (1986) found that pathological gamblers had sensation-seeking levels that were lower than those of the general population, which was substantiated by studies that found sensation seeking was not a significant predictor of pathological gambling (Anderson & Brown, 1984; Parke et al., 2004). Kuley and Jacobs (1988) found higher sensation seeking scores among problem gamblers, and argued that the non-significant differences between gamblers and non-gamblers in Anderson and Brown's study may be due in part to lack of control for age as sensation seeking scores have been found to negatively correlate with age (Reio & Choi, 2004; Zuckerman, S. B. Eysenck, & H. J. Eysenck, 1978). Another explanation for the conflicting results may be because of differences in the sample population, for example whether the study was conducted among clinical gamblers, community, or student samples.

McDaniel and Zuckerman (2003) examined the relationship between gambling and sensation seeking among a community sample from the US, and found that individuals who scored high on impulsivity and sensation seeking also showed greater interest in gambling. These researchers utilized a 19-item Impulsive Sensation Seeking scale, which distinguished between impulsivity and sensation seeking (Dickerson & Baron, 2000). Thus, another explanation for the mixed results may be a result of differing scales and dimensions used to measure sensation seeking as well as gambling pathology.

The Zuckerman Sensation Seeking Scale (SSS) is one of the most widely utilized tools for measuring sensation seeking. This measure combines impulsivity and

sensation seeking, as these constructs have been shown to strongly relate and predict similar phenomena (Zuckerman, 1994). The SSS is split into four subscales: thrill and adventure seeking, experience seeking, disinhibition, and boredom susceptibility. Unfortunately, SSS subscales are rarely reported separately (Harris, Newby, & Klein, 2015). In one of the few studies that has distinguished between subscales, Fortune and Goodie (2010) found that the disinhibition and boredom susceptibility factors of sensation seeking, as measured by the SSS, were related to pathological gambling but experience seeking and thrill and adventure seeking were not associated with pathological gambling. Based on content similarity, researchers have suggested two sub-constructs of sensation seeking: one consisting of thrill and adventure seeking and experience seeking, the other disinhibition and boredom susceptibility (Fortune & Goodie, 2010). Comparing non-problem and pathological/problem gamblers, non-problem gamblers appear to have higher or equal levels of thrill and adventure seeking and experience seeking, while pathological/problem gamblers appear to have equal or higher levels of disinhibition and boredom susceptibility (e.g., Blanco, Orensanz-Munoz, Blanco-Jerez, & Sáiz-Ruiz, 1996; Blaszczynski et al., 1986; Blaszczynski, McConaghy, & Frankova, 1990; Bonnaire, Lejoyeux, & Dardennes, 2004; Carrasco, Sáiz-Ruiz, Hollander, César, & Lopez-Ibor, 1994).

In attempts to delineate which specific types of gambling are associated with sensation seeking, researchers found that, among males, sensation seeking traits were associated with video poker, but not associated with slot machines, sports betting, or lotteries, whereas sensation seeking traits were significantly associated with all forms of gambling except off-track horse betting among females (McDaniel & Zuckerman, 2003). Collectively, these studies suggest that the relationship between sensation seeking and gambling is likely not linear, and may vary based on type of gambling activity, setting of gambling activity, age, and/or gender.

In a seminal study examining the predictors of pathological gambling in a university sample, Griffiths and colleagues (Griffiths, Parke, Wood, & Rigbye, 2010) found that online poker players who were more likely to be successful perceived themselves as more skillful and did not overestimate the level of skill involved in poker. The perception of one's own skill, however, did not appear to significantly predict pathological gambling. They reported participants' frequency of play, blinds (i.e., forced bets by players left of the dealer), and session length. However, it is unclear whether participants' perceptions of frequency of play, blinds, and session length matched their actual playing behaviours. The current study determined participants' perception of their own Hold'em behaviours and whether gambling pathology is related to these perceptions.

In a university student population, online poker players tend to play more hands (Montes & Weatherly, 2016), spend more money, and miss school more often (Petry & Gonzalez-Ibanez, 2015) compared to non-online poker players. Further, the context in which gambling occurs (e.g., online vs. non-online) influences the time and money individuals spend on gambling (Kairouz, Paradis, & Monson, 2015).

Therefore, it appears that the setting sought for poker may be related to likelihood of problematic gambling. However, it is unclear how personality factors relate to poker playing behaviours in in-vivo poker games.

The increased recognition of pathological gambling as a public health issue has fostered a growing concern regarding gambling behaviours among adolescents and young adults. However, despite the increasing popularity of Hold'em and the vulnerability to problem and pathological gambling among university students (Engwall, Hunter, & Steinberg 2004; Lesieur & Blume, 1987; Shaffer, Hall, & Vander Bilt, 1997; Stinchfield et al., 2006), the risk factors for pathological gambling for this population remain unknown. Given the unique nature of Hold'em, the present study had two aims: 1) To describe Canadian university students' gambling and Hold'em behaviours, and outline university students' perceptions of Hold'em gambling, and 2) To determine whether locus of control and sensation-seeking traits independently predicted gambling behaviours in a university sample, specifically among Hold'em players.

Methods

Participants

The inclusion criterion for this study was undergraduate status at a large South-western Ontario university. Participants also had to (a) be 18 years of age or older, (b) have previously played Hold'em on at least two prior occasions, and (c) report fluency in English. Individuals in the process of trying to abstain from gambling or those who had sought help from a gambling addiction hotline in the past three months were excluded from the study.

Measures

Rotter's Internality-Externality scale (I-E). Rotter's Internal-External (I-E) Locus of Control Scale (1966) remains one of the most widely used self-report measures of locus of control. The questionnaire consists of 29 items: 23 items which have a forced-choice format and ask participants to select between an internal or external interpretation, as well as six bogus items to make the questionnaire's purpose ambiguous to respondents. Items were designed to measure beliefs about the nature of the world (i.e., a general, non-contextualized dimension of locus of control) (Rotter, 1966). The total score is calculated to indicate the number of external choices made, whereby a higher score reflects a higher external locus of control. The I-E scale has been validated among different samples, including university populations (Beretvas, Suizzo, Durham, & Yarnell, 2008), with internal reliability estimates ranging from .19 to .93 ($M = 0.67$, $Median = 0.69$, $SD = .13$). The internal consistency for the current sample is $\alpha = .57$. Test-retest reliability estimates ranged from .53 to .86, with an unweighted average of .66 and a median of .64 ($SD = .09$) (Beretvas et al., 2008). The I-E scale has shown convergent validity with related

concepts, including self-esteem and neuroticism (Judge, Erez, Bono, & Thoresen, 2002). These results suggest that the I-E scale has sufficient internal consistency, test-retest reliability, and convergent validity.

Zuckerman Sensation Seeking Scale (SSS). The SSS (Zuckerman, 1994) is a 40-item measure used to assess individual differences in arousal and stimulation needs. The SSS produces a total score as well as four factor-analytically derived subscales: (1) Thrill and Adventure Seeking (TAS), (2) Experience Seeking (ES), (3) Disinhibition (Dis), and (4) Boredom Susceptibility (BS). The Dis and ES subscales are said to represent the more maladaptive forms of sensation seeking, whereas the TAS and BS scales are said to reflect more socially adaptive forms of sensation seeking (Zuckerman, 1979). The SSS uses a forced-choice response option of Yes-No. Acceptable to good internal consistency was found in previous research for each of the SSS subscales: TAS ($\alpha = .80$); ES ($\alpha = .75$); Dis ($\alpha = .80$); and BS ($\alpha = .76$) (Roberti, Storch, & Bravata, 2003). A confirmatory factor analysis on a sample of 336 Canadians confirmed a four-factor model, with good internal consistency for the total SSS score ($\alpha = .75$; Ridgeway & Russell, 1980). The internal consistency estimates of the four subscales in the current sample are TAS ($\alpha = .74$), ES ($\alpha = .39$), Dis ($\alpha = .68$), BS ($\alpha = .50$), and total SSS ($\alpha = .73$), which is in line with previous research that found internal consistency scores between .44-.80 and which shows the ES subscale to have the lowest internal consistency (Finn, Ben-Porath, & Tellegen, 2015; Roberti et al., 2003). The SSS has been repeatedly found to be a reliable and valid measure for predicting involvement in sensation-seeking behaviour among university students (Loas et al., 2001; Roberti et al., 2003; Zuckerman et al., 1978).

South Oaks Gambling Screen (SOGS). The SOGS (Lesieur & Blume, 1987) is a widely used internationally standardized survey screen for pathological gambling (Walker & Dickerson, 1996). The SOGS is a 16-item self-report questionnaire where 20 items are summed to produce a final score. The SOGS differentiates between non-problem gamblers (a score of 0), some problem gamblers (a score of 1–4), and probable pathological gamblers (a score of 5 or above). Correlations over .70 have been reported between the Diagnostic and Statistical Manual of Mental Disorders' (American Psychiatric Association, 2000) diagnostic criterion of gambling disorder and SOGS measures of pathological gambling (e.g., Slutske, Zhu, Meier, & Martin 2011; Wickwire, Burke, Brown, Parker, & Ryan, 2008). The internal consistency of the SOGS for the current sample is $\alpha = .70$.

Hold'em-specific Beliefs and Behaviours. The authors also included 14 items of interest specific to participants' Hold'em beliefs and behaviors prior to game play (as part of an online questionnaire) as well as 19 items post-poker play (paper-and-pencil format) in order to better understand participants' perceptions of Hold'em specifically and their beliefs about the game they had played. These items were developed in consultation with leading researchers in the field. Items include previous history playing Texas Hold'em, preference of players, and frequent location of game play. Other items include participants' perception of skills and luck (e.g., "I believe that poker is a game of ____ luck," where participants' assigned a percentage from

0-100%). Post-poker play items included items about the in-lab poker game they had played (e.g., “I believe that in the game I just played __ hands in total”). Subsequent to playing a game of Hold’em, each participant was asked to estimate how long they had been playing for and how many hands they had played for. A time accuracy score was calculated for each player by taking their own estimated time played (in minutes) and dividing it by their actual recorded time played (in minutes) and multiplying by 100. Similarly, a hand accuracy score was calculated. A score of 100 indicated an individual perfectly estimated the length of time or number of hands played; a score below a 100 indicated under-estimating time or number of hands played, whereas a score over 100 signified over-estimating time or number of hands played.

Procedure

Participants completed an online consent form and an online questionnaire that contained basic demographics, the I-E, SSS, SOGS, and the Hold’em beliefs and behaviours items. Participants were subsequently invited to participate in a poker game that took place in a laboratory setting that mimicked a social setting. Cell phones and watches were collected from the participants such that they would be unaware of elapsed time. There were 6–8 participants at each poker game. All participants were randomly assigned seats around the table, with a volunteer serving as the dealer and officiator of the poker game. Researchers observed game play through a one-way mirror in order to record the number of ‘hands’ played. Each session was set for a length of 60 hands (rounds). Following completion of the 60 hands, participants completed the post-poker items. In the event that a participant lost his/her chips prior to reaching 60 hands, he or she completed the post-poker items and was debriefed at that point. The actual time of elapsed play and number of hands was recorded. Participants received three psychology research credits for their participation.

Results

Sample Characteristics

A total of 97 undergraduate students were recruited for the final study. One participant was excluded from the sample as he was seeking help for gambling difficulties at the time of the study. The final sample consisted of 96 undergraduate students. Participants ranged in age from 18 to 30 years ($M = 18.78$ years, $SD = 1.53$). Participants were mostly male ($n = 87$, 90.63%) and Caucasian ($n = 63$, 65.61%). The remaining sample identified as Asian ($n = 17$, 17.70%), Multiracial ($n = 3$, 3.20%), Black ($n = 1$, 1.03%), Hispanic ($n = 1$, 1.03%), other ($n = 6$, 6.23%), or did not answer ($n = 5$, 5.20%). Age and gender were not significantly correlated to any of the outcome or predictor variables.

Hold’em Beliefs and Behaviours (Pre-Poker Play)

More than 80% of the sample reported they have played Hold’em on ten or more prior occasions. Only 12% reported that they have played Hold’em “five to ten

times” and 6% reported playing fewer than five times. Over 85% of the sample reported that had previously watched Hold'em on television.

The most common weekly gambling activity was playing cards for money (16.29%) followed by sports betting (10.42%), lottery tickets (8.29%), stock market (6.26%), dice games (2.10%), bingo (1.03%), off track betting (1.03%), and pull tabs or paper games (1.03%). The most frequent location of game play was at a friend's home (61.46%), followed by the participant's own home (14.58%), online practice websites (12.50%), university residence (7.29%), and online paid websites (4.17%). In-vivo Hold'em play was over five times more common than online play, 83.33 % to 15.67%, respectively. Participants most preferred playing Hold'em with friends (84.38%), compared to family members (3.13%), or unknown online gamers on the Internet (3.13%). Few respondents (9.56%) reported that they preferred playing with their family members and friends equally.

Prior to poker play, on average, participants reported that Hold'em was a game of 48.03% ($SD = 21.41$) luck. In a separate question, on average, participants reported that Hold'em was a game of 51.89% ($SD = 21.76$) skill. When asked the same questions again following playing Hold'em in the lab tournament, on average, participants reported that Hold'em was a game of 51.40% ($SD = 20.22$) luck and, on average, 48.87% ($SD = 20.38$) skill. Post-poker play, only 6.25% ($n = 6$) participants endorsed the statement that they believed they could make a successful living as a Hold'em poker player. The mean score for time and hand accuracy was 126.67 ($SD = 34.66$) and 139.12 ($SD = 84.54$), respectively.

Gambling Pathology and Personality Traits

The mean score on the SOGS scale was 1.43 ($SD = 2.01$, range 0-20). Eight participants fit the probable pathological gambler category. SOGS categories by gender are presented in Table 1. Descriptive statistics for the I-E, SSS and subscale scores, for the Sensation-Seeking Scale are presented in Table 2.

Relationship between Locus of Control, Sensation Seeking, Gambling Pathology and Success

Pearson product-moment correlation coefficients were calculated to examine the relationship between locus of control, sensation-seeking, SOGS scores, and participants'

Table 1

Participants' SOGS categories for the total sample and by gender

	Sample ($n = 96$) n (%)	Male ($n = 87$) n (%)	Female ($n = 9$) n (%)
Non-problem	41 (42.71)	35 (40.23)	6 (66.67)
Some Problem	47 (48.96)	44 (50.57)	3 (33.33)
Probable Pathological	8 (8.33)	8 (9.20)	0 (.00)

rank in the tournament/game play (see Table 3). The I-E scale was positively correlated with some problem gambling ($r(94) = .40, p < .001$, two-tailed), such that higher external locus of control scores were associated with higher pathological gambling scores. There was a significant positive correlation between the total SSS score and SOGS score ($r(94) = .35, p < .001$, two-tailed), such that higher sensation seeking scores were related to higher pathological gambling scores. The only SSS subscale that correlated with gambling pathology was BS ($r(94) = .38, p < .001$, two-tailed). SOGS score was also positively correlated with the rank in the in-vivo tournament ($r(94) = .86, p < .001$, two-tailed), such that higher pathological gambling scores indicated higher tournament rank. Hand accuracy was significantly positively correlated with SSS total score ($r(94) = .25, p = .015$), such that those who overestimated the number of hands they played had higher sensation-seeking scores.

Table 2

Mean Scores, Standard Deviations and Range for Personality Constructs (n = 96)

Scale	Mean	SD	Range
I-E	11.42	3.32	2–19
Total SSS	23.28	5.42	6–35
TAS	7.28	2.39	0–10
ES	5.05	1.75	1–9
Dis	6.49	2.32	0–10
BS	3.79	1.94	1–8

Note. Total SSS = Total sensation seeking score; TAS = Thrill and adventure seeking; ES = Experience seeking; DIS = Disinhibition; BS = Boredom susceptibility; I-E = Internality-Externality Scale; SOGS = South Oaks Gambling Screen; Rank = Ranking of success recording as participant's place in the tournament.

Table 3

Pearson Product-Moment Correlations Between Locus of Control, Sensation Seeking, and Gambling Pathology and Success (N = 96)

Variable	Total SSS	TAS	ES	Dis	BS	I-E	SOGS	Rank	Time	Hand
Total SSS	—	.55**	.45**	.54**	.41**	.32**	.35**	.20*	-.07	.25*
TAS		—	.35**	.29**	-.04	.04	-.06	.14	-.10	.13
ES			—	.16	-.08	.06	.02	.06	-.04	.13
Dis				—	.20	.23*	-.07	.03	-.12	.13
BS					—	.20	.38**	.03	-.13	.14
I-E						—	.40**	.03	-.05	.11
SOGS							—	.86**	.04	.02
Rank in tournament								—	.05	-.14
Time Accuracy									—	.03
Hand Accuracy										—

Note. Total SSS = Total Sensation Seeking Scale; TAS = Thrill and Adventure Seeking; ES = Experience Seeking; DIS = Disinhibition; BS = Boredom Susceptibility; I-E = Internality-Externality Scale; SOGS = South Oaks Gambling Screen; Success = Position in the tournament, whereby higher scores indicate higher success (leading chip holders).

** $p < 0.01$ (two-tailed). * $p < 0.05$ (two-tailed)

One-Way ANOVAs of Pathological Gambling and Personality Traits

Results were further analyzed using the categorical SOGS variable: non-problem, some problem, and probable pathological gamblers (see Table 4).

A one way analysis of variance (ANOVA) indicated that at least two of the three categories significantly differed from one another on scores of I-E, $F(2, 93) = 15.29$, $p < .001$. A post-hoc analysis, using the Bonferroni correction, indicated that probable pathological gamblers had higher external locus of control ($M = 16.88$, $SD = 2.01$) than some problem ($M = 10.95$, $SD = 3.17$), and non-problem gamblers ($M = 11.00$, $SD = 2.76$; $p < .001$ for all).

A one-way ANOVA was conducted to compare the total SSS across the three categories of gamblers. Results were significant for the total SSS score, $F(2, 93) = 9.48$, $p < .001$. The only subscale of the SSS that differed across groups was the BS subscale, $F(2, 93) = 7.13$, $p < .001$. A post-hoc analysis, using the Bonferroni correction, indicated that probable pathological gamblers had higher total SSS scores ($M = 30.25$, $SD = 2.54$) than some problem gamblers ($M = 22.78$, $SD = 4.79$), and non-problem gamblers ($M = 22.48$, $SD = 5.63$; $p < .001$ for all). Probable pathological gamblers had higher BS scores ($M = 6.13$, $SD = 1.64$) than some problem gamblers ($M = 3.64$, $SD = 1.92$; $p = .002$), and non-problem gamblers ($M = 3.51$, $SD = 1.74$; $p = .001$).

Regression Analyses for Variables Predicting Some Problem/Pathological Gambling

Because of the small number of probable pathological gamblers in the current study, a hierarchical regression analysis was conducted to determine how locus of control and sensation seeking predict some problem/pathological gambling as measured by the continuous SOGS score (see Table 5). In order to account for any variance attributed to age and gender, variables were entered in two blocks: (1) gender, age (2) I-E and four SSS subscales (TAS, ES, Dis, and BS). The four subscale scores were included

Table 4

SOGS Categories and the Relationship to Locus of Control and Sensation Seeking

	Non-problem (<i>n</i> = 41) <i>M</i> (<i>SD</i>)	Some Problem (<i>n</i> = 47) <i>M</i> (<i>SD</i>)	Probable Pathological (<i>n</i> = 8) <i>M</i> (<i>SD</i>)	One-way ANOVA	
				<i>F</i> (2, 93)	<i>P</i>
Total SSS ^a	22.48 (5.63)	22.78 (4.79)	30.25 (2.54)	9.48	<.001
TAS	7.36 (2.51)	7.34 (2.29)	6.50 (2.44)	.46	.63
ES	5.34 (1.72)	4.72 (1.75)	5.50 (1.77)	1.66	.20
Dis	6.56 (2.34)	6.45 (2.33)	6.38 (2.77)	.04	.96
BS	3.51 (1.74)	3.64 (1.92)	6.13 (1.64)	7.13	.001
I-E	11.00 (2.76)	10.95 (3.17)	16.88 (2.01)	15.29	<.001

Note. Total SSS = Total sensation seeking score; TAS = Thrill and adventure seeking; ES = Experience seeking; DIS = Disinhibition; BS = Boredom susceptibility; I-E = Internality-Externality Scale; SOGS = South Oaks Gambling Screen.

Table 5
Hierarchical Regression Analysis for Predicting SOGS Score

Variable	β	t	sr^2	ΔR^2
Step 1				.02
Gender	-.16	-1.54	.02	
Age	-.04	-.43	.00	
Step 2**				.29
Gender	-.12	-1.29	.01	
Age	-.04	-.43	.00	
I-E**	.40	4.32	.14	
TAS	-.02	-.18	.00	
ES	.09	.90	.01	
Dis*	-.23	-2.38	.04	
BS*	.31	3.23	.08	

Note. TAS = Thrill and adventure seeking; ES = Experience seeking; Dis = Disinhibition; BS = Boredom susceptibility; I-E = Internality-Externality Scale; SOGS = South Oaks Gambling Screen.

** $p < 0.001$ (two-tailed). * $p < 0.05$ (two-tailed).

instead of the total SSS scale as previous research suggests that the subscale scores differentially relate to some problem/pathological gambling (Fortune & Goodie, 2010).

The first-step of the regression model with gender and age did not significantly predict the SOGS score ($F(2,93) = 1.28$, ns). Gender and age were non-significant predictors. The addition of I-E and sensation seeking subscales resulted in significant incremental change ($F(5,88) = 7.61$, $p < .001$) of 29% variance. The I-E, Dis, and BS subscales were all significant predictors of SOGS, and explained 14%, 4%, and 8% of the variance, respectively. This suggests that having greater external locus of control, higher BS, and lower disinhibition increased the likelihood that individuals in our sample had higher SOGS scores (i.e., were more likely to be probable/pathological gamblers). The overall regression model with gender, age, I-E, and all four sensation seeking subscales significantly predicted the SOGS score ($F(7, 88) = 5.94$, $p < .001$) and explained 32% of the variance.

Discussion

The first goal of the current study was to describe Texas Hold'em beliefs and behaviours among Canadian university students. Playing cards for money was the most common weekly gambling activity (16.29%) and poker was most frequently played at a friend's home (61.46%). Although online poker is increasingly popular (Wood et al., 2007), only 4.17% of our population reported online paid websites to be their most common Hold'em setting. This low percentage may be reflective that our sample consisted of undergraduate students who perhaps play Hold'em as a social activity with friends as opposed to on online paid websites.

In terms of participants' perceptions of Texas Hold'em, skill and luck were reported to be equally important. Horbay and Fritz (1998) showed that successful poker

players emphasized the skill component of poker play, and believed that luck played a minimal role. Contrary to these results, no such significant correlations were reported in the current study with respect to perceptions of skill and luck, which may be because of the fact that questions were placed sequentially one after the other such that participants may have wrongly assumed that these values should total 100% and/or they may have speculated that the “correct” answer would be an even 50-50 split. Gambling measures have been developed that consider individuals’ perceptions of skill and luck. For example, McInnes and colleagues (McInnes, Hodgins, & Holub, 2014) refined the Gambling Cognitions Inventory into two subscales. The Skill and Attitude Subscale reflects skill and attitude cognitions (e.g., “I am a very skilled gambler”), whereas the Luck and Chance Subscale reflects luck/chance cognitions (e.g., “I lose because I am having a bad or unlucky day”). Future research in Hold’em could measure participants’ perceptions of skill and luck using such measures.

The second study aim was to examine the personality correlates of locus of control and sensation seeking with some problem/pathological gambling in a university sample. External locus of control was related to gambling pathology, suggesting that probable pathological gamblers may attribute life’s outcomes to external forces. Previous research (Chantal & Vallerand, 1996) has shown that gamblers who participate in skill-based forms of gambling are more likely to report motivations that are intrinsic, such as challenges associated with improving their skill as motivating factors. On the locus of control scale, the probable pathological gamblers differed significantly from the some problem and non-problem gamblers, but the some problem gamblers did not significantly differ from the non-problem gamblers. Generally, gamblers may attribute gambling success to internal factors (e.g., skill), and attribute gambling losses to external factors (e.g., luck) (Griffiths, 1990). However, those who have external locus of control may feel they are unable to control their gambling behaviours, predisposing them to problem gambling (Orford, Morison, & Somers, 1996), which is consistent with our results suggesting that pathological gambling (or higher likelihood of pathological gambling) is associated with greater external locus of control. Research has found no differences between “problem” and non-problem gamblers (Clarke, 2004); however, Clarke (2004) used a lower cutoff score than that used for probable pathological gamblers in the current study. Therefore, external locus of control may be associated with increased likelihood of pathological gambling.

Probable pathological gamblers were characterized by relatively high levels of sensation seeking. This finding is consistent with Zuckerman’s (1994) original hypothesis that predicted a relationship between gambling and sensation seeking. Researchers (Kuley & Jacobs, 1988) have pointed out that the lack of significant differences between gamblers and non-gamblers in previous studies could be a result of not controlling for age. Certain researchers have further suggested that it may not be the relationship between gambling pathology and sensation seeking that should be studied, but the betting behaviour itself (Walker, 1992).

Although the non-problem gamblers, the some problem gamblers, and the probable pathological gamblers did not differ on thrill and adventure seeking, disinhibition

and experience seeking, statistically significant differences were reported on the total sensation seeking score and on boredom susceptibility. Specifically, the probable pathological gamblers scored higher on total sensation seeking and boredom susceptibility than some problem and non-problem gamblers. The some problem and non-problem gamblers did not significantly differ from each other on these scales. These results suggest that pathological gambling may be related to more social aspects of the game or to alleviate boredom, rather than the “thrill of the game,” in line with previous research showing elevated levels of boredom susceptibility in pathological gamblers (Fortune & Goodie, 2010). With respect to sensation seeking, the findings have been mixed, and may be dependent on the type of gambling problem gamblers engage in. Our results are in line with previous research that shows that sensation seeking traits were associated with video poker (McDaniel & Zuckerman, 2003).

We failed to replicate Fortune and Goodie’s (2010) finding of elevated disinhibition subscale scores in pathological gamblers. This may have been because of the small number of individuals in the probable pathological gamblers category (i.e., $n = 8$) in the present study, which may have reduced power to detect such an effect. In the current study, a regression analysis using a continuous problem/pathological gambling score showed that external locus of control, higher boredom susceptibility, and lower disinhibition significantly predicted gambling pathology, accounting for 32% of the total variance. Our results suggest that boredom susceptibility significantly predicts some problem/pathological gambling, in line with previous research. However, the current sample showed that lower disinhibition scores were predictive of higher likelihood of some problem/probable pathological gambling in our regression analysis, contrary to previous research. Compared to other sensation seeking facets, disinhibition appears to be unique in that it is related to decreased problem gambling risk. These results may be because of differences between types of gamblers. Bonnaire et al. (2009) found that disinhibition scores were lower among pathological gamblers who play traditional games, such as roulette and card games. Therefore, it may be such that the some problem/pathological gamblers in the current study who self-selected to be a part of the current study were more likely to have lower disinhibition scores compared to other types of gamblers. These results suggest that different subsets of gamblers might display unique personality characteristics.

University students appear to play Hold’em as a means of escaping boredom and as a form of social activity in their university setting. Furthermore, because of the perceived skill of this game, one can speculate that the challenge that Hold’em presents to players is a motivator unique to poker play. These results are corroborated with the tendency for players to overestimate the elapsed time and number of hands played in the in-lab poker tournament. It is clear that future research needs to control for differences between gambling forms, as this may help to explain differences among gamblers’ personality traits.

The tendency to overestimate elapsed time and the number of hands played may be because of the environment in which Hold’em was played. Casinos are usually

designed to influence gambling behaviour and avoid clocks and windows, and introduce ambient music to reduce reference to time passed, which results in underestimation of duration of slot playing (Noseworthy & Finlay, 2009). Our lab environment attempted to replicate these conditions (e.g., researchers removed clocks/watches/cell phones; had a nice poker table and bar stools set up in a basement of a student-type building). However, participants were aware that this was a research study, which may have impacted sense of game play time. In the “real world” setting, the most frequent place of Hold’em play among our sample was a friend’s home. Future studies could examine if the amount of time university students play online or in-vivo (e.g., friends’ homes, residence) differs, and if they are aware of how long they are playing for and the number of hands played.

This study adds to previous research that examines Hold’em behaviours in online settings (e.g., Griffiths et al., 2010; Montes & Weatherly, 2016; Petry & Gonzalez-Ibanez, 2015) by investigating beliefs and behaviours in a real-world poker game. Further, external locus of control and higher levels of sensation seeking and boredom susceptibility characterize probable pathological gamblers compared to some problem and non-problem gamblers in a university sample. The results of this study suggest that the sample (e.g., university, community) and the type of gambling are important factors that contribute to the relationship between personality traits, some problem/pathological gambling, and gambling beliefs and behaviours.

Limitations and Future Directions

Limitations of this study include problems related to the self-developed items, concerns regarding the use of gambling pathology scale, low internal consistency of some of the measures used, and the generalizability of results. In terms of the self-developed items, the questions regarding skill and luck seemed to be not well understood by participants. Further, although the sample was picked specifically for its experience with Texas Hold’em, most participants (82%) reported playing over 10 times. A more sensitive measure of Texas Hold’em experience would be necessary to determine how skill and familiarity influence gambling behaviours.

It is unclear whether participants’ level of some problem/pathological gambling relates specifically to Hold’em. Further research should determine whether some problem/pathological gambling can be specifically related to certain types of gambling, and, further, determine how these individuals might display unique personality traits.

There are numerous measures used to determine gambling pathology, measures that distinguish between non-problem, some problem, and probable pathological gambling. The SOGS has weak predictive power of some problem gamblers; however, these criticisms are also true for other widely used measures of problem and pathological gambling, including the CPGI and the NODS (Williams & Volberg, 2014). The poor predictive power of gambling measures appears to be a result of divergent interpretations of concept operationalization and has implications for the

sensitivity of distinguishing between non-problem, some problem, and probable pathological gambling in the current study. Despite this, the SOGS continues to be widely utilized and preferred to newer measures, like the CPGI, which has faced criticism regarding its definitions and measurement approach (Svetieva & Walker, 2008). Further, the low internal consistency of the certain scales, particularly the experience seeking, disinhibition, and boredom susceptibility subscales of sensation seeking and the I-E scale, suggest that the measure may not in fact accurately reflect sensation seeking and locus of control and may, therefore, in turn limit the interpretability of the results.

The current study focused on a university sample, as university populations are particularly susceptible to problem gambling. Having a better understanding of gambling behaviours in this population allows a more holistic picture of how gambling pathology develops. However, this focus limits the generalizability of results. A longitudinal study could explore how locus of control and sensation seeking change as individuals engage in more problem gambling behaviours. Furthermore, the lack of comparison group of our sample to non-Texas Hold'em players limits the ability to infer comparisons of sensation seeking and locus of control between players and non-players.

The utility of personality traits as predictors of gambling pathology has been inconclusive. The results of our findings are limited because we only examined two factors known to be associated with gambling pathology. Future research should consider other dimensions of personality, and the potential for mediation and moderator effects. However, the numerous implications of locus of control and sensation seeking as predictors of gambling pathology warrant future research. Previous research has devoted insufficient focus on type of gambling activity as a moderator of gambling pathology and personality traits. Level of skill and luck involved in gambling has been largely ignored in gambling research. The skill-luck distinction has the potential to clarify the historically complicated relationship between gambling pathology and personality traits.

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Can We Expect More Students Dropping out of Education to Play Poker or Has Online Poker Become too Challenging?

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Abstract

Poker is a popular game, especially among male students. It is known to be highly time-consuming and might lead to players dropping out from education. Yet little is known about why it is so time-consuming. In this article, it is argued that developing and maintaining the requisite skill in poker is a continually ongoing process and the game is highly competitive. If a player is not capable of improving at the same or a higher rate as his or her opponents, that person will be bound to lose in the long run. Twelve young poker players and three “old-timers” were interviewed about changes in online poker and problems with combining poker and education. A thematic analysis was used, which concluded that prioritizing between poker and education can be understood in terms of a weight balance; if a student makes enough money from poker, then quitting school seems like a rational choice. If poker income decreases, then education becomes more important. Several of the informants have found themselves having to choose between poker and education. This study argues that poker has become more competitive and less popular in the last five years, making it harder to succeed as a professional player. Several of the informants described the poker population as more homogenous and with a higher level of skill than before. This, they claim, makes the game less profitable for the best players and that might reduce a student’s inclination to drop out of education.

Keywords: poker, dropout, education, excessive gambling, qualitative study

Résumé

Le poker est un jeu populaire, particulièrement auprès des étudiants masculins. On sait qu’on peut y consacrer beaucoup de temps et que ce jeu peut même mener à l’abandon des études. On s’explique pourtant mal les raisons pour lesquelles les joueurs y consacrent tant de temps. Dans cet article, on explique que ce jeu est très compétitif et que pour maintenir et développer ses compétences, il faut s’y adonner de manière assidue. Si un joueur ne parvient pas à s’améliorer au même rythme que celui de ses adversaires ou à un rythme plus rapide, il perdra à long terme.

Douze jeunes joueurs de poker et trois « vétérans » ont été sondés sur les changements dans le poker en ligne et les problèmes liés à la combinaison poker et études. On a utilisé une analyse thématique qui a permis de conclure que les priorités entre le poker et les études peuvent être comprises sur le plan de l'équilibre; si, par exemple, un étudiant fait assez d'argent au poker, quitter l'école semble alors être un choix rationnel. Si au contraire le revenu au poker diminue, les études deviennent alors plus importantes. Plusieurs personnes sondées ont révélé avoir eu à choisir entre le poker et les études. Cette étude fait aussi valoir que le poker est plus compétitif et moins populaire depuis les cinq dernières années, ce qui rend la réussite comme joueur professionnel d'autant plus difficile. Plusieurs ont décrit la population de joueurs comme étant plus homogène et ayant un niveau de compétence plus élevé qu'avant. Selon les répondants, le jeu serait devenu moins rentable pour les meilleurs joueurs, diminuant ainsi l'envie d'un étudiant d'abandonner ses études.

Introduction

Hardy (2006) describes a proliferation of poker in American colleges, with several students playing poker 10 hours or more a day, thereby leading to them falling behind in their classes. Several reports from both universities and colleges indicate the presence of a “poker craze,” one in which many of their students spend an excessive amount of time on poker (Brown, 2006; Hardy, 2006; McComb & Hanson, 2009). The “poker craze,” “poker boom” or “Moneymaker effect” all refer to the rapid rise of popularity poker had from 2003 to 2010. It all started in 2003 when the unknown amateur player Chris Moneymaker surprisingly won the most media-coveted and prestigious annual poker tournament, the World Series of Poker (WSOP) Main Event. From 2003 to 2006, global Internet poker revenues grew from US\$365 million to US\$2.4 billion (Monaghan, 2008) and it continued to grow to US \$4.99 billion in 2010 (Cook, 2016). A massive increase in live poker playing also took place. In a representative study of 2,139 Canadian full time undergraduate students, 366 (19.5%) had played poker within the previous year. Mihaylova, Kairouz and Nadeau (2013) conducted an analysis of these 366 poker players, in which they divided the players into two groups: those that had played only live poker (80%) and those that had played both online and live or only online (20%). Those that had played online experienced more educational problems and played at a higher frequency than those that only played live poker (Mihaylova et al., 2013). In a recent study of 909 college students from California, 47% of the male and 15% of the female students reported having played poker for money the previous year, making poker the most popular form of gambling among students (Shead, Derevensky, Fong & Gupta, 2012). As in the Canadian study, 80% of the poker players had only played live poker, nevertheless, 10% of the students considered online poker as a major problem among their peers (Shead et al., 2012). This finding shows us that, although live poker may be the more common, online poker may nevertheless be more related

to problematic gambling. Mihaylova et al. (2013) argues that the “poker craze” may lead to university students dropping out of school, thus creating a need for school prevention programs. According to Gupta & Derevensky (2008), the media are presenting poker tournaments as a sport, and among adolescents, the winners are seen as cult heroes. This might amplify the students view on poker as an alternative to education.

From 2008 and the following four years, the WSOP Main Event was won by players who had dropped out of college to become professional poker players a few years before their successes. Each of them received more than 8.5 million US dollars (in prize money). In 2008, Peter Eastgate (22) from Denmark won the tournament (Garcia, 2008). The following year the American Joe Cada (21) was the winner, leading to the newspaper *Dawn* to use as its heading for the story: “College dropout wins \$8.5 Mn” (2009). After a 23-year-old Canadian player finished in first place in 2010, a pokersite wrote: “The success of Jonathan Duhamel is proof that poker offers a chance for young people who want to make a decent living without attending college” (“Poker and the doors,” n.d.). The next year Bond (2011) from Dailymail reported that the 22-year-old German champion Pius Heinz almost quit the game to return to college before winning the bracelet, and in 2012 a similar “successful dropout story” was told by the American winner Greg Merson (26) to *The Washington Post* (Rosenwald, 2012; see also “Greg Merson wins,” 2012). Ryan Riess (23) from the United States broke the five-year-long consecutive winning strike of college dropouts in 2013. When asked if he ever planned to put his bachelor’s degree to work, he stated that he never even considered it because he had always known he was set to become a professional poker player (Willems, 2013; see also Slagter, 2013). The goal of this paper is to determine the probability by which we are set to see an increase or a decrease in the number of future students dropping out of post-secondary education to play poker.

Biolcati, Passini, & Griffiths, (2015, p. 19) describes online poker as one of the fastest growing forms of online gambling which have become increasingly more popular the last decade. However, statistics from online poker sites suggest that online poker has declined significantly after 2010 (Cook, 2016). I will address the reason for the decline in online poker later in the article.

This study aims to discuss whether online poker has become more competitive and less popular, thus making it harder to succeed as a professional player. It is therefore hypothesized that a decreasing number of students will drop out of college or university to play poker. Four young professional poker players, eight young amateur players, and three “old-timers” were interviewed as part of this study. The aim was to determine if young players were in fact struggling to combine playing poker with earning an education, and how the poker environment has changed during the last decade.

This article will discuss three questions:

- How do young poker players describe balancing studying and playing poker?

- Have they experienced changes in online poker?
- Do changes in online poker influence a student's inclination to drop out of education?

Poker is highly time consuming

In a game of poker, the result is greatly affected by the element of skill (Bouju, Grall-Bronnec, Quistrebert-Davanne, Hardouin, & Venisse, 2013; A. Parke, Griffiths, & J. Parke, 2005). The skill element and the way the betting is organized together make it possible for some players to win in the long run unlike most forms of gambling (Bjerg, 2010; Laakasuo, Palomäki, & Salmela, 2015; McCormack & Griffiths, 2011).

This is one of the main motivations for the players, but to develop these skills in poker requires substantial invested time than any other form of gambling (Laakasuo et al., 2015; Moreau, Chabrol, & Chauchard, 2016; Recher & Griffiths, 2012). As a result several studies have showed that poker may produce a new type of problem gambler, one who does not struggle financially, but instead spend so much time on poker that other parts of their life is affected, such as work, their relationships with others, and their education (Barrault, Untas, & Varescon, 2014; Biolcati et al., 2015; Bjerg, 2010; Griffiths, Parke, Wood, & Rigbye, 2010; Hing, Holdsworth, Tiyce, & Breen, 2014; Hing, Russell, Blaszczyński, & Gainsbury, 2015; Hopley & Nicki, 2010; Laakasuo et al., 2015; Shead, Hodgins, & Scharf, 2008). We have more knowledge of poker players with gambling problems than successful poker players. Treatment centers in Denmark report an increase of young poker players in need of treatment from virtually no patients in 2003 to 33% of their patients in 2009 (Bjerg, 2010). In a French survey 20% of the patients in a gambling treatment center were poker players, including 75% of the online players (Venisse & Grall-Bronnec, as cited in Moreau et al., 2016).

A survey of 179 online poker players (Hopley & Nicki, 2010), a qualitative study of 12 regular offline poker players (Vines & Linders, 2016), and a study of a high earning sub group of 31 online poker players (Hopley, Wagner, & Nicki, 2014) all found that the average player spent more than 30 hours a week on poker. Even though studies have shown that playing poker may be highly time-consuming and therefore affect the player's education (Biolcati et al., 2015; Bjerg, 2010; Griffiths et al., 2010; Hing et al., 2014), little is known about why poker is so time-consuming and how the poker players themselves describe their struggle to combine their studies with gambling.

Black Friday caused a decline in online poker

On April 15, 2011 the United States Department of Justice shut down some of the world's largest poker sites and made it impossible for players living in the United States to play online, poker players referred to this as "Black Friday" (Chumbley, 2012). Before black Friday the U.S. was by far the largest market for online poker

(Fiedler, 2013). This led to a massive decline in the number of online poker players and an international declining confidence in the online poker sites. Globally, the Internet poker gross gaming yield has declined from \$4.99 billion 2010 to \$3.87 billion 2014. The results for 2016 is expected to be \$3.53 billion (Cook, 2016; see also DellaFave, 2016).

A game with high variance

Palomäki, Laakasuo, & Salmela (2013) describes poker as a game with a very high variance. Over the long run the luck evens out and skill determines which players end up as successful (Palafox, 2016). However, in a short period of time, “luck” plays a huge part and feeling unlucky can be emotionally devastating (Palomäki et al., 2013; Palomäki, Laakasuo, & Salmela, 2012). The element of variance makes it harder for players to determine their own and other players’ skill level. A losing player may believing that he or she is just unlucky (MacKay, Bard, Bowling, & Hodgins, 2014). Boutin (as cited in Challet-Bouju et al., 2015 p. 210) illustrates that the impact of chance/variance is greatly affected by the skill gap between the players. When the players are evenly matched, chance becomes the dominant factor, but when there is a large skill gap, chance does not influence the results to the same extent. Since the opponents may improve their skills and their ability may vary from day to day, the game becomes more unpredictable.

Method

Participants

Four current or former young adult professional poker players, eight amateur young adult poker players, and three “old-timers” from different parts of Norway were interviewed using an exploratory qualitative interview study. All the participants have played poker for several years. They were recruited either through direct contact (all the “old-timers” and one of the poker professionals), advertisements during the first legal poker tournament in Norway with a cash prize (2015)¹, a Norwegian poker forum on the Internet, or snowball sampling. All the participants were male and all the interviews were conducted in Norwegian.

The term *old-timer* is used to differentiate them from newcomers, and emphasize their identity as experienced practitioners with a central position in the poker environment (see Lave, 1991, p. 68). These are part of a large network of poker players and combined they have experience from playing professionally before the “poker boom,” operating illegal poker clubs and discussion with most if not all of the famous

¹In Norway it is not illegal to play online poker although several attempts are made to make it difficult for the players to transfer money to poker sites. Live poker—that is, for real money—is illegal. In 2015, two exceptions to the rule was made: one annual national tournament was legalized, and private tournaments with a maximum of ten players and a modest buy-in (approximately USD \$115 per player) was allowed (for details see “Gaming in Norway,” 2017).

Norwegian players. The 3 “old-timers” ranged in age from > 35 to < 50 years, the 12 young poker players ranged in age between 20 and 30 with an average age of 25.5. The young players were categorized as professionals if they had had poker as their only income for over a year and earned a profit of more than USD \$100 000 from playing. If they did not meet these criteria, they were categorized as amateurs. All the informants had played Texas Hold’em extensively, but some of them had changed to a similar game named Omaha. One of the “old-timers” preferred other poker variants, but had significant experience in Texas Hold’em. Texas Hold’em is the most played form of poker and considered relatively easy to learn. Omaha has a bit more complexity and higher variance.

Data Collection

The interview guide consisted of twelve themes: the interviewees’ (1) introduction to poker, (2) preferred stakes format and frequency, (3) learning process and strategies, (4) potential problems related to playing, (5) online poker experience, (6) live poker experience, (7) intra game experience, (8) poker community, (9) combining poker with the life outside, (10) future poker expectations, (11) defining poker related concepts, and (12) closing remarks. Among the questions about potential problems and the combination of poker with the life outside (4) and (9), the balance between poker and education was especially emphasized. The interview was semi-directive, and its aim was to provoke the informants to talk spontaneously and to describe naturally as many of the aspects as possible, rather than letting the conversation be determined by the order of the interview questions.

After two pilot interviews minor adjustments were made in the interview guide and a few additional adjustments were made through the data collection. The first interview took place in October 2015 and the last in July 2016. Six of the interviews were conducted at the University of Oslo, six by telephone, and the last three at the informant’s workplace, the informant’s home, and the author’s home, respectively. Although the possibility cannot be excluded, there were no findings to indicate systematic differences in responses dependent on the interview location.

The interviews lasted for an average of 121 minutes. The shortest interview was 52 minutes and the longest 203 minutes.

Data Analysis

All the interviews were conducted and fully transcribed by the author. The whole corpus was 253,162 words with an average of 16,877 words per interview. The study was conducted after approval from the Norwegian Centre for Research Data (NSD), which is responsible for enforcing ethical guidelines. To gain an informed consent, all of the informants received an information sheet prior to the interview, which was either signed (face-to-face interview) or received verbal consent (phone interviews). All informants consented to an audio recording of the interview, and were invited to read through the transcriptions after the interview and to make comments.

In fact, three of the informants wanted to read the transcription, but none of the informants chose to provide comments. The informants did not receive any compensation for participating in the study. The program HyperTRANSCRIBE (version 1.6) was used for transcription and HyperRESEARCH (version 3.7.3) was used for analysis the data.

The interviews were then analyzed using thematic analysis (TA). This analysis is a method that aims at identifying, analyzing, and reporting the underlying themes within data (Braun & Clarke, 2006). The goal was to capture systematically important components within the data, and detect the patterned response. With TA, it is recommended that, during the coding, the researcher move back and forth between the data set and the coded extracts of data. This process can be performed either inductively (developing categories from the texts) or deductively (creating categories based on theoretical knowledge in the research field). A theme or code captures something important to the research question, and what is captured does not have to be dominant to be important. The aim of the study, and not the frequency, determines what is regarded as relevant (Braun & Clarke, 2006). Seven major themes and a total of 50 sub-themes were constructed. The majority of the major themes were constructed deductively and the majority of the sub-themes were conducted inductively. In addition, the informant's story went through a simple narrative analysis. This component of our method helped to determine changes in the poker economy and whether different players face the same challenges at different times.

The steps used in the TA in this study were inspired by Recher & Griffiths (2012) and Braun & Clarke (2006), but it also had a simple narrative approach (Riessman, 1993): (1) data transcription, (2) data familiarization, (3) short presentation of the informant's story using a simple narrative approach, (4) initial codes creation, (5) themes search, (6) themes review, and definition and naming of themes, and (7) report production.

The themes that are emphasized for this article are: (1) balance between poker and education, (2) volume, (3) personal story, (4) changes in online poker, (5) push and pull factors towards poker, (6) push and pull factors away from poker, and (7) poker versus education as weight scale. Each of the seven themes is described immediately below.

- (1) **Balance between poker and education:** This theme is the extent to which the informant believes that playing poker has led to him or her (a) being tired at school, (b) being absent from school, (c) not having enough time to study, or (d) dropping out of education, and how the informant reflects on combining playing poker with earning an education.
- (2) **Volume:** This theme is the amount of poker experience. Playing more will result in greater volume. Yet volume is not equal to time because playing poker online proceeds faster, especially when playing several tables at once.
- (3) **Personal story:** This theme is the informant's individual poker stories: (a) when he played poker for the first time, (b) when he decided to take poker seriously, (c) and how his career had subsequently developed.

- (4) **Changes in online poker:** This theme is how the informants describe changes over time in poker. Specifically, it addresses (a) how difficult it is to win money online, (b) how many players play online, (c) structural changes, or (d) changes in poker software.
- (5) **Push and pull factors towards poker:** Both long-term and short-term effects are identified.
- (6) **Push and pull factors away from poker:** Both long-term and short-term effects are identified.
- (7) **Poker versus education as weight scale:** The results are summarized in a model that describes the balance between playing poker or focusing on education as a weight scale, with push and pull factors described for both sides.

Results

Descriptive data and thematic choices

Among the twelve young poker players, four had or had had poker as their only income. This group was referred to as the *professional players*; the other group of eight was referred to as the *amateur players*. In Table 1, the groups and the pseudonyms of their respective members are presented, along with (1) each member's age, (2) the year the member started playing poker regularly, (3) each member's estimation of financial result from poker, and (4) to what degree time spent on poker has affected the player's education in high school and university.

The “old-timers” were accustomed to seeing changes over time in the poker world. They described how online poker was in the beginning and how the Norwegian and international poker environment subsequently developed. Oliver had a broad experience from poker and from several different games. He had been both an organizer and an amateur player. Oscar and Otto were former professional players and had played online and offline from before the poker boom.

Among the informants only Oliver reported having lost money in poker. Adam and Andy were a bit better in this regard than “break-even” players, and most of the informants claim that they had have made USD \$5,000–45,000. The four professionals and one of the “old-timers” all reported having won more than \$500,000.

Combining Poker with Education

Among the young players, 9 out of 12 had started on a bachelor's degree. Alfred (25) was missing a few courses from high school. Andy (20) and Arthur (26) had not yet started on a bachelor's degree but are planning to begin in a few years. Alfred played poker frequently during high school, both online on his computer during class and in his spare time. Nevertheless he claimed that poker had nothing to do with his dropping out of school.

All of the informants that have started on a bachelor's degree reported that poker in some way had affected their studies. For certain informants poker had had just a

Table 1
Presentation of the informants

	Name	Age	Started playing seriously	Income/loss \$ overall	Current/former professional poker player	Education affected high school	Education affected university	Interview location
Young professional players	Paul	30	2005	+ Ca 0.5 M	Current	No	Major	Telephone
	Peter	29	2004	> + 1 M	Former	No	Pause	University
	Patrick	28	2004	> + 0.5 M	Current	Minor	Pause	University
	Pierre	27	2006	> + 1 M	Current	Pause	End	Telephone
	Adam	30	2002	> + 0	No	Major	End	University
Young amateur players	Aaron	28	2005	Ca + 45 000	No	No	Pause	His Office
	Arthur	26	2005	Ca + 10 000	No	No	Not started	Telephone
	Alfred	25*	2009	> 0 (WNC')	No	Major	Not started	Telephone
	Andrew	23	2010	> + 10 000	No	No	Pause	Telephone
	Austin	23	2008	> + 5 000	No	No	Minor	Telephone
	Alex	21	2012	Ca + 20 000	No	No	Major	Author's home
	Andy	20	2013	> + 0	No	No	Not started	University
	Oscar	>40	1999	> + 0.5 M	Former	No	No	University
	Otto	>40	2002	WNC'	Former	No	No	His home
	Oliver	>35	2005	Ca - 50 000	No	No	Minor	University

* Alfred wouldn't reveal his age precisely but CLAIMED that it was between 20 and 30; to calculate a mean value he was given the age of 25. 'WNC' = Would Not Comment. All the professionals are given a name that starts with the letter P, the amateurs A, and the "old-timers" O. M=million (1 000 000) Ca=circa, approximately.

minor effect, but for others it led to them taking a pause or to drop out from their studies. A *minor* effect was typified as when the informant was unsure of whether poker has had an effect on education but nevertheless agrees that he had lost sleep and possibly skipped some homework because of poker. If the informant thought his grades would have been significantly better or his absences from school lower if he did not play poker it is then regarded as a *major* effect. *Pause* is if the informant claimed that he had taken a break or been delayed for at least one semester because of poker, but had since gone back and completed his planned education. *End* is if the informant had interrupted his education because of poker, and was not planning to resume his studies in the near future.

Several participants have found themselves in a dilemma where they had to choose between poker and education. We will first see how the poker professionals describe this process.

Paul (30) claimed that poker produced a major effect on his studies when he was a bachelor's student (around 2005). He was somewhat tempted at that time to quit school and become a poker pro but his "ferocious" parents demanded that he finish his university degree. After he finished his bachelor's degree, he did, in fact, become a full-time poker player. Today Paul regrets that he finished his degree in the "golden days of poker"² when many of his friends made substantial money playing poker. He claimed that online poker had changed extensively and dropping out today was completely different from how it used to be. Paul thought that his grades could have been meaningfully better if he had not invested so much time in poker.

Peter (29) had had the same dilemma as Paul (in around 2008), but he came to the opposite conclusion. He decided to quit school to become a professional poker player.

Peter: Well, I almost never showed up at school. Only once in a while. I did try to be there for the mandatory stuff. If I was playing well, I almost never bothered to go. This one guy I lived with attended the same study program, but we weren't exactly good at backing each other when it came to school, and we didn't need a good excuse to stay at home. So we stayed at home playing instead, and then I was at school a little. But not enough, really.

Peter estimated that he played at least 40 hours a week during this period. Even though he made a substantial amount of money, he nevertheless had tried to resume his studies several times, yet every time he ended up dropping out. He had had two main reasons for choosing poker over education: one was a strong almost physical urge to play, and the other a calmer and more calculated feeling of financial possibility:

Peter: There was this urge that you had to try again. And I thought about "milking the cow." I was conscious about that. To play a lot now because

²"The golden days of poker" is an expression used by several of the informants which refers to "when it was easy to make money playing poker online." The expression argues that, starting in 2003, after the poker boom, many of the players had inexpedient strategies. It is not totally clear exactly when "the golden days of poker" ended.

I knew that it wouldn't last. So trying to play a lot now because the plan was to start studying again when I stopped winning.

Pierre (27) started playing seriously in approximately 2006, when he was a high school student. He used to play about six to seven hours a day, four to five times a week, and since he played during the night, school became a challenge. As a result, he failed to finish one of his subjects and had to continue as a part-time poker player and part-time student. When selecting a bachelor's course, he wanted something that he could use to improve his poker skills. After a meeting with a student counselor he decided to study part-time over six years instead of three. He finished the first four years and then decided to quit school and play poker full time since so much money could be made.

The last poker pro is Patrick (28). Patrick stated that he was among the best students at his school when he attended junior high. But when he started high school he was suddenly a mediocre student.

Patrick: And there I stayed for three years and nothing really changed while playing poker. But if you're asking whether it affected my education when I did my bachelor's degree in ... [withheld to ensure anonymity] then yes. Absolutely! Do I regret it? Not really. Because I knew, I was aware what was happening.

He played poker frequently and had problems with his bachelor's thesis, so he decided to take a break from his bachelor's studies and moved to another European city after reading about the city in a poker forum online. He did not know anyone there and his parents were less than pleased with his decision. But he stuck to his plan and got back home after six months and finished his degree, before returning to playing poker full time. He claimed his bachelor's thesis was so poor that it was embarrassing, but at least he did not fail. He had had poker as his only income since then.

As we can see from the three poker professionals who either dropped out or took a break from their studies, this was a decision they did not regret afterwards. The only professional who regretted his choice was Paul, and he was the only one who decided to stay in school.

The professionals' thoughts about combining poker and their studies seem somewhat reversed from what society regards as the more responsible choice. From society's point of view, they should put education first and then play poker in their spare time, just like Paul's parents demanded of him. Paul followed their advice and stayed in school but now regretted this because he believed he accordingly missed out on a substantial amount of money.

Peter claimed that he knew all along that the poker times were almost too good to be true and that it could not last. He therefore played as often as possible and then returned to school when "the golden days of poker" were gone. When Pierre was about to choose a topic to study at the university, he wanted something that could

help his poker abilities. In all of these stories poker came first when choosing between poker and education.

Adam (30) started on his bachelor's degree in 2007 and spent 8 to 10 hours per day playing poker instead of studying. He tried again a few years later with the same result. He described himself as a little bit better than a breakeven player. He claimed that the hard part about quitting poker was to find something else to replace it with. He also made the point that dropping out of school to play poker was not something he planned, it just happened. He claimed further that he has never been late or absent from work because of poker because "then you are responsible for others than yourself." He was now working full time, and plays substantially less poker than he once did, but nevertheless still spent a considerable amount of time playing the game.

Alex was nine years younger than Paul and was now facing the same dilemma that the poker professionals did several years ago. Alex (21) spent 25 hours per week playing poker and he knew that this was affecting his studies.

Alex: I think I need to make up my mind whether I should play even more to become really good, or whether I should play less and do it as a hobby and perform well at school instead. Because it affects my performance at school. It has to, in a way, if you want to be good at it. I need to take a deep look at myself and figure out what I want.

Author: Is it a close call?

Alex: Not really. I would never quit studying to play poker. But I want to play a lot of poker, and it is an important part of my life. I think it's fun, it's useful, and it's actually practical mathematics.

Alex, as opposed to the poker professionals, held the opposite position: education came first. Nevertheless, he was not willing to give up completely on poker although he knew it affected his academic performance.

When asked in what way poker affected their academic performance, the informants highlighted time as the most problematic factor. Among the other factors mentioned was the issue of circadian rhythms, since online poker typically took place in the evening and nighttime (European time), thus making it difficult to anticipate how long a poker tournament³ will last. A tournament can last for several hours and you never know whether you will be knocked out within the first minutes of the tournament or if you will stay in it for the whole run.

Alex: [...] you're not getting much use from a lecture at 08:15 if you've been playing until 06:15.

³Poker comes in two formats; cash games and tournaments. In a cash game each player may collect his chips (money) and leave the table at any time he pleases. In tournaments however, the game continues until one player has all the chips, making it hard to estimate how long the game is going to last.

When Alex talked about a poker tournament that lasted until 06:15 am, it meant that he had been knocked out of a tournament substantially later than he had expected to be. This again meant that he had had a highly successful poker night. As we can see, success for Alex at the poker table then had a negative impact on his education the next day. Peter described that early in his poker career, when he had periods with a good poker result, he did not bother to go to school. This is the same idea in a prolonged period of time. Later Peter indicated that he had to “milk the cow,” which meant that he had put his education on hold for some years so he could earn as much as possible for as long as his poker success continued. This was, however, not a shift Alex was considering at the moment:

Alex: Studying doesn't get easier and I can't really imagine playing poker full time at any point. So I may need to reduce my playing in order to get acceptable grades. My study program is actually quite heavy. So the question is whether I'm willing to play less, and if I actually go through with it if I'm tempted to play more. I don't know how easy it would have been to just quit. I do think about poker every day, a little. So I've been asking myself whether I'm addicted and I guess that I am. But then I thought, that by my own definition, you would not be addicted if you didn't lose money. But I think that if I didn't make money from it, if I was just losing, then I wouldn't think it was fun and I would have quit. But my plan is not to become a worse player.

Here Alex reflected on whether it was possible to have a gambling problem and win money in poker simultaneously. Alex ended the statement with the belief that he would not enjoy poker if he were not winning. This happened to Peter and Oscar (> 40) and neither of them reported any problems with quitting poker when they stopped earning money. Patrick changed from online to offline when the income decreased, indicating that the players are able to adjust if the profit stops.

Austin (23) claimed he had completed the education he had planned to take, so for him poker did not have much effect, but of course he would have received considerably more sleep if it were not for poker.

Andrew (23) quit his studies for his bachelor's degree and spent a considerable amount of time playing poker. He was unsure whether he quit because he did not like the subject he was studying or because poker was so time-consuming. He had moved to another city because of education and continued to stay there, making most of his money from underground poker clubs. He had now started his studies again and was quite sure he would not drop out this time. One of the reasons he claimed, was that he was not a good enough player:

Andrew: No, right now I'm not good enough. And it's not just that. I also want to do other things. There are more things in life that interest me. And it takes a lot to become really good. It's very hard to be a student when you're playing poker full time, and I guess many people are not managing that very well. You hear about the dropouts, and you've been dedicating a lot of time to it. And not

had time enough for school. I don't want that; I want to get an education and get work experiences.

Aaron (28) reported that poker especially affected his studies one semester when he was a bit stuck trying to complete his master's thesis. This had led to a half-year delay in his studies, but Aaron thought the delay could have another cause were it not for poker.

Andy had not yet started on a bachelor's degree. When asked if he would like to become a poker professional, he replied that it was not a particularly realistic scenario even though was tempting.

Andy: Yes of course it is. To not have to get an education and all of that, and just do what you love. If you can make a living from your hobby, then that's awesome. You're always thinking about it, but it's not something I think can happen unless I do great in a tournament.

Author: Is it a big amount that would make it happen?

Andy: Yes, and it's usually like that with everyone. All professional players have usually had that one tournament that gave them the opportunity. So you just have to wait for that.

Author: Do you talk about that? Making a living from poker? Do people in your circle of friends?

Andy: Yes, I think so. But don't believe they think it's realistic. When you're small and playing soccer and want to play for United when you get older. But not many actually do that.

Here Andy described being a poker professional as a dream many young players maintain, even though they do not think it will in fact happen, and compared it to being a professional sports athlete. Earning an education was somehow second-best and the more realistic alternative. None of the amateur players in this study considered it realistic to become poker professionals. Austin thought he might have a chance playing live poker in another country but that he had no chance online. Adam and Aaron believed that they could have had a chance online in "the golden days of poker," but not anymore. And as we have seen, Andrew claimed that he was not good enough and that he wanted to do other things than playing poker full time.

Among the players that have started on a bachelor's degree, all of them answered that they spent considerably more time on poker during their bachelor's studies than they did during high school. Only Pierre believed that poker, though it had indeed affected significantly his studies in high school, nonetheless had affected his bachelor's degree in this regard even more. Several reasons exist for this phenomenon. Many of the informants had moved away from home between high school and studying for a bachelor's and therefore now had substantially more freedom in deciding how to spend their time. A bachelor's curriculum is more loosely organized than is a high

school one, with fewer mandatory assignments. There is an 18-year age limit to play poker with money online so most of the informants did not play with frequency during high school.

There seems to be a broad agreement among the informants that, to become a successful poker player, the player must obtain significant volume. This requires the contribution of a considerable amount of time and, if online, playing several tables at the same time (multi-tabling).

If the other players train and develop their skills by playing more, the player in question risks falling behind. To become a professional player, investment of a substantial amount of time is essential. This is a fact players use both as an argument for playing frequently and as an argument for not pursuing a career in poker. Oliver (> 35) talked about a recognition he made early (2011) in his career when talking to a friend who was a professional poker player:

Oliver: If he didn't play poker during the weekend, he would spend a week to achieve the same win rate that he had before the weekend. That's how quickly the game evolved. And it was then I realized that I would never have the time for that. I will never be able to spend the time and energy needed to become a pro.

Patrick describes how poker became more challenging, especially online, and what kind of commitment that challenge consequently made necessary. He illustrated this fact with an anecdote about an encounter he once had with another professional poker player at the beach:

Patrick: He said he played poker four to five hours online every day, and studied poker for one to two hours. It was like a full work day every day. And this was at the beach; it was around half past three when he went home to play. To read and play. On a beautiful summer evening at Huk in Oslo. And then I thought that if this is what it takes then I will never get there. Because I've never had that level of dedication during my poker career. Yes, I've played a lot, and talked a lot, but I've never been very structured, maybe because the people I played against were bad enough that I didn't need to. I should have done it but didn't need to.

Pierre described how it was hard to spend time with his girlfriend when the games were good.

Pierre: During the week we could agree to go to a movie on Friday, but when Friday arrived I was playing six tables and making \$2000 an hour and I felt that I just had to cancel.

He felt that it was irresponsible to give up on the opportunity when he made that kind of money. Of course Pierre did not make \$2000 per hour most of the time he played. In fact the poker income was highly unstable, which made it even more necessary to prioritize poker before everything else when such conditions occurred.

Such a situation contributes to making it difficult to combine poker with education or one's life outside.

Pull and Push Factors Balancing Poker and Education

To capture the dilemma described by the informants' choosing between playing more and becoming a poker professional or playing less and focusing on education, we use the figure of a weight scale. There are push and pull factors on both sides of the scale, because studying harder and playing more can both be tempting. The scale is also affected by both stable and unstable effects.

A stable effect is something that is more or less always there and the unstable is something that is changing rapidly. Parents' opposition to poker is viewed as a rather stable effect, unlike emotional well-being, which can be unstable. Income from poker was described as highly unstable on a weekly basis but stable on an annual basis. Push factors represent the feeling of almost being forced, and the pull factors represent a desire.

Broad agreement existed among the informants that poker can be emotionally exhausting. Since coincidence plays a huge part in the short-term result (in other words, the game has a high variance), all of the informants had experienced periods when everything was perfect (good runs) and dreadful periods when nothing worked (bad runs). Luck (variance) is a force that evens out over a long period of time, but can be difficult to handle over a short one. Periods when the informants were "running good" could lead to the informants becoming more eager, with a strong flow of dopamine, and greater personal excitement. "Bad runs" were described by a feeling of nausea, anger, regret, sorrow, and problems with making the right decisions. If they had been "running bad" for a long time it typically instigated a bad mood, uncertainty about their own capability, more resistance from family and friends, problems with defending their investment in poker, and a feeling of being sick and tired of the game. When the opposite was the case, it led to a feeling of high confidence, more acknowledgment from the other players, and a feeling of invincibility. It was common to take breaks in periods when they were unsuccessful but not in periods when they were winning more than normal. In short, more success leads to more play and less success to considering taking a break or quitting.

Has online poker changed?

The professionals and the "old-timers" all described poker as considerably more challenging now than it was five years ago (2011–2016). One of the reasons for this was "Black Friday" April 15, 2011, when online poker was shut down in the United States, and certain poker sites were closed permanently. This event led to a large decrease in online player liquidity, in part because of the high proportion of US players across online poker sites, and in part because of a global decline player trust for poker sites.

Peter claimed it almost seemed as if he had lost his job.

Peter: [...] most of those you won a lot of money from were not there anymore. So my job kind of disappeared. And also Everest [poker site] moved to another network with plenty of good players and I felt like I couldn't find the old players. It was like my workplace closed down. That feeling. So I thought that I had to do something else.

He did not describe giving up poker as challenging, but it proved hard for him to sit down and read a book after being used to playing 6 to 12 poker tables simultaneously and becoming accustomed to a considerable amount of stimuli. He still had not completely stopped playing poker, but he had stopped making money. He took with him a huge profit from his poker days and had invested this in stocks, a car, and an apartment.

Pierre claimed that he used to spend 70 hours a week playing poker a few years ago, but finding good games had become more difficult, therefore he now spent only around 40 hours a week playing. This shift started after Black Friday, and he believed that poker had slowly become more challenging. Before 2011, there were many players, even at the highest stakes, that had little poker experience, and therefore became an easy target for the poker professionals, according to Pierre. Now at best they met excellent players who were used to another form of poker (tournament players playing cash game or Texas Hold'em players playing Omaha). Since the games on the highest stakes had disappeared, Pierre had been forced down to lower stakes and as a consequence he made less money. Changes in rake, rake back, and bonuses from the poker sites had also decreased the player's profit. All of the poker professionals claimed that they had made less money the last two years than before 2011. None of the amateur players are even close to making as much money as the professionals did when they started playing. According to Paul, it would be extremely unwise to leave school or college today to become a professional poker player.

Paul: I wouldn't quit my studies in 2015 to play poker if I didn't have an exceptional gift for it.

Author: How were things 5 to 10 years ago?

Paul: I would say it was madness to even study at all. That's my greatest mistake. I saw many of my friends become dollar millionaires with little effort and they asked me why [I was studying]. But I felt that it was something I should do in life because I was raised that way. So it was a coincidence that I ended up playing semi-professionally and making \$3–4,000 a month as a side job.

Oscar was one of the "old-timers," and when asked about the difference between making a living from poker in 2007 and 2016, he responded:

Oscar: If you took the best quarter of the players they might have been able to learn how to make a living from it.

Author: And how many is that today?

Oscar: A fraction. The market is so saturated that those who work really hard might earn \$10 an hour or something like that. And you might be happy about that if you're from Asia, China, or Russia. They are many and they push it down to that level. They're good enough to win a little. And there are few enough bad players so that's where the equilibrium is.

Oscar was a poker professional from 2003 to 2013 and claimed professional playing was no longer worth the personal investment.

Paul had moved to Asia because of poker and tax issues. He was not optimistic about the possibility of making a living from poker in the future. When asked if he knows many other poker professionals, he answered:

Paul: When I live down here there's a good amount. In Norway it's fewer and fewer. I think the trend will continue, unfortunately. I think that poker as a career will be dead in Norway in two years. I can explain why, if you want me to?

Author: Yes, please do.

Paul: The poker economy is declining. The pros are moving down in stakes. And to live a good life in Norway, and for poker to still be worth playing, you have to earn a good amount of money. It is quite hard to get there. And poker is changing, and these other countries have more incentives than we do. They're just as good, so we are falling behind.

According to Paul, in other countries many people were happy to make \$10 per hour.

Otto (> 40): Online is not the same as ten years ago. Ten years ago making money was easy online if you had basic knowledge and basic patience.

As an explanation, Otto emphasized poker software, which offered statistics on how the players were playing, and the fact that the poker population in general had become more experienced. It all contributed to making the games more evenly matched and the variance larger. When the games were more even, they would consequently last longer and the casino would make more (from rake), leaving correspondingly less money for the players. With the decrease in new players fewer weak opponents were now playing, thereby making a game more difficult for all of the players. The new players who did enter the site would now have a greater chance of running into more experienced players and therefore have a greater chance of losing their money faster. Since losing players often quit playing, the poker economy always needs to recruit new players. Patrick had a somewhat long but excellent explanation on why poker had become gradually more challenging after the poker boom (2003).

Patrick: The thing is that during the poker boom there were a lot of new players who had seen poker on TV. Most of the player base consisted of new people

who wanted to try poker. Not a lot of them knew what they were doing, but there were some who understood that if this is happening, that these players are joining and they don't know what they're doing, then it's possible to earn a lot of money. ... So, some people sat down, thought about strategies to beat them. And big Internet forums were created where we could discuss. And then the skill level increased, and then they thought we can make money not just from playing but from making videos that people pay to watch. And people watch those videos too and raise their skills further and realize what works and what doesn't. People are getting better and there aren't as many new players, and the player base is more homogenous. There's a big industry with coaching sites, authors that make a living from poker books, poker on TV, and it makes players become even better. So the player base is all moving up in skill, and then in the US, they ban poker so the supply of new players is cut off. And those at the bottom of the player base are now suddenly so bad that they have to stop playing because they're just losing money. So it's all compressed in a way. You're left with quite decent players who can survive online without the same supply of new players compared to what you had before.

The three remaining poker professionals interviewed were considering retiring within the next few years. All of them described their poker income as significantly decreasing during the last few years. This was especially true for Patrick, who reported that his income the last year had been like a "badly paid part-time job." Difficulties with combining family life with an unstable poker income are also mentioned by several informants. None of them wanted to end up as an old professional poker player. Among the hobby players and the youngest players few have a dream of becoming a poker professional.

Austin made money by playing at illegal poker clubs on the weekends against drunken players, but he considered online poker as too challenging to make a profit.

Austin: [...] and I've felt that I'm stagnating online, and I lose that spirit, you know. I know what the level is like; I've played a lot online, and I have a lot of friends who play online. And I know that it's very hard. ... I have 25 to 30 friends who play online and none of them profit in the long run.

If we return to the poker versus education weight scale, the informant's description suggests that the weight balance between poker and education had changed considerably in the last decade. If gamblers do indeed believe that poker becomes more competitive and less profitable, this belief may tilt the scale from pursuing a career as professional player to staying in college or university.

Discussion

This study is, to my knowledge, the first to invite poker players to elaborate on whether they have struggled with combining poker and education. This article aimed to discuss three questions:

What Makes Combining Poker with Education Difficult?

The results from the interviews suggest that the main reason why poker can produce a negative effect on education is the large amount of time the players need to invest in the game. To be successful as a player, one must keep up with one's opponents, and do so through two ways: frequent playing, and the consequent development of playing skills. The importance of investing time to develop poker skills has previously been discussed by several other authors (Jouhki, 2011; McCormack & Griffiths, 2011; Recher & Griffiths, 2012). An elaboration on this idea is to understand poker as a relative skill where the relevant ability is the player's skill compared to his or her opponents. To become better is not enough if other players improve at an equal or higher speed. The higher the level a player is on, the more important it becomes for him or her to invest more time. In this way, poker success becomes a reinforcing process, as it leads to better concentration, more confidence, and higher skills, all of which in turn lead to greater success. In the poker hierarchy, taking a break from poker could be costly.

Choosing between poker and education could be understood as a weight scale where both short-term and long-term success in poker may produce a negative effect on education. Short-term success can lead to longer periods of playing and affect the circadian rhythm since it is hard to quit when the game provide excitement or satisfaction. Since it is also hard to quit a game while winning, long-term success may consequently lead to dropping out of education. Or as Bjerg (2010) puts it, poker players are chasing wins.

Poker seems to have a higher priority than education among the best players even though several of them have attempted to combine the two. All of the professionals are considering retiring within a few years because the income from poker has decreased. It may come as a surprise that former successful and highly competitive players find giving up poker an easy choice if the income decreases. To understand this we should look at the downsides of poker described both by the informants as well as earlier studies. The game has a very high variance as Palomäki et al. (2013) have pointed out (see also Palafox, 2016). Short-term and long-term losses can be emotionally devastating (Palomäki et al., 2013; 2014). As Boutin (as cited in Challet-Bouju et al., 2015) proposes, when the game becomes more evenly matched, chance becomes more important. This fact makes playing more psychological challenging and less financially rewarding. It seems like both the professionals and amateurs have an ambivalent relation to poker. Therefore, if the income disappears, it pushes the weight scale towards not prioritizing poker. For the older players, at least some of this shift might be because of the age factor. It is not uncommon to desire a family and more stability at the start of one's thirties; it is, however, interesting that the players in their early twenties were less keen on becoming poker professionals, indicating that the changes in poker itself were also a contributing factor to this decline.

Difficulties with predicting how long a poker tournament is going to last and poker's effect on an individual's circadian rhythms may cause a short-term effect on

education on days that players are more successful than normal. As an example, the largest weekly online poker tournament (Sunday Million on Pokerstars) starts at 19:30 GMT and lasts for approximately 10 hours. If a player is successful in this or similar tournaments, his (or her) sleep will be greatly affected. If he is not, then chances of him being tired of poker at least for a short period of time decreases and he gets the sleep he needs.

The informants argued that, unlike education, poker is changing. Taking a break from poker to finish your education would greatly affect the gambler's chances to become a successful poker player. To the gambler, taking a break from education instead therefore seems as a less risky path.

Has online poker become more challenging?

The vast majority of the informants claim that making money from online poker has become considerably more difficult the last five years. According to the poker scale figure Figure 1, a decreased income will result in less poker playing. To my knowledge no previous study has discussed whether online poker has become more challenging. The topic is, however, often widely discussed in poker forums and poker news sites.

According to the informants, among the reasons why online poker has become more challenging are the growth in experience of the poker population, legal issues concerning American players, more software programs to help the players, and new players settling for less profit. There is also a huge industry creating and promoting poker videos and books, one that makes the new (and old) players more aware of strategies. Players with poor strategies today will more quickly lose their money than they would have during the "poker boom" (2003–2006) because the players they compete against have more developed skills. This leads to fewer new players coming in to the poker sites and that again makes the games more evenly matched. The importance of playing against inferior players for the professional players is earlier discussed by McCormack & Griffiths (2011) as well as Vines & Linders (2016).

If the players are evenly skilled, their games will become longer and more money will become rake at the casino. The former successful players will have a reduced income and former breakeven players will therefore be losing players and might retire. The player population therefore consists of a more homogeneous group making it harder to become successful.

Do changes in online poker affect a student's inclination to drop out of education?

In this study several findings suggest a decrease in students quitting school to play poker. Among the amateur players few had the ambition to become professional players. The youngest player claimed that the situation somewhat matches becoming a professional soccer player: it is an achievement many persons dream about but not an achievement they believe will ever happen.

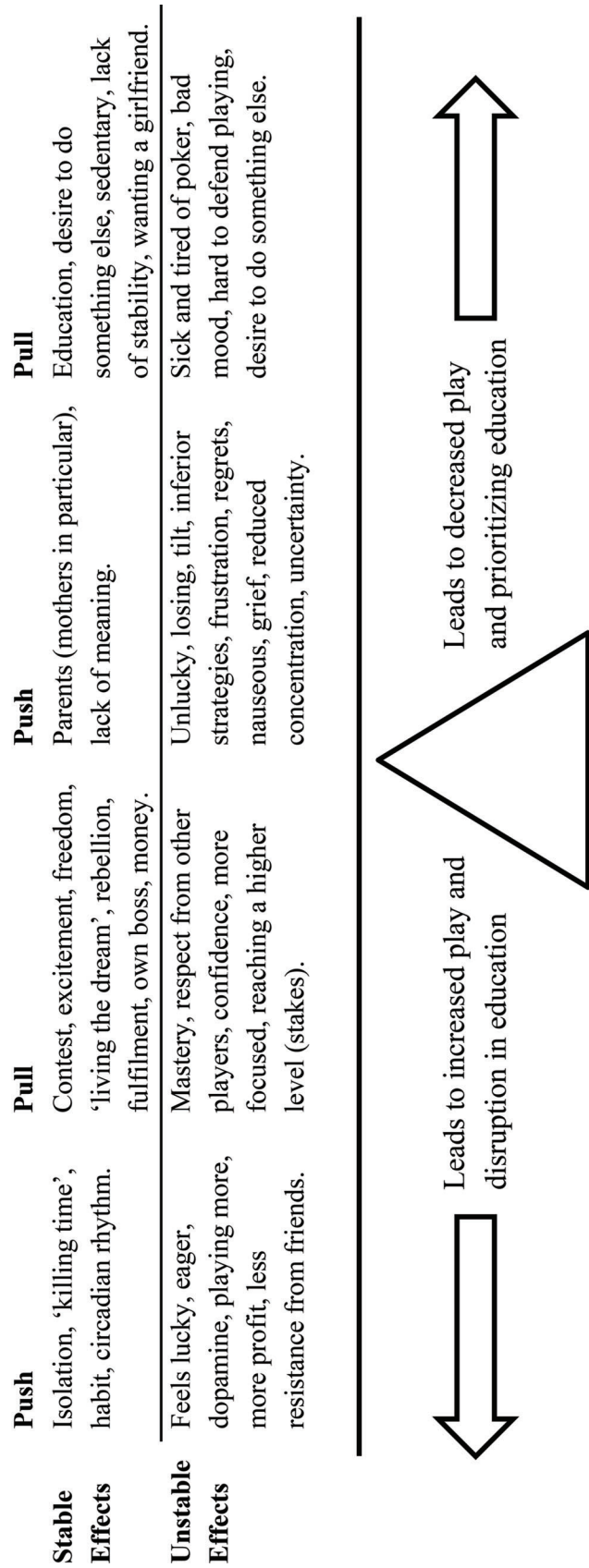


Figure 1. The poker versus education weight balance.

The professional players all dropped out of school after a significant poker income. None of the amateur players had a poker income that was anywhere close to the professionals' income when the professionals were the same age. Both amateurs and professional players reported that it is exceptionally challenging to make money online now compared to "the golden days of poker."

It is, however, possible that an increase in former semi-professional players no longer able to make a profit from online poker, and therefore in need of a different occupation or education, will take place. Such a rise may also increase the number of poker players in need of treatment, since breaking even or making a small profit is harder than it was prior to 2011. We might see a decreasing number of poker players at the same time as a higher share of the poker population is in need of treatment.

When approaching a young player who is considering becoming a poker professional, informing them of how the online poker has developed towards a less profitable direction and the experienced players feeling a lack of meaning and experiencing a struggle that is far from glamorous might be fruitful.

Conclusions

This study includes several limitations. The informants interviewed are generally successful professional players or successful amateur players. Only one of the informants admitted an overall loss of money playing poker. The informants were not representative for poker players in general. Different countries maintain different tax rules and poker laws, thus the potential to become a professional poker player may differ depending on country. The players commanded generally long experience and had worked hard to develop their respective poker skills. With fewer strategic players as part of the study, the results would accordingly have been different. No attempts were made to control the accuracy of the informants' personal stories and no psychometrics testing or diagnostic gambling tests were conducted.

Since this is an exploratory interview study with a small number of informants the research design is not suitable for generalizations and casual explanations. It is however possible to make assumptions and generate hypotheses. The three main hypotheses generated from the informants' stories were as follows. (1) To succeed in poker the player requires an excessive amount of time, dedication and structure. As a consequence it is difficult to combine poker playing at the highest level with studies and leisure time. (2) The online poker base has gradually become more experienced, skilled and homogeneous after the poker boom, making the game more competitive. After "Black Friday" a decrease in new players entering the poker sites has taken place. This shift amplifies the challenges to gaining a profit. (3) Since online poker has become less profitable, we are likely to expect a decrease in the number of students dropping out to play the game, and an increase in former professional poker players who retire. More research is needed to determine if these findings could be reproduced or elaborated on by other studies. To understand better how a dedication

to playing poker affects students' lives, we need research on poker players' learning processes, as well as their and variety of learning methods. Understanding the poker players' perspectives may be highly valuable for prevention and treatment of gambling problems.

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A coordinated health communication campaign addressing casino and sports gambling among undergraduate students

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Abstract

Research has outlined many negative effects of disordered gambling. While gambling disorder exists among all US sociodemographic groups, college students are particularly vulnerable. This study describes a health communication approach commonly studied in the intervention of college behaviors such as risky alcohol/substance use and sexual activity. Specifically, two health communication messages targeting casino and sports betting disordered gambling were distributed at a Midwestern US public research university, and central intercept techniques were utilized to collect quantitative and qualitative data assessing student reception. Results revealed females preferred the casino message more than males ($U = 4696.50, p < .05$) and stated more often that the advertisement would appeal to friends ($U = 4745.50, p < .05$). Individuals who lost more money than they intended to lose 1–2 times understood the message more than those persons who never gambled ($U = 946.50, p < .05$) and those persons who never lost more than planned ($U = 249.50, p < .05$). Students who first gambled at ages 16–18 liked the casino message less than those students who first gambled at 13–15 ($U = 208.00, p < .05$) and the students who had never gambled ($U = 1656.00, p < .05$). For the sports betting message, the only significant association was between students' understanding of the advertisement and race/ethnicity ($\chi^2(5) = 14.095, p < .05$). Based on our findings, we suggest a health communication approach might be effective to raise awareness about gambling disorder among college students. We recommend researchers develop targeted materials with support of college administrators to deter disordered gambling.

Keywords: gambling disorders, college students, health communication, public health, college health

Résumé

La recherche a mis en relief de nombreux effets négatifs du jeu pathologique. Bien qu'on retrouve des problèmes de jeu dans tous les groupes sociodémographiques américains, les étudiants constituent une classe particulièrement vulnérable. Cette étude décrit une approche de communication sur la santé qui est couramment étudiée pour effectuer des interventions sur les comportements à risque observés dans les collèges et universités, tels que la consommation d'alcool ou de drogues et l'activité sexuelle. Plus précisément, on a distribué deux messages sur la santé ciblant les jeux de hasard et les jeux de paris sportifs dans une université de recherche publique du Midwest américain, et on a eu recours à des techniques centrales d'interview pour recueillir des données quantitatives et qualitatives évaluant la réception des messages par les étudiants. Les résultats ont révélé que les femmes ont préféré les messages du casino davantage que les hommes ($U = 4696,50, p < 0,05$) et ont plus souvent dit que l'annonce intéresserait les amis ($U = 4745,50, p < 0,05$). Les personnes qui ont perdu au jeu une à deux fois de plus que prévu ont davantage saisi le message que ceux qui n'ont jamais joué ($U = 946,50, p < 0,05$) et que ceux qui n'ont jamais perdu plus que prévu ($U = 249,50, p < 0,05$). Les étudiants qui ont joué pour la première fois entre 16 et 18 ans ont moins aimé le message du casino que les étudiants qui ont joué la première fois entre 13 et 15 ans ($U = 208, p < 0,05$) et que les étudiants qui n'avaient jamais joué ($U = 1656, p < 0,05$). Pour le message sur les paris sportifs, la seule association significative était celle entre la compréhension de l'annonce par les étudiants et la race/l'origine ethnique, $\chi^2(5) = 14,095, p < 0,05$. Selon nos constatations, nous sommes d'avis qu'une approche de communication sur la santé pourrait être efficace pour sensibiliser les étudiants aux problèmes du jeu. Nous recommandons donc aux chercheurs de concevoir du matériel ciblé, avec le soutien des administrateurs de collèges et d'universités, pour dissuader les comportements de jeu pathologique.

Introduction

Numerous forms of gambling exist, including lottery, casino games, slot machines, bingo, card playing, sports betting (including office pools), and informal gambling among friends (National Center for Responsible Gaming [NCRG], 2012). Accordingly, the diversity of options and inherent risk involved with gambling yields the potential for gambling-related problems. Estimates place the number of individuals in the United States who either currently suffer from or have suffered from a pathological gambling disorder in their lifetime at 0.6 percent, and an additional 2.3% have suffered from some non-diagnosable problem with gambling in their lifetime (Kessler et al., 2008). The fifth edition of the *Diagnostic and Statistical Manual of Mental Health Disorders* (DSM-5) defines gambling disorder as the “[p]ersistent and recurrent problematic gambling behavior leading to clinically

significant impairment or distress,” as indicated by four (or more) criteria in a 12-month period (American Psychiatric Association [APA], 2013).

Gambling is a common activity among young people, approximately 86–93% of adolescents having gambled in their lifetimes for money (Derevensky, Gupta, & Winters, 2003). Given their age and often-newfound independence, college students in the United States enjoy many opportunities to engage in potentially damaging behaviors. Their experiences may range from basic experimentation to a consistent gambling habit, one potentially leading to more excessive forms of disordered gambling (Stinchfield, Hanson, & Olson, 2006). Various studies have confirmed the regularity of gambling behaviors among this demographic, with prevalence rates ranging from 42%–75% of college students engaging in this behavior in the past year (Barnes, Welte, Hoffman, & Tidwell, 2010; Blinn-Pike, Worthy, & Jonkman, 2007; Engwall, Hunter, & Steinberg, 2004; LaBrie, Shaffer, LaPlante, & Wechsler, 2003). A meta-analysis of 15 studies from 1999 to 2005, representing nearly 10,000 college students, estimated the proportion of gambling disorder among college students to be approximately 8% (Blinn-Pike et al., 2007). The authors argued that the rise in gambling over the past few decades was partially because of increased access. This suggestion was similarly echoed by the findings of LaBrie et al. (2003), in which the authors found college students with two or more forms of legalized gambling in the state of their respective institutions were 1.65 times more likely to gamble. Additionally, Blinn-Pike et al. (2007) predicted the rates of gambling disorder would continue to rise within this demographic group because of the increased number of legal gambling venues and opportunities, a prediction confirmed in a later meta-analysis by Nowak and Aloe (2014) that estimated 10.23% of students to be probable disordered gamblers.

The negative effects of gambling disorders among college students extend beyond just the potential to incur debt. Among one sample, Engwall et al. (2004) noted that gambling disorder was positively associated with heavy drinking, tobacco and marijuana use, and negative consequences resulting from alcohol consumption. Derevensky and Gupta (2004) found that problem gambling in college can lead to consequences such as tense interactions, delinquency, and unlawful comportment, all outcomes with both short and long term repercussions for both the individual and college society as a whole. Students with gambling disorder also have higher risk for severe depression, increased alcohol and substance abuse, severe anxiety, and suicide (Derevensky & Gupta, 2004), with one other study finding that students with gambling problems were twice as likely to report considering or attempting suicide (Stuhldreher, W. L., Stuhldreher, T. J., & Forrest, 2007). Although research has suggested college students may not differ significantly from the overall population of young adults in terms of general gambling behaviors (Barnes et al., 2010; LaBrie et al., 2003), the cumulative lifetime effects for college-aged disordered gamblers might be greater.

Accordingly, public health approaches are needed to address this complex behavior. Under this paradigm, researchers and practitioners can address gambling-related

problems via harm reduction strategies in an effort to minimize the deleterious consequences associated with gambling (Messerlian, Derevensky, & Gupta, 2005). Specifically, a health communication intervention can yield a favorable cost-to-benefit ratio, given that researchers can use the approach to reach large number of individuals quickly. Health communication is defined by the Centers for Disease Control and Prevention (CDC, 2011) as “the study and use of communication strategies to inform and influence individual decisions that enhance health” (para. 12). Although health communication alone is usually not sufficient to alter such macro-level social variables, as the availability of gambling venues in an area or the adoption of legal policies that address gambling, it is nonetheless particularly useful in educating, informing, and empowering individuals who may be more susceptible to engaging in particular risk behaviors (Parvanta, C. F., Nelson, Parvanta, S. A., & Harner, 2011).

Health communication media campaigns have been used extensively to address alcohol and other substance abuse among college students (Churchill, Pavey, Jessop, & Sparks, 2016; Quick & Bates, 2010), and they have been shown collectively to have small, yet significant effects on behavior change for both addictive and non-addictive behaviors (Snyder, Hamilton, Mitchell, Kiwanuka-Tondo, Fleming-Milici, & Proctor, 2004). Nonetheless, a dearth of research exists using these strategies to address problem gambling behavior among college students and youth, compared to other risk behaviors such as tobacco use, unsafe sexual behavior, and substance abuse (Messer, Shoe, Canady, Sheppard, & Vincus, 2011; Scheier & Grenard, 2010; Scribner et al., 2011; Witkiewitz et al., 2014). In one of the few published studies in this area, McKinley and Wright (2012) discovered that college campus counselling services employed health communication messaging as an intervention strategy to address gambling among college students much less frequently compared to other common behaviors such as alcohol and other drug use.

Further, of the little health communication focus that has been applied to problem gambling among college students, one primarily suggested strategy is targeting underage gambling advertising and promotion (Byrne, Dickson, Derevensky, Gupta, Lussier, 2005; Friend & Ladd, 2009; Lemarié & Chebat, 2012). Byrne et al. (2005) described that health communication messages that denormalize gambling may have a positive impact on youth knowledge, attitudes, and behavior, similar to what has been demonstrated for other risk behaviors such as substance abuse, unsafe sexual practices, and eating disorders. More specifically, Munoz, Chebat, and Suissa (2010) also demonstrated that fear appeal health communication messages are effective in positively influencing attitude and intention to practice safer gambling behavior among video lottery terminal users. Yet researchers have suggested the effectiveness of fear appeals might depend on an individual’s perceived risk regarding a specific behavior (Andrews, Netemeyer, Kees, & Burton, 2014). Collectively, the few existing research findings support the need for continued testing of gambling disorder messages on college campuses to help determine what approaches college students perceive as being most appealing, understandable, and effective at reaching their peer groups. Noar (2006) found that health communication media campaigns were more

likely to be successful if campaign designers conducted this sort of formative research with their target populations.

Perhaps because of lower levels of awareness about gambling disorder among college students (as compared, for example, to alcohol or drug abuse), few university administrators have either created policies related to gambling on campus or have formally addressed potential gambling disorders among their student populations. Shaffer, Donato, LaBrie, Kidman, & LaPlante (2005) discovered that out of 119 colleges examined, only 26 schools featured an explicit gambling policy. Furthermore, McKinley and Wright (2012) reviewed college counselling centre websites and found only 15% contained any information about gambling disorders, with only 1% of those websites displaying information about gambling on their main homepage. Overall, campus officials typically direct their resources towards the prevention and treatment of alcohol and other drugs; however, gambling is an emerging issue affecting substantial numbers of students.

Since universities often have limited funds available to address multiple college health issues, many universities might never fund larger interventions addressing gambling issues. Given the comparative low cost, a health communication campaign is an excellent first step towards increasing awareness. Student feedback on media messages can be incorporated into the design of future materials (Noar, 2006), and it can also be used to inform targeted interventions using other approaches beyond health communication. First, though, formative data must be collected to help researchers better understand the target population. Accordingly, this exploratory study sought to assess student response to two messages created as part of a coordinated disordered gambling health communication campaign at a large public research university in the Midwestern United States. Included in this study is a detailed description of the creation of the media messages, collaborative strategies used to disseminate the campaign, as well as the positive and negative student responses to the campaign.

Method

After approval by the university's institutional review board, two health communication posters targeting gambling disorders among undergraduate students were created for this study. Posters were created by researchers in conjunction with the problem gambling director and administrators from a local mental health and substance abuse treatment facility. After agreeing upon message themes, content, and layout, both posters were pilot tested using theatre testing in undergraduate university courses to assess initial student reactions. Students in each university course used for pilot testing were shown both of the posters. After making minor adjustments to graphics and layout based on pilot testing feedback, the university's director of residence life approved the two posters for distribution throughout on-campus residence halls. A total of 40 posters (20 per message) were placed in prominent areas (e.g., bathrooms, bulletin boards, study areas, hallways) of four undergraduate residence halls by residence hall directors and residence assistants. The first message was displayed for one week, and at the conclusion of the

dissemination period, central intercept testing (i.e., one-on-one interviews with the target audience) was conducted by teams of two individuals who were trained by members of the research team. Team members were instructed to collect as many surveys as possible during a two-hour block of time; specifically, they approached undergraduate students in the atriums of the residence halls as they entered or exited, showed them a copy of the poster, and invited them to complete central intercept surveys. The instrument included questions about whether students noticed the advertisements hanging throughout the residence halls, as well as if they liked, understood, and were influenced by the posters' messages. The surveyors explained the purpose of the study and obtained participant consent prior to student completion of the survey. Upon completion of this first set of interviews, the entire process was repeated to assess student response to the second health communication poster within the same four undergraduate residence halls.

Messages

Two poster advertisements were designed for this health communication campaign. One targeted casino gamblers and featured a slot machine with three reels indicating the word "Broke." The poster's tagline was "What are the odds?" written in heavily stylized font, and its byline implored students, "To talk to someone about your gambling, call..." and featured the telephone number for a local mental health and addiction services organization that provided treatment for gambling disorders. The word "gambling" was emphasized via capital letters and different colored font.

The poster targeting sports gamblers featured three racially diverse young males watching a television screen intently, one of whom is holding a basketball with images of money superimposed on it. To emphasize further the targeted behavior, the image presented a basketball court and hoop in the distance behind the men. The tagline read, "Having trouble rebounding from your losses" and the word "rebounding" was emphasized with capital letters and different colored text. The byline was the same as in the other advertisement, including the emphasis of the word "gambling" and the telephone number of the treatment agency.

Although the research team wished to test and distribute additional messages related to college student gambling, only casino gambling and sports betting were addressed because of time and funding constraints. These topical areas were chosen because a casino had recently been opened in the metropolitan area of the study, and NCAA March Madness, a basketball tournament often associated with "bracket pool" betting, was taking place contemporaneous to the study. Because of time and budgetary constraints, as well as having to work within university administration timeframes and guidelines, these two messages were prioritized over other possible options (e.g., informal poker games, lottery).

Measures

Questions on the first part of the survey were derived from a previously content-validated message-testing instrument that was found to be reliable across different

undergraduate health risk behaviors (Domigan, Glassman, Miller, Hug, & Diehr, 2015; Glassman et al., 2013). In the present study, students responded to the following open-ended questions: “What is the very first thing you noticed when you looked at the ad?”; “In a few words, what does this ad ‘say’ to you?”; “What do you think the people who created this ad want you to know?”; “What do you think the people who created the ad want you to do?” and, “What suggestions do you have that would make the ad better?” Eight questions assessing message comprehension, believability, likability, appeal, quality, third-person effect, and topical relevance were measured using a 4-point Likert scale, ranging from “strongly disagree” to “strongly agree.”

The final portion of the survey contained two sets of questions: demographics, including gender, age, academic year, and race/ethnicity; and information about participants’ gambling behaviors. In particular, students were asked the following questions: “In the past year, how many times have you lost more than planned when you gambled?”; and “At what age did you first gamble for money or possessions?”

Analysis

Responses to open-ended questions were organized thematically, and comments were coded as recommended by Creswell (2012). Apart from the principal investigator, two other members of the research team analyzed the data for themes, initially agreeing on 90% of the coding. After debriefing and discussion, all researchers came to 100% consensus. Items measured with Likert scales were analyzed first for normality. Upon discovering that response patterns did not conform to the Gaussian distribution, data were analyzed nonparametrically using Kruskal-Wallis H tests for analyses featuring ordinal dependent variables and Mann-Whitney U tests for those with dichotomous dependent variables. When Kruskal-Wallis H tests were significant, ordinal groupings were analyzed in pairs to determine specific differences.

Results

Sample Demographics

Table 1 displays the demographic information of the total sample. A total of 431 participants completed the central intercept surveys; approximately half assessed the casino message ($n = 214$), while the other half assessed the sports betting message ($n = 215$). In both groups, just under half of the participants (41% and 40%, respectively) reported that they had seen the posters hanging up in their residence halls during the previous week. Overall, participants were predominantly first-year students (71.7%), Caucasian (65%), under 21 years old (88.2%), and evenly split between males (49.2%) and females (49.9%). Nearly 34% had gambled in the last year, and 11.2% of those individuals reported losing more than intended at least one time in the past year. Regarding age of gambling initiation, approximately 10% of the sample first gambled for money or possessions before 13 years of age.

Table 1
Demographic Characteristics of Total Sample

Demographic Characteristics		<i>n</i>	%
Gender	Male	212	(49.2)
	Female	215	(49.9)
	Transgender	4	(0.9)
Age	18-20	380	(88.2)
	21-23	48	(11.1)
	24 or older	3	(0.7)
Academic year	1st Year	309	(71.7)
	2nd Year	70	(16.2)
	3rd Year	31	(7.2)
	4th Year	16	(3.7)
	5th Year	5	(1.2)
Race/ethnicity	White/Caucasian	280	(65.0)
	Black/African Descent	101	(23.4)
	Hispanic/Latino	15	(3.5)
	Asian/Pacific Islander	13	(3.0)
	South Asian	1	(0.2)
	Other	2	(0.5)
Lost more than planned in the last year	Multi-Racial/Multi-Ethnic	19	(4.4)
	N/A (Didn't gamble)	285	(66.1)
	0	98	(22.7)
	1-2	35	(8.1)
	3-4	5	(1.2)
	> 5	8	(1.9)
Age student first gambled	> 13	42	(9.7)
	13-15	37	(8.6)
	16-18	68	(15.8)
	19-21	19	(4.4)
	> 21	3	(0.7)

Note: *N* = 431

Descriptive Statistics

Tables 2 and 3 display the results for each of the message assessment questions, suggesting that students found both advertisements appealing. They understood, believed, and liked each advertisement; moreover, they thought the advertisements would appeal to their friends, were of professional quality, discouraged disordered gambling, and encouraged someone with a problem to seek treatment. The observed student responses for both messages differed significantly from the hypothesized normal distribution. For the message focused on casino gambling, results for the aforementioned characteristics were as follows: understanding ($\chi^2 = 193.963$, $p < .01$), believability ($\chi^2 = 136.318$, $p < .01$), liking ($\chi^2 = 157.813$, $p < .01$), appeal to self ($\chi^2 = 70.449$, $p < .01$), perceived appeal to friends ($\chi^2 = 74.112$, $p < .01$), quality ($\chi^2 = 159.794$, $p < .01$), discouraged disordered gambling ($\chi^2 = 84.879$, $p < .01$), and encouraged treatment ($\chi^2 = 87.084$, $p < .01$). For the message pertaining to

Table 2
Descriptive Statistics for Casino Advertisement

	Strongly Agree		Agree		Disagree		Strongly Disagree		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Understanding	122	(57.0)	83	(38.8)	7	(3.3)	2	(0.9)	214	(100)
Belief	84	(39.3)	106	(49.5)	21	(9.8)	3	(1.4)	214	(100)
Likeability	65	(30.4)	123	(57.5)	23	(10.7)	3	(1.4)	214	(100)
Appeal (Friends)	40	(18.7)	103	(48.1)	54	(25.2)	17	(7.9)	214	(100)
Appeal (Self)	50	(2.4)	102	(47.7)	45	(21.0)	17	(7.9)	214	(100)
Quality	96	(44.9)	103	(48.1)	13	(6.1)	2	(0.9)	214	(100)
Discourages Gambling?	76	(35.5)	95	(44.4)	33	(15.4)	10	(4.7)	214	(100)
Encourages Treatment?	93	(43.5)	81	(37.9)	27	(12.6)	13	(6.1)	214	(100)
Total	626	(36.6)	796	(46.5)	223	(13.0)	67	(3.9)	1712	(100)

Note: *n* = 214

Table 3
Descriptive Statistics for Sports Betting Advertisement

	Strongly Agree		Agree		Disagree		Strongly Disagree		Total	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Understanding	97	(45.1)	101	(47.0)	15	(7.0)	2	(0.9)	215	(100)
Belief	60	(27.9)	142	(66.0)	12	(5.6)	1	(0.5)	215	(100)
Likeability	38	(17.7)	130	(60.5)	39	(18.1)	8	(3.7)	215	(100)
Appeal (friends)	22	(10.2)	107	(49.8)	72	(33.5)	14	(6.5)	215	(100)
Appeal (self)	29	(13.5)	102	(47.4)	66	(30.7)	18	(8.4)	215	(100)
Quality	65	(30.2)	114	(53.0)	29	(13.5)	7	(3.3)	215	(100)
Discourages gambling?	54	(25.1)	97	(45.1)	58	(27.0)	6	(2.8)	215	(100)
Encourages treatment?	84	(39.1)	109	(50.7)	17	(7.9)	5	(2.3)	215	(100)
Total	449	(26.1)	902	(52.4)	308	(17.9)	61	(3.5)	1720	(100)

Note: *n* = 215; Some percentages may not add up to 100 percent because of rounding.

sports betting, the findings were thus: understanding ($\chi^2 = 154.098, p < .01$), believability ($\chi^2 = 229.819, p < .01$), liking ($\chi^2 = 155.772, p < .01$), appeal to self ($\chi^2 = 81.279, p < .01$), perceived appeal to friends ($\chi^2 = 107.102, p < .01$), quality ($\chi^2 = 121.949, p < .01$), discouraged disordered gambling ($\chi^2 = 77.558, p < .01$), and encouraged treatment ($\chi^2 = 143.158, p < .01$). Students predominantly agreed or strongly agreed with most of the message assessment questions (Table 2, Table 3).

Inferential Analysis

For the advertisement focused on casino gambling, there were significant associations between various demographic variables and the responses to the central intercept questions (Table 4). Specifically, females (mean rank = 114.27, *Mdn* = 3) liked the advertisement more than males (mean rank = 97.81, *Mdn* = 3) ($U = 4696.50, p < .05$) and stated (mean rank = 113.80, *Mdn* = 3) more often than males (mean rank = 98.27, *Mdn* = 3) that the advertisement would appeal to their friends ($U = 4745.50, p < .05$). A Kruskal-Wallis H test revealed students' understanding of the advertisement differed by how many times they had lost more than planned in the past year ($\chi^2(4) = 11.271, p < .05$). Particularly, individuals who lost more than planned one or two times (mean rank = 97.92, *Mdn* = 4) understood the advertisement more than those who never gambled (mean rank = 77.71, *Mdn* = 4) ($U = 946.50, p < .05$) and those who gambled without losing more than planned (mean rank = 29.92, *Mdn* = 3), ($U = 249.50, p < .05$). Lastly, students' liking of the advertisement differed by the age they first gambled for money or possessions ($\chi^2(5) = 12.730, p < .05$). Specifically, students who first gambled at ages 16–18 (mean rank = 24.28, *Mdn* = 3) liked the advertisement less than students who first gambled at 13–15 (mean rank = 32.76, *Mdn* = 3) ($U = 208.00, p < .05$) and students who had never gambled (mean rank = 88.76, *Mdn* = 3) ($U = 1656.00, p < .05$). No significant associations were found between the responses to the central intercept questions and age or race/ethnicity.

Table 5 displays the results of inferential tests for the sports betting advertisement. No significant associations existed between the central intercept responses and the following variables: gender, age, academic year, having lost more than planned in the last year, and age when student first gambled. A significant association was found, however, between students' understanding of the advertisement and race/ethnicity ($\chi^2(5) = 14.095, p < .05$). In particular, white students (mean rank = 71.83, *Mdn* = 3) understood the advertisement more than Hispanic students (mean rank = 40.75, *Mdn* = 3), ($U = 223.50, p < .05$).

Thematic Analysis

In response to the open-ended questions on the central intercept survey, participants highlighted images for each message they considered to be most prominent. In the casino advertisement, they stated the poker chips, casino table, and slot machine were most noticeable, whereas in the sports betting message, they noticed the three men,

Table 4
Inferential Results for Casino Advertisement

Advertisement Assessment	Understanding		Belief		Likeability		Appeal (friends)		Appeal (self)		Quality		Discourages gambling?		Encourages treatment?	
	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>
Gender	.432	.511	.071	.790	4.933	.026^a	3.951	.047^a	2.817	.093	.285	.593	.591	.442	.878	.349
Age	1.132	.568	.412	.814	2.00	.398	2.370	.306	2.131	.345	2.634	.268	5.668	.059	.985	.611
Academic Year	5.437	.245	2.425	.658	2.273	.686	5.194	.268	6.701	.153	4.176	.383	13.929	.008^b	1.578	.813
Race/Ethnicity	3.908	.689	4.546	.603	6.871	.333	2.123	.908	1.720	.944	6.031	.420	4.121	.660	5.062	.536
Lost more than planned in last year	11.271	.024^c	6.214	.184	2.959	.565	1.322	.858	4.282	.369	5.180	.269	3.258	.516	.900	.925
Age student first gambled	2.772	.735	5.920	.314	12.730	.026^d	6.341	.274	5.786	.328	2.692	.747	6.546	.257	8.132	.149

Notes: Results from Kruskal-Wallis H Test. All results significant at $\alpha = .05$.

a. Females more than males liked the advertisement and thought it would appeal to friends.

b. Post-hoc Mann-Whitney U comparisons found both 1st year and 2nd year students thought the message discouraged gambling more than 4th year and 5th year students.

c. Post-hoc Mann-Whitney U comparisons found individuals who lost more than planned 1–2 times understood the advertisement more than those who never gambled and those who gambled without losing more than they planned.

d. Post-hoc Mann-Whitney U comparisons found students who first gambled at ages 16–18 liked the advertisement less than students who first gambled at 13–15 years old and students who had never gambled.

Table 5
Inferential Results for Sports Betting Advertisement

Advertisement Assessment	Understanding		Belief		Likeability		Appeal (Friends)		Appeal (Self)		Quality		Discourages gambling?		Encourages treatment?	
	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>	χ^2	<i>p</i>
Gender	1.144	.285	3.379	.066	.499	.480	.158	.691	.606	.436	2.435	.119	3.760	.052	1.638	.201
Age	.089	.957	1.338	.512	1.470	.479	2.727	.256	2.442	.295	1.579	.454	2.108	.349	1.778	.411
Academic Year	1.640	.802	1.546	.819	1.348	.853	1.397	.845	5.966	.202	5.964	.202	3.993	.407	2.499	.645
Race/Ethnicity	14.095	.015^a	9.873	.079	2.710	.745	2.103	.835	6.978	.222	5.137	.399	5.233	.388	9.128	.104
Lost more than planned in last year	.727	.948	2.303	.680	1.059	.901	6.696	.153	4.928	.295	2.980	.561	9.326	.053	3.279	.512
Age student first gambled	3.755	.440	2.882	.578	2.161	.706	4.022	.403	5.747	.219	1.297	.862	7.493	.112	2.467	.651

Notes: Results from Kruskal-Wallis H Test. All results significant at $\alpha = .05$.

a. Post-hoc Mann-Whitney U comparisons found white students reported understanding the advertisement more than Hispanic students.

the basketball court, and the basketball most often. They overwhelmingly responded both advertisements' messages emphasized risk vs. reward considerations:

"You have a better chance of going broke than winning."

"Gambling, though tempting, can be dangerous."

"Sports gambling has serious consequences."

Additionally, they understood both posters' goal of raising awareness about gambling disorders among college students:

"[I should] self-evaluate to see if I have a gambling addiction."

"It is important to gamble responsibly."

"Gambling affects college students daily."

There were, however, a few criticisms about the advertisements as well. Certain students were concerned that the bright images in the casino advertisement could unintentionally promote gambling, thereby acting as a trigger to students who might already have a gambling disorder:

"I thought it was promoting gambling at first. It makes gambling look fun."

"Make it more clear that [the advertisement] is to help people."

For the sports betting advertisement, concerns were expressed that the individuals portrayed in the image were all males, men who some presumed to be athletes themselves:

"Women have this problem also."

"Only men who play sports have a gambling problem."

Nonetheless, the qualitative feedback for both posters was overwhelmingly positive—though more so for the casino advertisement—and participants understood the advertisements were intended to raise awareness of gambling disorders among college students as well as to provide them with linkage to treatment options.

Discussion

Based on the limited availability of research, there is an evident further need to explore the impact that health communication interventions may have on problem gambling behavior among college students. To create more focused and effective materials, researchers must conduct *message testing* with the target audience to assess perceived effectiveness, appeal and general understanding of the information (Noar, 2006). Accordingly, the purpose of the present research study was to describe a disordered gambling health communication campaign for undergraduate students at a large public research university in the Midwestern United States, including the creation of materials and student reactions to the messages featured in the campaign.

Two posters were designed for this purpose, one focusing on casino gamblers, and the other targeting individuals who engage in sports betting. Messages were placed in well-travelled locations in four undergraduate residence halls for one week per poster, and immediately following each message's dissemination, undergraduate students were approached and asked to fill out central intercept surveys assessing their reactions to each message.

Students responded particularly favorably to the casino gambling message; however, certain students noted that the flashy and bright images could inadvertently urge students to gamble. Indeed, to avoid iatrogenic effects, message designers must achieve balance between using captivating images, while addressing the problematic behavior (i.e., gambling) rather than potentially normalizing it or promoting it. Also, students who self-reported they lost more than planned said they understood the message more than those who had neither gambled nor lost more than planned. Since regularly losing more than intended is a warning sign of gambling disorder (APA, 2013), future campaign designers might consider using messages focused on this particular antecedent behavior.

Furthermore, females were more receptive to the message, underscoring the need for continued research on messages and images that appeal most to each gender, perhaps related to various factors that motivate each gender to gamble, in concordance with the findings of Korn, Gibbins, & Azmier (2003). When subsets of the target population (such as males and females) differ in response to message-testing variables, segmenting the audience by major demographic characteristics can help to ensure more impactful and targeted health communication messages (Noar, 2006). Consistent with the findings from the current study, research has shown that males are between two and five times more likely than females to be problem gamblers (Barnes et al., 2010; LaBrie et al., 2003), and they are more likely to have an overall higher gambling debt than other college males if they are members of Greek organizations (Stuhldreher et al., 2007). As such, it is critical that the creators of future health communications campaigns utilize approaches that might better target these subsets.

Finally, students who had only recently begun gambling were less receptive to the casino advertisement. Nonetheless, it is crucial to continue targeting this particular demographic with messages, given the research suggesting that students who begin gambling problematically in college have a greater likelihood of remaining as problem gamblers throughout adulthood (Shaffer & Hall, 2001). Since students in this age group are likely living independently for the first time, researchers must continue to employ educational strategies that both emphasize the seriousness of problems related to gambling while not offending the target audience. Korn et al. (2003) noted that individuals with greater household income participated more frequently in gambling, though individuals in lower income households spent more. College students paradoxically might fit into both categories, given that many likely come from families of middle to high socioeconomic status in which gambling has

been normalized yet are living independently—or semi-independently—for the first time with fixed incomes.

With the poster highlighting the risks associated with betting on sports (in this campaign, betting pools for college basketball were targeted), there were fewer demographic differences in students' assessment of the message, the primary finding being that white students understood the advertisement better than Hispanic students did. Among the general United States population, the percentage of disordered gamblers is higher among blacks and Native Americans (Alegria et al., 2009), and among young adults, studies have suggested that minority groups are more likely to gamble than their white counterparts (Barnes et al., 2010; Rinker, Rodriguez, Krieger, Tackett, & Neighbors, 2016; Stinchfield, 2000). Therefore, more attention to cultural inclusiveness and diversity regarding health communication materials is needed to improve effectiveness. Regarding gender, one predominant criticism both males and females had was the focus of the message on men. Nonetheless, though students often seek equal gender representation in communication materials, health practitioners must segment their audience to target those most affected by a particular health issue, much as commercial marketers do with their products (Institute of Medicine, 2002; Lee & Kotler, 2011). In this case, previous researchers support the decision to target males for this specific gambling behavior. For example, one national study conducted by Welte, Barnes, Wieczorek, Tidwell, & Parker (2002) found that, with regard to sports betting, men not only gambled more frequently, but also enjoyed larger wins and losses.

Implications

The findings from this message-testing study underscore the need to conduct more research on gambling health communication campaigns, as this behavior is not as studied among college students nearly as often as other addictions using these techniques. Additionally, these formative data can be used to develop future health communication media materials or to inform other potential interventions among college students. Using the findings from existing research on how income affects gambling might provide useful insight in researching college settings in greater detail, since many college students come from middle-to-upper class families yet, upon entering college life, easily can find themselves short of money. Hence, there remains particular need for awareness campaigns addressing the addictive dangers of gambling, especially with college students just beginning their academic careers. Along with providing formative research data, the present study represents one method of building awareness of gambling disorder among college students, particularly considering the low priority often given to gambling disorders as compared with alcohol and substance use issues. At the very least, this study's findings can provide college administrators with evidence that students are generally receptive to messages about disordered gambling.

Wider-reaching health communication campaigns that target other gambling behaviors, especially more informal types (e.g., lottery tickets, informal card or

dice games), should be implemented and audience-tested as well. Researchers should continue to explore using diverse channels, such as currently popular forms of social media and students' existing social networks, to disseminate messages and assess the most effective channel for gambling-related health communication. Perhaps, too, the creators of future campaigns might consider disseminating messages in locations outside of the residence halls, specifically in areas that might be visited more frequently by students 21 years of age and older. Ultimately, upon identifying students' preferred messages (and media formats), researchers should consider using experimental or quasi-experimental designs to determine which of the preferred messages are more effective at producing desired behavior change. Finally, as various researchers have explored the impact of injunctive and descriptive social norms beliefs on gambling behavior (see Larimer & Neighbors, 2003; Meisel & Goodie, 2014), to date no one has assessed the efficacy of a social norms message specifically tailored to gambling. Further, in alignment with Noar's (2006) recommendations for future studies, it may be beneficial to create messages that address the perceived approval of students' reference groups (such as friends, family, and authority figures) related to this behavior, as college students tend to be more motivated by proximal rather than distal norms.

Limitations

The findings from this study should be interpreted with a few limitations in mind. First, the survey instrument measured student perceptions of the messages (e.g., likability, believability, understanding) using single item scales. Although the questions were used previously in other message-testing studies (Domigan et al., 2015; Glassman et al., 2013) and were initially designed following Lee and Kotler's (2011) message-testing suggestions, multi-item scales might allow for a more accurate understanding of student perceptions. Second, no additional psychometric testing was conducted for this specific study; it should be noted, though, that the instrument was shown to be reliable for health communication campaigns across other risk behaviors in similar college populations. The wording of the portion of the instrument that assessed message response was written generically (e.g., "What do you think the people who created this ad want you to know?") and did not include gambling-specific questions, which were collected only in the demographics section.

Furthermore, this study was implemented at only one Midwestern university in the United States and did not include a control group, so the results cannot be generalized to all college students. Even though the survey instrument itself was anonymous, given the nature of self-reported data, it is possible students responded in a socially desirable manner, especially since many respondents were under the age of 21 and may have engaged predominantly in illegal forms of gambling. Another limitation is that only two types of gambling behaviors (i.e., casino gambling and sports betting) were addressed in this campaign; these were chosen for two primary reasons: the existence of a casino in the metropolitan area and the beginning of NCAA March Madness, a basketball tournament often associated with "bracket pool" betting. Because of time and budgetary constraints, as well as having to work

within university administration timeframes and guidelines, these two messages were prioritized over other possible options (e.g., informal poker games, lottery). To address other gambling behavior, additional tailored messages should be developed and tested, preferably using a control or comparison group. Additionally, since no identifying information was collected, it is possible that certain students who responded to the first poster message may have also responded to the second message, thereby providing them with a frame of reference by which to compare the two posters. It is possible that those students may have responded differently from students who had only seen one of the posters. Furthermore, students who chose not to participate in the study at all may have differed significantly from those who agreed to fill out surveys. Finally, all associations discovered in this study were correlational in nature; consequently, no causal links can be inferred.

Conclusions

This health communication campaign assessed student response to two health communication posters addressing casino gambling and sports betting that were created by university researchers in conjunction with gambling counselors from a local mental health and substance abuse treatment facility. Coordinated health communication campaigns have been used successfully to address various other addictive behaviors—such as high-risk drinking and drug abuse—among college students, and public health practitioners should continue using these approaches, applying similar principles to disordered gambling behaviors. Researchers can use findings from this study to target specific subsets of the college student population, developing customized messages for demographic groups that are either disproportionately affected by, or vulnerable to, gambling disorders. When messages have been appropriately tailored to subsets of the college student population, targeted multi-faceted interventions should be created and fully evaluated using experimental or quasi-experimental designs. Regardless, when developing messages and determining their related distribution channels, special emphasis should be directed towards race, ethnicity, gender as well as idiosyncratic issues concerning gambling.

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The Modified Gambling Motivation Scale: Confirmatory Factor Analysis and Links With Problem Gambling

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Abstract

The Gambling Motivation Scale (GMS), a scale based on self-determination theory, consists of seven motivations: to learn the game, to feel competent, to experience excitement, to socialize, to feel important, to win money, and to continue gambling aimlessly (Chantal, Vallerand, & Vallieres, 1994). The GMS has never been tested with confirmatory factor analysis to determine the appropriate structure of gambling motivation. In the present study, we developed the Modified Gambling Motivation Scale (MGMS) to improve the reading comprehension and psychometrics of the GMS. We also proposed a simpler interpretation of motivation scores than that applied to the previous scoring system. Confirmatory factor analysis, structural equation modelling, and measurement invariance were performed on the GMS and the MGMS, which suggested that six motivations were distinct and important to gambling behaviour: to experience an intellectual challenge (combined motivations to learn and to feel competent), to experience excitement, to socialize, to feel important, to win money, and to continue gambling aimlessly. This six-factor structure of gambling motivation aligns more closely with self-determination theory and removes problems with estimations in the seven-factor structure. The results showed that gamblers who were motivated to experience excitement and to socialize had more problem gambling than did other gamblers.

Keywords: gambling motivation, problem gambling, confirmatory factor analysis, structural equation modelling, criterion-related validity, measurement invariance, Modified Gambling Motivation Scale, Gambling Motivation Scale

Résumé

L'Échelle de motivation envers les jeux de hasard et d'argent, fondée sur la théorie de l'autodétermination, est constituée de sept motivations : apprendre le jeu, se sentir compétent, vivre une expérience excitante, socialiser, se sentir important, gagner de l'argent et continuer à jouer pour le simple plaisir (Chantal, Vallerand, et Vallières, 1994). La structure de l'échelle n'a jamais été soumise à des tests avec analyse

factorielle confirmatoire pour déterminer la structure appropriée de la motivation du jeu. Dans la présente étude, nous avons mis au point une échelle modifiée de motivation de jeu pour améliorer la compréhension de la lecture et la psychométrie de l'échelle. Nous proposons également une simplification de l'interprétation des pointages de motivation par rapport au système précédent. L'analyse factorielle confirmatoire, la modélisation de l'équation structurelle et l'invariance de mesure ont été réalisées sur les deux échelles de motivation, et les résultats démontrent que six motivations étaient distinctes et importantes pour le comportement du jeu. Il s'agissait des motivations relatives au défi intellectuel (combinées à des motivations d'apprendre et de se sentir compétent), de vivre une expérience excitante, de socialiser, de se sentir important, de gagner de l'argent et de continuer à jouer pour le simple plaisir. Cette structure de motivation envers les jeux à six facteurs correspond davantage à la théorie de l'autodétermination et supprime les problèmes d'estimation avec la structure à sept facteurs. Les résultats ont montré que les joueurs qui étaient motivés à vivre une expérience excitante et à socialiser avaient plus de problèmes de jeux compulsifs.

Introduction

People are motivated to gamble for various reasons, but which motivations can lead to problem gambling? Research suggests that emotions, social connections, monetary gain, self-worth, and intellectual challenge are commonly related to gambling behaviour (e.g., Chen, Wu, & Tong, 2015; Francis, Dowling, Jackson, Christensen, & Wardle, 2015; Lee, Chae, Lee, & Kim, 2007; Neighbors, Lostutter, Crouse, & Larimer, 2002; Stewart & Zack, 2008; Wu, Tao, Tong, & Cheung, 2012). Because gambling is a source of entertainment, people often use it to cope with negative feelings and to induce positive feelings such as excitement and thrills from winning money (Chen et al., 2015; Dechant & Ellery, 2011; Flack & Morris, 2015; Goldstein, Stewart, Hoaken, & Flett, 2014; Lister, Wohl, & Davis, 2014; McGrath, Stewart, Klein, & Barrett, 2010; Stewart & Zack, 2008; Wu et al., 2012). People can also be attracted to gambling because of its social aspects, such as spending time with friends (Dechant & Ellery, 2011; Flack & Morris, 2015; Francis et al., 2015; McGrath et al., 2010).

Throughout this paper, we refer generally to “problem gambling” rather than to more specific terms such as “pathological gambling,” “gambling disorder,” or “probable pathological gambling,” in order to emphasize our dimensional, as opposed to categorical, approach. The *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition (*DSM-IV*; American Psychiatric Association, 1994) and fifth edition (*DSM-5*; American Psychiatric Association, 2013) and the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) refer to these terms on the basis of

categorized symptom counts. Our analyses refer to problem gambling as a latent variable, without considering whether individuals reach a particular criterion.

Research suggests that both problem and non-problem gamblers gamble to win money, for chances to win large rewards, and to make money to fulfil obligations (Binde, 2013; Clarke et al., 2007). Problem gamblers, in particular, are more motivated to win money than are non-problem gamblers (Francis et al., 2015; Lee et al., 2007). For instance, problem (vs. non-problem) gamblers often fail to recognize the disadvantages of large rewards in the Iowa Gambling Task (IGT), a measure of risky behaviour and insufficient learning to recognize large losses associated with large rewards (Bechara, Damasio, Damasio, & Anderson, 1994). Instead, problem gamblers often focus too much on chances of winning large rewards and too little on chances of losing in the IGT (Lorains et al., 2014). Although research consistently shows that monetary gain commonly relates to gambling behaviour, some studies suggest that younger adults are more motivated to gamble for a monetary reason than are older adults (Canale, Santinello, & Griffiths, 2015; Neighbors et al., 2002). Other motivations to gamble include enhancing self-worth, learning, and intellectual challenge (Binde, 2013; Carruthers, Platz, & Busser, 2006; Chen et al., 2015; Lee et al., 2007; Thrasher, Andrew, & Mahony, 2011; Wu et al., 2012). For example, gamblers are sometimes attracted to sports betting because they can research information about teams and the odds of winning. They can also increase their self-esteem by appearing to be knowledgeable about games.

Assessing Gambling Motivations

Over time, researchers have developed various scales to measure gambling motivations. The scales consist of some overlapping gambling motivations but ignore other gambling motivations that have been observed in the literature. We investigated the Gambling Motivation Scale (GMS; Chantal, Vallerand, & Vallieres, 1994), which captures more distinct motivations to gamble and derives from self-determination theory (SDT). Other gambling motivation scales are the Gambling Motives Questionnaire (GMQ; Stewart & Zack, 2008), the Reasons for Gambling Questionnaire (RGQ; Canale et al., 2015), and the Reasons for Gambling Scale (RGS; Luceri & Vergura, 2015). The motivations included in these scales are presented in Table 1.

Scales other than the GMS have advantages but, crucially, capture fewer motivations. They exclude motivations to learn gambling-related games and to be socially recognized, either of which can act as a gateway to developing problem gambling later on. For example, the GMQ proposes that three motivations drive gambling behaviours: enhancement, coping, and social. Although the revised GMQ, the GMQ-Financial (GMQ-F), includes an additional financial motive that commonly reinforces gambling behaviour, it still lacks motives such as alleviating boredom and learning new skills (Binde, 2013; Chen et al., 2015; Clarke et al., 2007; Dechant, 2014; Dechant & Ellery, 2011; Lee et al., 2007; Linke et al., 2010; Wu et al., 2012).

Table 1
Comparisons of Scales With Different Gambling Motivations

Name in GMS	Name in MGMS	Description	GMQ-F	RGS	RGQ	GMS	MGMS	MGMS items
Intrinsic motivation								
Knowledge	Intellectual challenge	Desire to learn the game, to learn strategies in the game, and to feel competent in gambling activities				X	X	3, 6, 10, 15, 18, 19, 20, 24
Accomplishment								
Experience stimulation	Excitement	Desire to experience thrills and excitement induced from gambling	X	X	X	X	X	1, 12, 14, 28
Extrinsic motivation								
Identified regulation	Socialization	Desire to build relationships with others, to relieve boredom and negative feelings (coping), and to relax via gambling	X	X	X	X	X	4, 13, 17, 23
Introjected regulation	Social recognition	Desire to feel important and to increase self-esteem via gambling			X	X	X	2, 9, 16, 26
External regulation	Monetary gain	Desire to win money from gambling activities	X	X	X	X	X	8, 11, 22, 27
Amotivation	Amotivation	Continue to gamble even without a purpose or a reason				X	X	5, 7, 21, 25

Note. GMS = Gambling Motivation Scale; MGMS = Modified Gambling Motivation Scale; GMQ-F = Gambling Motives Questionnaire with a financial subscale; RGS = Reasons for Gambling Scale; RGQ = Reasons for Gambling Questionnaire.

Confirmatory factor analysis (CFA) was not performed to confirm the factor structure of the four motives to gamble in the GMQ-F, and only the social motive subscale contained items with negative factor loadings (Dechant, 2014). Although these negative loadings for the social motive subscale could indicate reverse scored items, the scores did not appear to be reversed (e.g., “because it makes a social gathering more enjoyable,” “to be sociable”). The most serious consequence of these negative loadings could be inaccurate relationships among factors and inaccurate interpretations of gambling motives with other variables. In addition, one can imagine that people gamble to feel social connections and positive emotions, but the social motive was negatively related to enhancement, coping, and financial motives in the GMQ-F.

The RGQ and RGS also focus on emotional, social, and monetary reasons to gamble, but exclude the intrinsic motivation to learn the games, which may provide useful insights into the reasons behind gambling behaviour. In addition, the RGQ and RGS have not been compared to problem gambling psychometrically. This raises the question of whether these two scales measure gambling motivations that are related to problem gambling.

SDT Applied to Gambling Motivation

The GMS was developed by using SDT to assess gambling motivation (Chantal et al., 1994). SDT states that people are motivated to behave based on their need to be autonomous, competent, and related to others (Deci & Ryan, 2000; Ryan & Deci, 2000). If these fundamental needs are not satisfied, this can negatively affect personal well-being and development. *Autonomy* refers to the need to freely behave in a way that is consistent with personal growth. *Competence* is the need to control outcomes and achieve mastery,¹ and *relatedness* is the need for companionship or acceptance by others. For example, an individual may be motivated to play guitar. The desire to play guitar is autonomous if the behaviour results from an innate need for personal development of musical skill. The individual satisfies the need for competence if she or he successfully plays a difficult song.¹ The individual can also satisfy the relatedness need by playing guitar in a band.

These needs relate to intrinsic and extrinsic motivations that initiate behaviour. *Intrinsic motivation* refers to a desire to engage in activities for personal development or growth. *Extrinsic motivation* refers to a desire to engage in activities because of external influences such as money and social factors. According to SDT, intrinsic motivation to engage in activities is more beneficial for well-being than is extrinsic motivation because people seek challenges and novelty for their personal growth, which positively relates to their well-being. *Amotivation* is a lack of intention to act. It is neither intrinsic nor extrinsic. For example, an amotivated individual may act without intention or purpose behind the act. From the theory and literature on gambling motivation, previous researchers suggested seven gambling motivations, ordered from the most autonomous (*self-determined* or intrinsic in SDT) to the least

autonomous (*non-self-determined*, or extrinsic in SDT; Chantal & Vallerand, 1996; Chantal et al., 1994; Chantal, Vallerand, & Vallieres, 1995).

Intrinsic motivation *toward knowledge* captures a drive to learn or explore new games and strategies. Intrinsic motivation *toward accomplishment* refers to receiving pleasure from achievements in gambling activities such as enjoyment in testing abilities and controlling the games. Intrinsic motivation *toward experience stimulation* refers to deriving excitement from gambling activities, such as experiencing thrills or strong sensations from the games. Extrinsic motivation *toward identified regulation* refers to relaxing, escaping from stress, and socializing via the gambling activities. Extrinsic motivation *toward introjected regulation* refers to self-esteem and self-worth enhancements. These enhancements are accomplished through betting greater amounts of money in order to feel important among peers. Extrinsic motivation *toward external regulation* refers to pleasure in pursuing monetary rewards. In addition to these intrinsic and extrinsic motivations to gamble, individuals sometimes gamble without a sense of purpose, or with amotivation (Chantal & Vallerand, 1996; Chantal et al., 1995).

Previous studies have used the GMS to show specific motivations related to certain gambling activities (e.g., skill-based gambling and luck-based gambling) and problem gambling (Carruthers et al., 2006; Chantal & Vallerand, 1996; Chantal et al., 1995; Clarke, 2004, 2005; Neighbors & Larimer, 2004). However, the GMS has been criticized for the lack of CFA to test whether its motivations are distinct and necessary to measure the gambling motivation (Luceri & Vergura, 2015). In the current study, we fill this gap by performing CFA to examine the gambling motivation structures and by performing structural equation modelling (SEM) to examine the criterion-related validity of gambling motivation and problem gambling constructs. This allows for a more sophisticated examination of how well gambling motivations predict problem gambling than has been previously reported.

Across various scales of gambling motivation, the GMS, which is built upon a motivational theory, can provide better insight into gambling motivation than can other scales that focus less on motivation. The GMQ-F, RGS, and RGQ are derived from operant conditioning theory and primarily examine the need to regulate emotions. This need is manifested in avoiding negative emotions and seeking positive emotions via the entertainment and social aspects of gambling. In addition, operant conditioning and the need to regulate emotions via gambling align more with extrinsic motivation than other types of motivation, resulting in an incomplete conceptualization of gambling motivation. In contrast, the GMS is derived from SDT, which focuses on intrinsic motivation, extrinsic motivation, and amotivation. This focus on motivations results in more distinct gambling motivations in the GMS than those in the other scales. The GMS also measures intrinsic motivation to gamble such as for the intellectual challenge. The use of a gambling motivation scale that emerges from a motivational theory and measures a more defined spectrum of gambling motivations can improve the understanding of gambling motivations and gambling severity across gambling activities.

The Present Study

The present study had four aims. First, we developed the Modified Gambling Motivation Scale (MGMS), an adaptation of the GMS (Chantal et al., 1994), as an alternative scale to measure gambling motivation. Previous research found that problem gamblers are less educated than non-problem gamblers (Abbott & Volberg, 1996; Lorains et al., 2014; Volberg, 1994), making it worthwhile to improve the language comprehension of the GMS. The MGMS clarifies the language used in the GMS items and GMS Likert scale by rephrasing the items and the anchors to simplify the language. For instance, one item of the GMS reads, “For the feeling of efficacy that I get when I play my favorite game.” The meaning of the word “efficacy” may be vague and people may respond to the item by using different definitions of the word. The MGMS changes this item to read, “I feel competent when I gamble.” The GMS and MGMS items are presented in Appendix A and Appendix B, respectively. We expected to improve the language comprehension of the GMS with the MGMS.

The second purpose was to assess gambling motivation from the framework by Chantal et al. (1994). Four measurement models were tested: a seven-factor model, a six-factor model, a one-factor model, and a two-factor model. Previous research has supported this seven-factor structure of the GMS with exploratory factor analysis (Chantal et al., 1994), but not with CFA. We performed CFA to test the previously proposed structures (i.e., the seven-factor model and the two-factor model) and our hypothesized structures of the GMS, specifically the six-factor model and the one-factor model.

We hypothesized that the six-factor model would be more theoretically consistent with SDT than would the seven-factor model. Motivations toward knowledge and accomplishment are theoretically similar to intrinsic regulation in SDT (i.e., intrinsic motivation) because they indicate an inherent interest in learning and achieving mastery at gambling. Excitement would be theoretically consistent with integrated regulation in SDT because of a motivation to experience extrinsic enjoyment from achieving goals (i.e., winning money in gambling). Socialization also satisfies personal goals (e.g., social connections or coping with negative feelings) and would conceptually align with identified regulation in SDT, which emphasizes satisfaction of personal goals and values. In addition, being socially recognized from winning rewards would correspond with the introjected regulation to improve self-esteem and ego in SDT. Winning or perceiving chances to win money would facilitate gambling behaviour and would coincide with a drive to act that is exerted by external rewards, as defined by external regulation in SDT. Lastly, amotivation aligns with non-regulation due to aimless gambling or a lack of control in gambling in SDT.

This six-factor model would also reduce the multicollinearity issue in the seven-factor model by combining motivations toward knowledge and accomplishment, as they were shown to be moderately correlated ($r = .65$) in the study by Chantal et al. (1994). Because these two motivations seem to measure a motivation to intellectually

overcome challenges in gambling, we attempted to combine them into a motivation of intellectual challenge, which has been suggested as a motivation to gamble and would align with intrinsic regulation in SDT (Binde, 2013; Ryan & Deci, 2000).

The one-factor model tested whether these six motivations could be grouped under a general construct of gambling motivation. The two-factor model tested whether the six motivations could be grouped into either self-determined motivation or non-self-determined motivation on the basis of previous research (Chantal et al., 1994; Wu & Tang, 2011). Motivations that are more autonomous and intrinsic were grouped in self-determined motivation, whereas motivations that are less autonomous and extrinsic were grouped in non-self-determined motivation.

The third purpose of the study was to test for the criterion-related validity of gambling motivation and problem gambling because these specific motivations have not been compared with problem gambling psychometrically. In addition, this structural model allowed us to examine the role of gambling motivation in problem gambling. The fourth purpose was to test whether the MGMS is equivalent to the GMS psychometrically by using measurement invariance. We hypothesized that if the MGMS is the same as, but easier to read than, the GMS, the MGMS could be a better measure of gambling motivation because its psychometrics are sound.

Method

Participants

Participants ($N = 525$) were recruited from the psychology research pool at the University of Georgia, in exchange for partial completion of a research requirement. The data of 37 participants were removed because of computer errors, and 86 were removed because of no gambling participation in the past 12 months. Analyses included the remaining 402 participants (61% male, 78% Caucasian, 10% Asian, 7% African American, 5% other races) ranging in age from 18 to 29 years ($M = 19.37$, $SD = 1.38$).

Measures

Gambling Motivation Scale (GMS). Participants rated 28 items by using a degree of correspondence for each item (1 = *does not correspond* to 7 = *corresponds exactly*). More details about the seven motivations and the complete GMS are presented in Table 1 and Appendix A, respectively. The GMS items include knowledge (e.g., “For the satisfaction of learning new ways of playing my favorite game”), accomplishment (e.g., “For the feeling of efficacy that I get when I play my favorite game”), excitement (e.g., “Because it is exciting to play for money”), socialization (e.g., “Because, for me, it is the best way to relax completely”), monetary gain (e.g., “To get rich”), social recognition (e.g., “Because it makes me feel like somebody important”), and amotivation (e.g., “I play for money, but sometimes I ask myself

what I get out of it”) on 7-point Likert scales. Each set of four items measures each motivation subscale. The total GMS scores are highly consistent ($\alpha = .94$).

Modified Gambling Motivation Scale (MGMS). Participants completed the 28 modified MGMS items by using a 7-point Likert scale (1 = *strongly disagree* to 7 = *strongly agree*). Unlike the seven motivations in the GMS, the MGMS measures six motivations: intellectual challenge (e.g., “I enjoy learning new strategies”), excitement (e.g., “It is exciting to gamble”), socialization (e.g., “It is the best way to relax”), monetary gain (e.g., “I play for money”), social recognition (e.g., “It makes me feel important”), and amotivation (e.g., “I play for money, but I sometimes wonder what I get out of gambling”). The explanation of each motivation and the complete MGMS are presented in Table 1 and Appendix B, respectively. Like those of the GMS, the internal consistencies of the MGMS total scores ($\alpha = .92$) and the MGMS subscales are adequate and reported in Table 2.

We revised all 28 GMS items except Item 9 while keeping the meaning of items the same. Four items measure each of the five subscales: excitement, socialization, social recognition, monetary gain, and amotivation. Eight items of the MGMS measure intellectual challenge.

Previous researchers have proposed a formula for a self-determination index from the GMS, as shown below:

$$\left[\frac{2 \times (knowledge + accomplishment + excitement)}{3} \right] + socialization$$

$$- \left[\frac{(social\ recognition + monetary\ gain)}{2} + 2 \times (amotivation) \right]$$

This self-determination index is ambiguous and difficult to interpret because it is unclear why each subscale is weighed differently compared with the other subscales. According to the previous study (Chantal et al., 1995), higher scores on the index indicate higher self-determination to gamble, and lower scores indicate higher non-self-determination to gamble. However, this scoring system introduces problems. For example, a score of 0 is not meaningful. Gamblers who have high scores on both self-determination and non-self-determination can receive a score of 0 because the scores cancel each other out. Zero does not mean no self-determination in this case. Zero also does not necessarily indicate amotivation, and it is unlikely that a score of 0 would correspond with amotivation because the amotivation score is scored as a negative term in the formula. Researchers should cautiously interpret the results of previous studies that used this problematic formula (e.g., Carruthers et al., 2006; Chantal et al., 1995).

Table 2
Pearson Correlations of Problem Gambling and Motivations From the Modified Gambling Motivation Scale

	1	2	3	4	5	6	7	8	9	10
1. Self-determined	(.91)									
2. Non-self-determined	.60***	(.85)								
3. DIGS	.47***	.46***	(.89)							
4. Gambling motivation	.89***	.90***	.52***	(.92)						
5. Amotivation	.36***	.76***	.33***	.63***	(.86)					
6. Intellectual challenge	.83***	.50***	.29***	.74***	.27***	(.88)				
7. Excitement	.87***	.51***	.41***	.77***	.27***	.66***	(.78)			
8. Socialization	.78***	.49***	.46***	.71***	.35***	.43***	.50***	(.82)		
9. Social recognition	.65***	.73***	.38***	.78***	.35***	.60***	.51***	.52***	(.76)	
10. Monetary gain	.38***	.77***	.33***	.65***	.35***	.29***	.38***	.26***	.36***	(.86)

Note. Internal consistencies are reported on the diagonal. All of the MGMS total scores and subscale scores were calculated by using the new scoring formulas. Self-determined motivation is an average of intellectual challenge, excitement, and socialization. Non-self-determined motivation is an average of social recognition, monetary gain, and amotivation. Problem gambling is measured by the Diagnostic Interview for Gambling Severity (DIGS). Gambling motivation is the total score of the Modified Gambling Motivation Scale.

*** $p < .001$.

New scoring system for the MGMS. Because of the ambiguity of the self-determination index, we proposed a simpler and more applicable formula for the total gambling motivation scores. The intellectual challenge score is an average of its eight items. A score of the other five motivations is an average of their respective four items. The total gambling motivation score is the sum of the averages of the six subscales, resulting in a range of 0-42. Higher scores indicate greater motivation to gamble for a specific reason or greater motivation to gamble in general. Each subscale score ranges from 0 to 7. This new formula introduces a simpler calculation and interpretation of the scores, while allowing researchers to assess specific motivations or a general motivation to gamble.

Diagnostic Interview for Gambling Severity (DIGS; Fortune & Goodie, 2010; Winters, Specker, & Stinchfield, 2002). DIGS scores are calculated from 18 items that measure nine gambling symptoms on a Likert scale (1 = *false*, 2 = *somewhat true*, and 3 = *very true*) that are based on the gambling disorder criteria in the *DSM-5*. We used the DIGS measure by Winters et al. (2002), as modified by Fortune and Goodie (2010), which captures 10 gambling symptoms according to *DSM-IV* criteria. However, to reflect these criteria, we omitted the questions related to illegal acts and calculated the DIGS scores by using the remaining 18 items related to nine symptoms: a need to increase betting to achieve the same excitement, irritability when cutting down on gambling, losing control, preoccupied with gambling, escaping from negative emotions via gambling, chasing after losses, lying, jeopardizing significant relationships or work because of gambling, and relying on others to relieve desperate financial situations from gambling. Each gambling symptom is measured by a set of two items. For each set of items, participants scored 0 if they responded with a combination of false and false, or 1 with any other combination. In the present study, a problem gambling construct was assessed via the DIGS in the predictive model.

South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). Participants rated 20 items on 2-, 3-, and 4-point scales to assess their risk of pathological gambling. This scoring system is taken from Lesieur and Blume (1987) and has a range of 0-20. In the original formulation, gamblers whose scores are 3-4 are deemed problem gamblers, and those with scores ≥ 5 are deemed probable pathological gamblers.

Demographic questionnaire. The demographic questionnaire measured age, gender, education, race, marriage, gambling activities (e.g., “Played cards for money with friends?” or “Bet on the outcome of a sporting event?”), and gambling frequency (“How many times do you gamble?”). Participants rated how often they participated in gambling activities (1 = *never*, 2 = *less than monthly*, 3 = *monthly*, 4 = *weekly*, 5 = *daily*) and how frequently they gambled in the past 12 months (1 = *never gamble*, 2 = *once a year*, 3 = *once a month*, 4 = *once a week*, 5 = *two to three times a week*, 6 = *four to five times a week*, 7 = *more than five times a week*).

Procedure

Each participant signed a consent form and responded to the GMS, a demographic questionnaire, the DIGS, the SOGS, and the MGMS at a computer station, in that

order. Participants were debriefed at the end of the experiment. The two gambling motivation scales were counterbalanced.

Analytic Plan

To test the first purpose of the study, Flesch Reading Ease (Flesch, 1948) and Flesch-Kincaid Grade Level scores (Kincaid, Fishburne, Rogers, & Chissom, 1975) were used to compare the reading comprehension of the MGMS with that of the GMS. The readability statistics in Microsoft Word produced these reading ease and reading level scores. For the second purpose, CFA was used to test the structures of the gambling motivation construct with four measurement models: the seven-factor model, the six-factor model, the one-factor model, and the two-factor model. For the third purpose, SEM was used to test one structural model (the predictive model) for criterion-related validity. The predictive model tested the effects of six specific motivations on problem gambling (measured with the DIGS) at a latent level. For the fourth purpose, measurement invariance was performed to test the equality of the gambling motivation structure between the GMS and the MGMS.

Results

Sample Gambling Characteristics

The most frequent gambling activities on a weekly basis were betting on sports (35%), the lottery (14%), or bowling or golf (13%) and playing cards (6%). The frequency at which participants gambled varied (17% once a year, 24% monthly, 43% weekly, 14% two to three times per week, or 2% four times or more per week), but this frequency was not significantly skewed (skewness = 0.12, $SE = 0.12$) or kurtosed (kurtosis = -0.02, $SE = 0.24$).

The average DIGS score was 3.01 ($SD = 2.49$), with 60% of participants showing scores of 0-3 and 40% showing scores of 4-9. The distribution of DIGS scores was not normal, with a skewness of .63 ($SE = 0.12$) and a kurtosis of -.51 ($SE = 0.24$). The SOGS ($M = 2.21$, $SD = 2.84$) score distribution (skewness = 1.91, $SE = 0.12$; kurtosis = 3.86, $SE = 0.24$) was similar to that of the DIGS scores. In addition, the MGMS total scores ($M = 23.64$, $SD = 5.50$) ranged from 6 to 42 and were not normally distributed, with a skewness of -0.48 ($SE = 0.12$) and a kurtosis of 0.76 ($SE = 0.24$). Table 2 shows the correlations between the DIGS scores and the MGMS scores, which were calculated with our new scoring system.

Scale Reading Level

The Flesch Reading Ease (Flesch, 1948) and the Flesch-Kincaid Grade Level scores (Kincaid et al., 1975) showed that the MGMS was easier to read and required a lower reading level than did the GMS. The Flesch Reading Ease and the Flesch-Kincaid Grade Level reported scores of 84.1 and 3.6 for the MGMS and 77.9 and 5.0 for the GMS, respectively. The MGMS items (234 words, 906 characters,

8.3 words per item on average) were also briefer than the GMS items (294 words, 1,198 characters, 10.5 words per item on average). The internal consistencies of the MGMS ($\alpha = .92$) and the GMS ($\alpha = .94$) were also high. Because the reading level of the MGMS was lower and thus more broadly applicable than that of the GMS, the remaining analyses refer to the MGMS results.

Confirmatory Factor Analysis

Responses from 402 participants were analyzed for the factor structures of gambling motivation and criterion-related validity by using LISREL 9.1. To test the factor structures of gambling motivation, we used four measurement models by using CFA with maximum likelihood estimation. Although robust maximum likelihood (RML) could deal with non-normality, its standard errors and estimates were non-sensible. The reviewers agreed that maximum likelihood should be used in this study. The seven-factor model tested the original seven gambling motivations as first-order factors, which were intercorrelated. The other models consisted of six specific motivations that combined knowledge and accomplishment into an intellectual challenge in order to reduce multicollinearity and to be consistent with SDT. The six-factor model tested the six specific motivations as first-order factors, which were also intercorrelated. The one-factor model tested one second-order factor of general motivation consisting of six motivations. The two-factor model tested two second-order factors of self-determined motivation (consisting of intellectual challenge, excitement, and socialization) and non-self-determined motivation (consisting of social recognition, monetary gain, and amotivation).

Fit indices used in this study were as follows: comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), Akaike information criterion (AIC), and Bayesian information criterion (BIC). We also used the chi-square test to measure the models' goodness of fit. Generally, a good model fit ranges from .95 to 1.00 and an adequate fit from .90 to .95 for the CFI and TLI (Hu & Bentler, 1998, 1999; Lance & Vandenberg, 2001). For the RMSEA and SRMR, a good fit is between 0.00 and 0.08, while an adequate fit is between 0.08 and 0.10 (Browne & Cudeck, 1992; Hu & Bentler, 1999; Kline, 2016; MacCallum, Browne, & Sugawara, 1996). A smaller AIC and BIC indicate a better fit and a simpler model (Kline, 2016; Raftery, 1995). Table 3 reports fit indices of the measurement models. An additional discussion of the chi-square test and fit indices occurs in Appendix C.

Although the seven-factor model appeared to best fit the data, the other three measurement models fit the data nearly as well as the seven-factor model. Specifically, the confidence intervals of RMSEAs among the four measurement models overlapped, indicating equally good fit, while other fit indices were nearly identical. We believed the six-factor model was the most appropriate for the gambling motivation structure because it aligned more closely with SDT and it eliminated a multicollinearity issue. When we performed CFA to test the seven-factor model with the GMS, motivations toward knowledge and accomplishment were nearly identical for both the GMS

($r = .92$) and the MGMS ($r = .87$). These high correlations between motivations toward knowledge and accomplishment created problems with estimations (Joreskog, 1999). In addition, we believed they measured the same motivation because these highly correlated factors referred to intrinsic motivation to overcome intellectual challenge, which aligned with intrinsic regulation in SDT. Thus, combining the two motivations into an intellectual challenge factor in the six-factor model solved problems with estimations and allowed for a more consistent interpretation with SDT. Therefore, the six-factor model was preferred. The factor correlations of the seven-factor model and the six-factor model from the MGMS are shown in Tables 4 and 5, respectively.

Structural Equation Modeling

To test the criterion-related validity of gambling motivation and problem gambling, we performed SEM with maximum likelihood estimation on a structural model to test which motivation constructs led to the problem gambling construct. It should be noted that robust maximum likelihood that deal with non-normality produced non-sensible standard errors and estimates. The reviewers agreed that maximum

Table 3

Fit Indices of Measurement Models for the Modified Gambling Motivation Scale

Model	χ^2	<i>df</i>	RMSEA	TLI	CFI	SRMR	AIC	BIC
			Est (LL, UL)					
1. Seven-factor	965.10***	329	0.069 (0.064, 0.074)	.95	.96	0.059	17265	17573
2. Six-factor	1100.45***	335	0.075 (0.071, 0.080)	.94	.95	0.071	17388	17672
3. One-factor	1173.37***	344	0.077 (0.073, 0.082)	.93	.94	0.079	17443	17691
4. Two-factor	1164.48***	343	0.077 (0.072, 0.082)	.93	.94	0.078	17436	17688

Note. RMSEA = root mean square error of approximation; Est = estimates of the RMSEA; LL = lower limit; UL = upper limit; TLI = Tucker-Lewis index; CFI = comparative fit index; SRMR = root mean square residual; AIC = Akaike information criterion; BIC = Bayesian information criterion.

*** $p < .001$.

Table 4

Factor Correlations of the Seven-Factor Model

	1	2	3	4	5	6	7
1. Knowledge	—						
2. Accomplishment	.87**	—					
3. Excitement	.68**	.81**	—				
4. Socialization	.32**	.58**	.63**	—			
5. Social recognition	.54**	.86**	.66**	.64**	—		
6. Monetary gain	.27**	.36**	.45**	.33**	.45**	—	
7. Amotivation	.16**	.40**	.34**	.42**	.44**	.39**	—

Note. The data are from the Modified Gambling Motivation Scale.

** $p < .01$.

Table 5
Factor Correlations of the Six-Factor Model

	1	2	3	4	5	6
1. Intellectual challenge	—					
2. Excitement	.75**	—				
3. Socialization	.43**	.62**	—			
4. Social recognition	.69**	.66**	.65**	—		
5. Monetary gain	.31**	.45**	.32**	.45**	—	
6. Amotivation	.27**	.34**	.42**	.44**	.39**	—

Note. The data are from the Modified Gambling Motivation Scale.

** $p < .01$.

likelihood should be used in this study. Adding support to the preference for the six-factor model over the seven-factor model, the use of seven motivations to predict problem gambling created problems with estimations, which disappeared when the six motivations predicted problem gambling. This predictive model is shown in Figure 1. Although the chi-square goodness-of-fit test showed a poor fit to the data, $\chi^2(968) = 2527.41$, $p < .001$, the fit indices indicated good fit (TLI = .94, CFI = .94, SRMR = 0.072, RMSEA = 0.063, 90% confidence interval [0.060, 0.066], AIC = 12724, BIC = 13175). We relied on fit indices more than chi-square goodness-of-fit tests because chi-square tended to be significant in large sample sizes. More details about fit statistics are discussed in Appendix C. Overall, this SEM model better fit the data than the measurement model of the six factors did and it explained 40.2% of the variance, suggesting meaningful relationships between gambling motivation and problem gambling.

Of the six motivations, only excitement (standardized coefficient = .24, $t = 2.08$, $p < .05$) and socialization (standardized coefficient = .35, $t = 3.87$, $p < .001$) predicted more problem gambling. The results suggested that people who gambled for excitement (e.g., pleasures and thrills) and socialization (e.g., improved social connections) had more problem gambling.

Measurement Invariance

Because the six-factor model was the preferred structure of gambling motivation, it was used to test whether the GMS and MGMS were the same psychometrically. The goodness-of-fit statistics for measurement invariance are presented in Table C1. Factor covariances of the GMS and the MGMS are also shown in Table C2. In general, chi-square difference tests were not reliable in determining invariance, and the uniqueness invariance test is difficult to achieve according to Vandenberg and Lance (2000). A more detailed discussion to determine the support of invariance tests is available in Appendix C. In the present study, fit indices such as RMSEAs and CFIs were similar across all invariance tests, suggesting an invariance between the GMS and the MGMS. The MGMS and the GMS had the same dimensional structure (configural invariance), had similarly strong links between the item scores

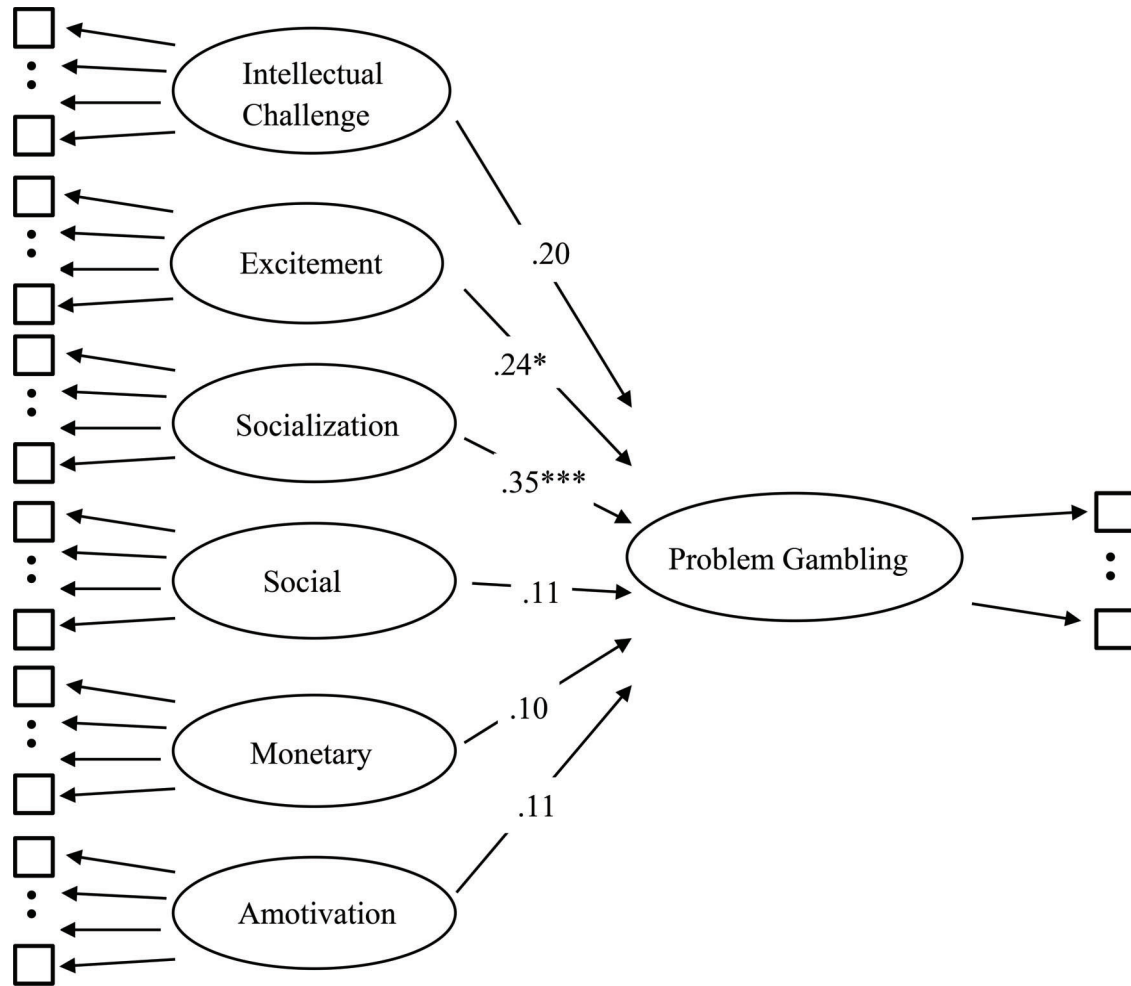


Figure 1. The predictive model showing the predictions of six gambling motivations for problem gambling. With the Modified Gambling Motivation Scale, eight items measure intellectual challenge and four items measure five other motivations. With the Diagnostic Interview for Gambling Severity, 18 items measure problem gambling. Each square indicates each item of a motivation.

* $p < .05$. *** $p < .001$.

and the gambling motivations (metric invariance), had the same level of measurement error (uniqueness invariance), were measured on similar scales (scalar invariance), and showed the same interrelatedness between measured factors (factor covariances). The measurement invariance suggested that the GMS and the MGMS were the same psychometrically, but the MGMS requires a lower reading level and less education than does the GMS.

Discussion

As determined by the four purposes of the current study, the MGMS appears to be a useful scale and compares favourably with existing scales, including the GMS. First, the Flesch Reading Ease and the Flesch-Kincaid Grade Level scores indicated that the MGMS items were easier to read and required a lower grade level to understand than did the GMS items. Second, CFA on the seven-factor, six-factor, two-factor,

and one-factor models with the MGMS demonstrated that the six specific motivations to gamble were validated and shown to be the most consistent with SDT, on which the scale was based. Despite slightly better fit indices of the seven-factor model, the seven-factor structure had problems with estimations, whereas the six-factor structure did not. This finding suggests that the six-factor structure contributes to the understanding of gambling motivation beyond the seven-factor structure by offering an alternative conceptual framework for gambling motivation and allowing gambling motivations to predict problem gambling.

Third, the present study assessed the criterion-related validity of the MGMS. The six motivation constructs were used to predict the problem gambling construct in the predictive model. Of the six motivations, excitement and socialization significantly predicted greater problem gambling, consistent with previous findings (Canale et al., 2015; Chen et al., 2015; Francis et al., 2015; Lee et al., 2007; McGrath et al., 2010; Neighbors et al., 2002; Stewart & Zack, 2008; Wu et al., 2012). This suggests that individuals with more problem gambling gamble because they want to improve social connections, relieve negative feelings, and feel pleasure. In addition, the GMS and MGMS findings may be relatable to the GMQ findings, as the three factors of the GMQ can plausibly be mapped onto the two factors of the GMS (i.e., GMQ enhancement to MGMS excitement, and GMQ coping and social motives to MGMS socialization). According to SDT, these desires to feel excited and satisfy social needs from gambling are aligned with integrated regulation and identified regulation, respectively. When individuals are motivated by external stimuli such as gambling, these motivations negatively affect well-being (Ryan & Deci, 2000). This may explain why relying on gambling to improve mood and connect with others leads to poor well-being, and in this case, to more problem gambling.

Fourth, the MGMS is a good measure of gambling motivation because less education is required to complete it and equally good psychometrics are required relative to the GMS. We also suggested a new and simpler scoring of the MGMS, which, in contrast with the previous formula, allows researchers to assess a score for each motivation as well as a meaningful total motivation score. Specifically, the advantages of the new scoring system are that (a) higher scores now indicate higher motivation, (b) a score of 0 is meaningful, (c) amotivation is no longer grouped with non-self-determined motivations, and (d) the formula is simpler and more intuitive.

Limitations and Future Directions

College samples tend to consist of individuals with less problem gambling than do clinical samples. Ours was a college sample in which 40% of participants scored 4 or more on the DIGS and 17% scored at least 5 on the SOGS (i.e., who were at risk of becoming probable pathological gamblers). This proportion of probable pathological gamblers was higher than that in an average college sample of 8% probable pathological gamblers (Blinn-Pike, Worthy, & Jonkman, 2007). This may be attributable to the fact that we recruited only people who gambled in the past 12 months and that the SOGS often produces high false positive rates (Goodie et al., 2013).

It is also possible that social desirability played a role in our results, as none of the instruments contained items to detect social desirability. Finally, motivations other than excitement and socialization may predict problem gambling in populations that include more severe gamblers, as other studies have suggested (Chantal et al., 1995; Lee et al., 2007; Stewart & Zack, 2008).

We recognize the generalizability of a non-clinical sample to a clinical sample. Because of the small sample sizes of problem and non-problem gamblers, we could not perform measurement invariance across groups of differing degrees of problem gambling and confidently interpret the results. Replicating these results in a clinical sample prior to relying on it for clinical purposes may be necessary in future studies. Such studies could compare a college population with a problem gambler population to examine whether the MGMS measures gambling motivation similarly or differently across the two populations by using measurement invariance. This measurement invariance across samples would allow researchers to be more confident in generalizing the results to a more clinical population. To better understand the relationship between gambling motivations and gambling problems, future studies could also re-test the model in which gambling motivations predict gambling problems in community samples in order to expand the participants' range in age and gambling severity.

Despite these limitations, this paper aimed to improve the assessment of gambling motivation for a better understanding of problem gambling. To accomplish this, we evaluated the existing motivation scales in the gambling literature, modified the GMS that aligned closely with SDT, and included a more refined spectrum of gambling motivation discussed in the literature. Compared with the GMS, the MGMS could be a useful tool for measuring gambling motivations with more meaningful motivation scores and more stable psychometric properties.

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Appendix A

Gambling Motivation Scale

Does not correspond at all	Corresponds a little		Corresponds moderately	Corresponds a lot		Corresponds exactly
1	2	3	4	5	6	7

Why do you play for money (bet) at your favorite game?

1. Because it is exciting to play for money.
2. Because it makes me feel like somebody important.
3. For the feeling of efficacy that I get when I play my favorite game.
4. Because, for me, it is the best way to relax completely.
5. I play for money, but sometimes I ask myself if I should continue to play my favorite game.
6. Because playing for money allows me to test my capacity to control myself.
7. I play for money, but sometimes I ask myself what I get out of it.
8. To get rich.
9. To show others that I am a dynamic person.
10. For the pleasure I get at improving my knowledge of the game.
11. To buy something that I dream of.
12. Because it allows me to enjoy myself enormously.
13. Because it is the best way I know of to eliminate tension.
14. For the strong sensations I feel when I play my favorite game.
15. For the satisfaction of learning new ways of playing my favorite game.
16. To be envied by others.
17. Because it is the hobby I have chosen to clear my mind.
18. For the pleasure of knowing my abilities at this game.
19. For the satisfaction I feel when I can control the game.
20. For the curiosity of knowing what can happen in the game.
21. I play for money but sometimes I feel I am not getting a lot out of it.
22. To make money quickly and easily.
23. Because it's the best way I know of to meet my friends.
24. For the feeling of control it gives me.
25. I play for money but I sometimes ask myself if it is good for me.
26. Because when I win, I feel like someone important.
27. To make a lot of money.
28. For the thrill or the strong sensations it gives me.

THE MODIFIED GAMBLING MOTIVATION SCALE

Items for each subscale:	Knowledge	10, 15, 18, 20
	Accomplishment	3, 6, 19, 24
	Excitement	1, 12, 14, 28
	Socialization	4, 13, 17, 23
	Monetary gain	8, 11, 22, 27
	Social recognition	2, 9, 16, 26
	Amotivation	5, 7, 21, 25

Appendix B**Modified Gambling Motivation Scale**

Strongly disagree	Disagree	Slightly disagree	Neutral	Slightly agree	Agree	Strongly agree
1	2	3	4	5	6	7

Why do you gamble at your favorite game?

1. It is exciting to gamble.
2. It makes me feel important.
3. I feel competent when I gamble.
4. It is the best way to relax.
5. I play for money, but I sometimes worry if I should continue playing.
6. Gambling allows me to test my control.
7. I play for money, but I sometimes wonder what I get out of gambling.
8. I play for money.
9. To show others that I am a dynamic person.
10. I enjoy improving my knowledge of the game.
11. I play for money to buy what I desire.
12. It allows me to enjoy myself enormously.
13. It is the best way I know to eliminate tension.
14. I experience strong sensations when I gamble.
15. I enjoy learning new strategies.
16. I want to be envied by others.
17. It is my hobby to clear my mind.
18. I enjoy knowing my ability in this game.
19. I like it when I can control the game.
20. I am curious to know what will happen in the game.
21. I play for money, but I sometimes feel I do not get a lot out of it.
22. It is quick and easy money.
23. It is the best way to spend time with friends.
24. It gives me a feeling of control.
25. I play for money, but I sometimes wonder if it is good for me.
26. I feel important when I win.
27. It makes me a lot of money.
28. It gives me a thrill or strong sensation.

Items for each subscale:	Intellectual challenge	10, 15, 18, 20, 3, 6, 19, 24
	Excitement	1, 12, 14, 28
	Socialization	4, 13, 17, 23
	Monetary gain	8, 11, 22, 27
	Social recognition	2, 9, 16, 26
	Amotivation	5, 7, 21, 25

Appendix C

Discussion of Fit Statistics and Results of Measurement Invariance

The chi-square goodness-of-fit test tends to become significant as sample sizes increase even if there is a small difference between the observed and the predicted variance-covariance matrices in large samples, such as in our sample ($N = 402$). However, large sample sizes are needed for the chi-square to have asymptotic distribution and multivariate normality (Brown, 2006; Kline, 2016; Marsh, Balla, & McDonald, 1988). Therefore, poor models can have a non-significant chi-square if their sample sizes are small enough, but good models can have a significant chi-square if their sample sizes are large enough. This suggests that the chi-square difference test has higher Type I error rates in large sample sizes.

Regardless of the sensitivity to sample sizes of the chi-square, many researchers still use chi-square tests to judge the goodness of fit because there are no other statistical tests that use the known distribution, the chi-square distribution (Vandenberg & Lance, 2000). Thus, other fit indices (e.g., TLI, CFI, RMSEA, SRMR, AIC, and BIC) should be considered when judging model fit because fit indices compare the observed models with the alternative models from the data. If a set of fit indices indicates good fit, researchers can be more confident about their results. In measurement invariance, the change of CFI can adequately judge whether the measurement invariance holds across groups. If the change of CFI is smaller than or equal to .01, it is reasonable to conclude that the groups have the same level of measurement invariance (Cheung & Rensvold, 2002; Meade, Johnson, & Braddy, 2008). According to Tables C1 and C2, our results suggest that the measurement invariance holds between groups across levels of measurement invariance.

Table C1
Fit Indices for Measurement Invariance of Both Gambling Motivation Scales on the Six-Factor Model

Model	χ^2	df	$\Delta \chi^2$	Δdf	RMSEA		TLI	CFI	SRMR	AIC	BIC
					Est (LL, UL)						
1. Configural invariance	2133.80***	670	—	—	0.074 (0.070, 0.077)		.95	.96	0.066	35719	36385
2. Metric invariance	2166.38***	692	32.55	22	0.073 (0.069, 0.076)		.95	.96	0.063	35819	36645
3. Uniqueness invariance	2271.81***	720	105.36***	28	0.073 (0.070, 0.077)		.95	.96	0.066	35757	36189
4. Scalar invariance	2771.81***	742	0.00	22	0.072 (0.068, 0.075)		.96	.96	0.066	35825	36416
5. Factor covariance	2326.26***	769	54.46***	27	0.071 (0.068, 0.074)		.96	.96	0.095	35826	36290

Note. RMSEA = root mean square error of approximation; Est = estimates; LL = lower limit; UL = upper limit; TLI = Tucker-Lewis index; CFI = comparative fit index; SRMR = root mean square residual; AIC = Akaike information criterion; BIC = Bayesian information criterion.
 *** $p < .001$.

Table C2
Factor Covariances of the Six Motivations of the GMS and MGMS

	1		2		3		4		5		6	
	GMS	MGMS	GMS	MGMS	GMS	MGMS	GMS	MGMS	GMS	MGMS	GMS	MGMS
1. Intellectual challenge	—	—	—	—	—	—	—	—	—	—	—	—
2. Excitement	1.00***	.58***	—	.52***	—	.61***	—	.58***	—	.34***	—	—
3. Socialization	.65***	.39***	.72***	.54***	.78***	.25***	.58***	.43***	.57***	.31***	—	—
4. Social recognition	.76***	.61***	.72***	.54***	.42***	.42***	.55***	.43***	.57***	.31***	—	—
5. Monetary gain	.42***	.23***	.52***	.30***	.42***	.42***	.55***	.43***	.57***	.31***	—	—
6. Amotivation	.44***	.25***	.50***	.29***	.55***	.42***	.55***	.43***	.57***	.31***	—	—

Note. Factor covariances were standardized. These factor covariances were estimated without any invariant restrictions. GMS = Gambling Motivation Scale; MGMS = Modified Gambling Motivation Scale.
 *** $p < .001$.

Exploring the Effects of Introducing a State Monopoly Operator to an Unregulated Online Gambling Market

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Abstract

Recent expansions in regulated offerings to include online forms of gambling have been undertaken amid animated debate on the potential impacts of this legalization. The objective of the present study is to examine changes in online gambling patterns before and after the opening of *Espacejeux*: the state-operated gambling website in Québec, Canada. Information on gambling habits was drawn from two repeated cross-sectional surveys conducted with samples representative of the general adult population of the province of Québec in 2009 ($N = 11,888$) and 2012 ($N = 12,008$). Behavioural data were retrieved from the Online Poker Database of the University of Hamburg (ODP-UHH) for 4,591,298 (2009/2010) and 2,909,562 (2013) unique real money poker identities; all Québec players were retained for analysis. Gambling patterns before and after legalization of online gambling were compared. The prevalence of Internet gambling remained stable: 1.5% of the population gambled online in 2012 compared to 1.4% in 2009. Of those surveyed, 82.5% continued to gamble on unregulated sites in 2012 and data from ODP-UHH confirmed that 90% of all real money online poker players still bet on unregulated sites in 2013. Results suggest that it may be prudent for government stakeholders to consider alternative approaches for managing online gambling offerings. Longitudinal analyses are needed to disentangle the effects of legalization of online gambling.

Keywords: Online gambling, legalization, regulation, Québec, poker

Résumé

L'augmentation récente d'offres réglementées, notamment des jeux en ligne, a fait l'objet de vifs débats sur les répercussions possibles de cette légalisation. Cette étude examine les changements dans les modèles de jeux en ligne avant et après l'ouverture d'Espacejeux, le site de jeux exploité par la province de Québec, au Canada. L'information sur les habitudes de jeu a été tirée de deux enquêtes transversales répétées,

réalisées avec des échantillons représentatifs de la population générale adulte de la province de Québec en 2009 ($N = 11\,888$) et 2012 ($N = 12\,008$). Les données comportementales ont été tirées de la base de données de poker en ligne de l'Université de Hambourg (ODP-UHH) sur 4 591 298 (2009/2010) et 2 909 562 (2013) joueurs de poker avec argent réel. Tous les joueurs québécois ont été retenus pour l'analyse. On a comparé les modèles de jeu avant et après la légalisation de jeux en ligne. La prévalence de jeu sur Internet est restée stable : 1,5 % de la population a joué en ligne en 2012 contre 1,4 % en 2009. Parmi les personnes sondées, 82,5 % d'entre elles ont continué de jouer sur des sites non réglementés en 2012 et les données de l'Université de Hambourg ont permis de confirmer que 90 % des joueurs de poker en ligne avec argent réel misent toujours sur des sites non réglementés en 2013. Avec ces résultats, les parties prenantes du gouvernement seraient avisées d'envisager d'autres approches pour la gestion des offres de jeux en ligne. Il faut effectuer des analyses longitudinales pour distinguer clairement les effets de la légalisation du jeu en ligne.

Introduction

Online gambling is emblematic of both the Internet revolution and the technological innovations of the late twenty-first century. The regulation of gambling on the Internet, given that it is global, frontier-free and not geographically bound, has raised major challenges for governments to manage this rapidly growing sector both legally and economically (European Commission, 2011). While precise market sizes are difficult to determine, the global online gambling market was estimated to be worth \$35.97 billion USD in 2014 and is projected to reach a value of \$66.59 billion USD by 2020 (H2 Gambling Capital, 2016). Government-operated gambling revenue in Canada over the 2013–2014 fiscal year totaled approximately \$13.67 billion CAD, with \$2.52 billion CAD from the province of Québec and \$41.88 million CAD from online gambling within the province (Canadian Partnership for Responsible Gambling [CPRG], 2015). *Espacejeux*, the online gambling platform run by Québec's state monopoly operator since 2010, generated \$66.2 million CAD in gambling revenue over the 2015–2016 fiscal year (Loto-Québec, 2016a). In Québec, the prevalence of online gambling was 1.5% in 2012 with poker as the most popular reported online gambling activity (Kairouz & Nadeau, 2014). Given its popularity, with 249 online poker websites available worldwide (Casino City, 2017), poker situates itself as a form of gambling of particular interest when examining the context of legalization and regulation of online gambling.

Regulation of Sites and Gambling Behaviour

In response to what some authors have defined as a matter of sovereignty, governments have taken various regulatory approaches ranging from prohibition to open unregulated legalization of online gambling (McMillen, 2000), yet debate regarding

the most effective approach continues (Gainsbury & Wood, 2011). Each approach has strengths and weaknesses in terms of the capacity to channel gambling from regulated to unregulated markets, secure government revenue and protect citizens from fraud and health risks. Somewhere along the continuum of online regulation lies the case of Québec, where a state monopoly operator was introduced into a previously unregulated online market.

Empirical research has recently begun to investigate changes associated with the legalization of online gambling within treatment seeking populations. A recent Spanish study reported a significant increase in online gambling participation in a sample of pathological gamblers surveyed before the legalization of online gambling through a licensing system (2.53%) and three years after (24.21%; Chóliz, 2016). A study by Planzer et al. (2014), using a quasi-experimental design, produced a finding of noteworthy significance. The only significant association between prevalence of gambling-related problems and gambling policies across 34 European jurisdictions was that rates of problem gambling were higher where advertisement for online gambling was less regulated. Studies have also compared differences in gambling patterns and related harm between regulated and unregulated sites. In 2016, Costes, Kairouz, Eroukmanoff, and Monson reported that gambling on unlicensed websites was associated with more intense gambling patterns and more gambling-related problems compared to gambling on licensed websites.

Without evaluation before and after the legalization of online gambling offerings, the debate about the pros and cons of a given regulatory approach remains speculative. As such, studies providing empirical data before and after the regulation of online gambling, such as the present one are necessary and will provide support to ongoing discussion and debate regarding the best form of regulation for online gambling.

Anticipated Consequences of Legalization

Two opposing positions have been heavily debated regarding the consequences of legalization of online gambling focusing on the (1) economic benefits of channelling of online gambling offerings, and (2) detrimental risks of increased gambling-related problems.

The first position argues that legalization will lead to increased safety and security for players through channeling of participation to regulated websites while emphasising the positive economic impact. Developing a legal framework for the online gambling sector is projected to provide a foundation from which governments can begin to regulate, or control, the economic market as well as begin to steer citizens away from unregulated, and, at times, unsafe, gambling websites (European Commission, 2012). It is also hypothesized that government regulation via a public monopoly operator will protect citizen consumers more efficiently against developing gambling-related problems. Furthermore, revenues from legalized online gambling offerings would enable the increase of allocated funds to improve initiatives pertaining to responsible

gambling and to ensure the security and integrity of online gambling offerings (Nadeau et al., 2014).

The alternative position argues that legalization and the liberalization of the market will lead to increases in prevalence and concentration of gambling-related problems due to higher availability and normalization of online gambling. This position holds that expanding online gambling offerings might increase participation in online gambling and result in increases in higher risk behaviour and gambling-related problems (Nadeau et al., 2014). This debate is of particular concern for public health officials given that specific characteristics of online gambling, such as greater accessibility and anonymity, are associated with higher risk for gambling problems (Gainsbury & Wood, 2011).

The Case of Québec

In Canada, gambling is regulated under federal law via provisions outlined within the *Criminal Code of Canada* (Korn, 2000), which provides provincial governments, within the limits of their territory, the sole authority to manage and conduct gambling ventures (Nadeau et al., 2014). Until recently, all Canadian provinces had chosen to prohibit online gambling. In 2010, the Québec government authorized the Société des lotteries du Québec to offer online gambling in the province (Loto-Québec, 2016b) and later that year *Espacejeux*, the second provincially regulated online casino in Canada, was launched (Loto-Québec, 2016b). *Espacejeux* later joined BCLC's *Playnow* platform to offer a pan-Canadian poker network. With the opening of *Espacejeux*, the regulatory environment in Québec shifted from one where online gambling was completely illegal, to one where the state monopoly was instead competing with unregulated operators.

The website launch received extensive media attention and criticism from public health experts and commentators despite a dearth of empirical data concerning the relationship between regulatory frameworks and gambling-related outcomes. Using a repeated cross-sectional design, we aim to examine whether (1) whether the introduction of state-monopolist *Espacejeux* to the online gambling market of Québec was associated with an increase in the prevalence of online gambling and online poker among the Québec population, and (2) whether the introduction of *Espacejeux* to the online gambling market of Québec was associated with a channeling of the unregulated market in the form of capturing the majority of online gamblers.

Method

Data Sources

This study was conducted using two sources of information on online gambling patterns among residents of the province of Québec, Canada: (1) ENHJEU-Québec Survey data collected through a province-wide gambling survey using a representative sample of the adult population, and (2) Online Poker Database of the University of Hamburg (OPD-UHH) behavioural data collected from unregulated online poker

sites available to Québec residents. Unregulated sites were defined as operators who operate in a jurisdiction without having a license issued by that jurisdiction.

ENHJEU-Québec Survey Data. Data were derived from the two cross-sectional waves of the ENHJEU-Québec Survey, conducted in 2009 ($N = 11,888$) and 2012 ($N = 12,008$), to monitor trends in gambling patterns among the French and English speaking adult population living in private households throughout the province of Québec. Data were collected using computer-assisted telephone interviews from June to September in both 2009 and 2012, except in the Laurentians administrative region, where data collection in 2009 was completed by June 23 (prior to the opening of a casino in the city of Mont-Tremblant). The Research Ethics Board of Concordia University approved the study, and informed consent was obtained from each participant.

Sampling design. In both ENHJEU-Québec surveys, sampling was conducted using a two-stage, stratified and non-proportional design covering regions and households. The 2009 sample was stratified geographically according to the 16 health regions of the Minister of Health and Social Services planning areas. Sample sizes were proportional to the square root of the number of census households in each region. Private households were selected by random digit dialing and one adult per household was randomly selected to participate in the survey. In 2012, stratification was performed by drawing samples from seven distinct regions according to Statistics Canada's classifications: (1) the census metropolitan area (CMA) of Montreal, (2) the 5 remaining CMAs (including Québec City, Sherbrooke, Ottawa-Gatineau, Trois-Rivières and Saguenay), and (3) all non-CMA areas. Given the under-representation of young men in the 2009 survey, male participants aged 18 to 35 were oversampled in the 2012 survey to replicate their proportion in the general population according to census data. Data were weighted to adjust for non-response and the multi-stage cluster sampling design, as well as to align with census information.

Survey measures

Participation in gambling activities. Respondents' gambling participation during the previous 12 months was assessed for 11 activities: lotteries, bingo, horse racing, slot machines, video lottery terminals (VLTs), poker, table games (excluding poker), keno, sports betting, card games and games of skill. The gamblers group comprised those who reported betting or spending money on at least 1 of the 11 listed activities. To identify lifetime non-gamblers, past-year non-gamblers were asked to report whether they have ever bet or spent money on games of chance. Participants indicated which online gambling websites they used (i.e., *Espacejeux* or unregulated sites).

Poker-specific questions. Respondents were asked a series of questions regarding time and money spent on online poker for cash games and tournaments, separately. Cash games were defined as all types of real money poker excluding tournaments. Participants were asked to report the number of times they bet or spent money on Internet poker in the past year. The amount of time each respondent spent on a typical occasion of playing online poker was recorded. Participants were also asked to indicate the amount of money spent during a typical session of playing online poker as well as

the most amount of money spent in a single day. To match the timeframe of the behavioural data, the annual spending and frequency estimates were divided by two to obtain six-month estimates for 2009 and 2012. Time spent on online poker cash games over 6-months was obtained by multiplying the reported duration of a typical session of online poker cash games by the 6-month frequency of online poker cash games.

OPD-UHH Behavioural Data. The second source of information regarding the gambling practices of individuals residing in Québec was the Online Poker Database of the University of Hamburg (ODP-UHH): a collection of behavioural data gathered from online poker networks. The first round of data collection took place from September 2009 to March 2010, with data collected for every real money cash game player on the following poker networks: PokerStars, Full Tilt Poker, Everest Poker, IPN (Boss Media), and Cake Poker. A second round of data collection was conducted between March and September 2013; data were collected for every real money cash game and tournament player on PokerStars.com, PokerStars.es, PokerStars.fr, PokerStars.it and the Revolution Network. The final sample included 4,591,298 unique real money poker identities in 2009/2010 and 2,909,562 unique players in 2013. Players self-reported their geographic location. At Time 1, 24,212 players reported playing from Québec. At Time 2, PokerStars.com, the largest network of Canadian players, did not disclose data regarding players' cities, resulting in a smaller sample of Québec players drawn from the remaining networks. In 2013, 177 players were identified as playing from Québec.

Behavioural indicators. Detailed information was gathered for all virtual playing tables, including the nicknames of players actively sitting at a table, the type of games they played, how much money they had bet at any given moment and players' geographic location. The data collected was used to generate different variables of playing patterns: such as number of sessions (i.e., uninterrupted period of play during which the player is virtually seated at one or more tables and not absent for a period longer than 15 minutes), playing time per session and number of tables played simultaneously during a given session (i.e., multi-tabling). When used in combination, the variables yield a key figure, the money volume in dollars rake spent (Figure 1). Money volume is defined as the product of playing time over a 6-month period, the mean number of tables played simultaneously and the mean rake paid to the operator per hour. The money volume of a player is the mean amount of money a player has paid to the operator during the six months of the observation period. It is important to note that this figure does not account for any cash flow between players. However, money volume should equal players' spending, since poker is a zero-sum game (after rake).

Analyses

Logistic regressions were conducted with each dataset to compare gambling patterns before (2009) and after (2012) legalization of online gambling. Odds ratios and 95% confidence intervals are reported for Internet gambling prevalence, Internet poker prevalence and online games. For money spent and time spent mean, median and standard deviations for each year are reported.

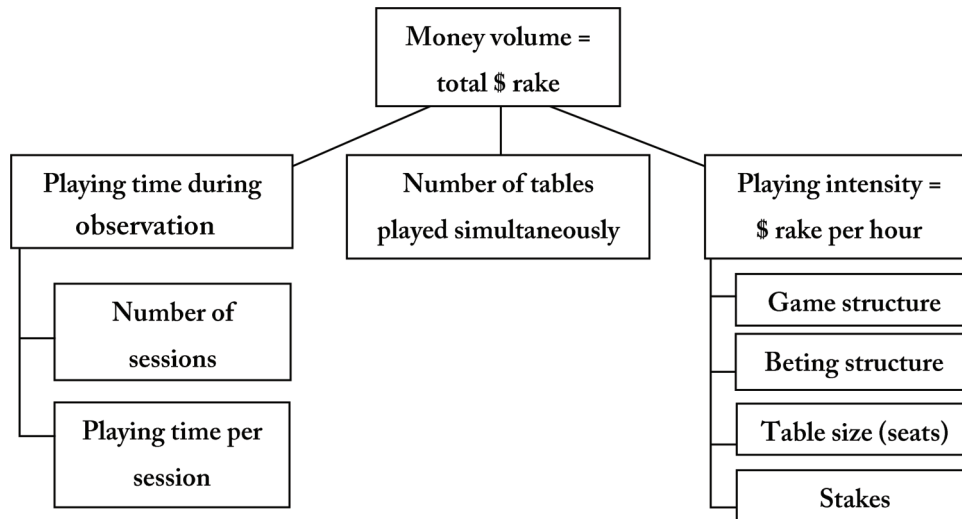


Figure 1. Variables of Cash Game Playing Habits.

Results

The ENHJEU-Québec survey demonstrated that only 1.5% of the population gambled online for real money in 2012 versus 1.4% in 2009 (before *Espacejeux*). The majority of online gamblers played poker online at least once per year, and the corresponding online poker participation rates were 0.8% (2009) and 0.9% (2012). Behavioural data from the OPD-UHH show a modest decline in online poker participation from 0.84% in 2009/2010 to between 0.68% and 0.75% in 2013.

Prior to the introduction of *Espacejeux* by Québec's state monopoly operator in late 2010, all online gambling took place solely on unregulated sites. Data from the ENHJEU-Québec Survey in 2012 reveals that, after the introduction of a regulated online gambling site, 82.5% of online gamblers continued to play on unregulated sites, 58.3% exclusively. Data from OPD-UHH reveals similar results with between 89.2% and 90.2% of all real money online poker players from Québec playing on unregulated sites in 2013. These findings demonstrate that the introduction of *Espacejeux* did not lead to channeling of the majority of online gamblers from the unregulated market to a regulated site. In 2012/2013, both survey and behavioural data revealed that the majority of online poker players reported either gambling on cash games exclusively or on both cash games and tournaments (Table 1).

Online poker players who participated in the ENJHEU-Québec Survey reported having spent a mean of nearly \$2,500 CAD over the course over a six-month period in 2009 and \$683 CAD over six-months in 2012. The median spending lies at \$67.5 and \$100 CAD in 2009 and 2012, respectively, suggesting that the money spent is a highly skewed distribution with a few intense players driving most of the spending. This observation is reinforced by the large standard deviations of over \$1,800 and \$2,200 CAD, respectively. The mean time spent over the course of 6 months was 72 hours in 2009 and 132 hours over 6 months in 2012, with the median values being

Table 1
Descriptive statistics of online gambling activities among adults in Canada and Québec

	ENHJEU-Québec Survey Data						OPD-UHH Behavioural Data					
	Québec						Canada			Québec		
	2009 (n = 111)		2012 (n = 159)		OR ²		CI OR ³		2009/10		2009/10	
	%	CI % ¹	%	CI % ¹					%	%	%	Upper bound ⁵
Internet gambling prevalence	1.4	1.1–1.8	1.5	1.2–1.8	1.09	0.8–1.5	–	–	–	–	–	–
Internet poker prevalence	0.8	0.6–1.2	0.9	0.7–1.2	1.09	0.7–1.7	–	1.03	0.73	0.84	0.68	0.75
Players on unregulated sites	100	–	82.5	74.0–88.7	–	–	–	–	–	–	–	–
Exclusively unregulated	100	–	58.3	48.4–67.6	–	–	–	–	–	–	–	–
Unregulated & regulated	–	–	24.2	16.9–33.4	–	–	–	–	–	–	–	–
Online games (12 months)												
Poker ⁶	60.5	48.9–71.1	60.6	50.5–70	1	0.5–1.9	–	–	–	–	–	–
Other activities exclusively	39.5	29–51.2	39.4	30.2–49.5	ref.	ref.	–	–	–	–	–	–
Online poker (12 months)												
Cash games only	–	–	56.2	43.6–68	–	–	–	–	26.6	–	26.5	33.3
Cash games & tournaments	–	–	39.2	27.9–51.8	–	–	–	–	48.1	–	43.5	48.0
Tournament only	–	–	4.7	1.8–11.3	–	–	–	–	25.3	–	23.3	25.3
Online poker on unregulated sites	100	–	90.0	81.6–94.8	–	–	–	100	–	100	89.2	90.2
Exclusively unregulated	100	–	58.9	46.2–70.4	–	–	–	–	–	–	–	–
Unregulated & regulated	–	–	31.1	20.8–43.8	–	–	–	–	–	–	–	–

¹ 95% Confidence interval (CI).

² Odds ratio.

³ Odds ratio 95% Confidence interval (CI).

⁴ Assumption: the regulated market 100% substitutes the unregulated market.

⁵ Assumption: the regulated market 0% substitutes the unregulated market.

⁶ May include other activities.

Table 2

Descriptive statistics of online poker cash game gambling in Québec, bi-annual

	ENHJEU-Québec		OPD-UHH ¹	
	2009	2012	2009/2010	2013
Total money spent (CAD)				
<i>N</i>	50	92	24,212	177
MEAN	2,483.18	683.42	196.43	317.06
MED	67.50	100.00	5.30	17.38
<i>SD</i>	1,8435.33	2,202.86	2,421.80	976.20
Total time spent (hrs)				
<i>N</i>	52	91	24,212	177
MEAN	71.88	131.99	21.83	33.67
MED	13.75	12.00	4.43	4.36
<i>SD</i>	133.75	765.72	58.14	63.55

¹ Spending figures were converted from USD to CAD to ensure comparability with ENHJEU-Québec data.

considerably lower at 13.75 ($SD = 134$) and 12 ($SD = 766$) hours, respectively. Again, the standard deviations are quite large, also suggesting a high concentration of playing time on a small number of intense players.

The behavioural data reveal similar trends: over the course of six months, Québec poker players were observed to spend a mean of \$196 in rake in 2009/2010 and a mean rake of \$317 in 2013. The median is considerably lower at \$5 and \$17, respectively, confirming the strong concentration of playing volume, which is further supported by the large standard deviations of \$2,422 and \$976. Playing time in hours is also concentrated in the behavioural data, but to a lesser extent: the mean values lie at 22 hours (2009/2010) and 34 hours (2013), with the median playing time amounting to 4.43 hours and 4.36 hours and standard deviations being 58 hours and 64 hours. Behavioural data thus suggest that money and time spent are, in actuality, lower than what players report when being asked (Table 2).

Discussion

The combination of both survey and behavioural data clearly show that the introduction of *Espacejeux* by the province's state monopoly operator into Québec's online gambling landscape did not increase the overall prevalence of gambling participation including poker. As previously reported, the rates of problem gambling also remained stable within the population (Kairouz & Nadeau, 2014; Kairouz, Paradis, Nadeau, Hamel, & Robillard, 2015).

The data indicate that despite the introduction of *Espacejeux*, the majority of online gamblers have continued playing on unregulated sites, a result in direct contrast with the hypothesis that offering a legal option for online gambling will result in the channeling of a significant portion of players from unregulated websites to *Espacejeux*. Given these results, it may be prudent for government stakeholders to consider

alternative approaches for managing online gambling offerings. Considering that the online gambling market is well established, government agencies need to be cognizant when entering a mature market. As in the case of Québec, perhaps a more suitable response would be the establishment of a licensing system where existing private operators obtain licences from government regulatory bodies and follow guidelines established by their respective jurisdictions.

There are multiple potential explanations for the stability of the online gambling market despite the introduction of *Espacejeux*. The player pool of the *Espacejeux* network is small compared to other sites, which is particularly salient with regards to online poker (Fiedler & Philander, 2013), an activity that represents the biggest share of the online gambling market in Québec. Because what is commonly known as the network effect, where each additional player in the player pool benefits the other players, *Espacejeux* is particularly disadvantaged in this regard. Furthermore, poker is unique among online gambling activities because it is both a game of chance and of skill (Costes et al., 2016; Fiedler & Rock, 2009). Thus, the network effect is strengthened by a skill effect whereby players want to compete with the best players and will choose where they play accordingly. All of these factors result in a small number of large companies dominating the online poker market with smaller and newer providers or operators struggling to grow and capture a portion of the market (Katz & Shapiro, 1985). A state monopoly is further hindered by the necessity to limit its offering within the geographic bounds of their province. In this respect, unregulated websites have an edge compared to regulated gambling offerings because of the unrestricted geographic scope of their participant pool (Costes et al., 2016). If players do not find enough games or players for their preferred variant, skill level and stakes of poker, they are likely to choose a different site with those features. Hence, the only way for *Espacejeux* to become more attractive is by either shutting down the (unregulated) competition or by expanding the player pool to include other operators and offering more competitive clientele.

Contrary to the idea that gamblers underreport their gambling involvement in surveys as a result of biased memory or anticipated moral sentiments (Meyer & Bachmann, 2005), our findings comparing survey data to data on actual playing behaviour indicate that surveyed gamblers overreported their gambling expenditures. A possible explanation for the observed overreporting is that players may have misunderstood the question as having asked how much they bet instead of how much they actually lost (i.e., bets minus winnings) (Błaszczynski, Ladouceur, Goulet, & Savard, 2006). That being said, while the 2009 mean is strongly influenced by one outlier, who spent considerably more than others, an overreporting was also found in 2013, although to a lesser extent. Other potential reasons for this overreporting might be that the behavioural dataset does not include all operators and players could also have played and spent funds elsewhere or that behavioural data includes only the rake paid to the operator and not the amount lost to other gamblers. However, the latter should only affect the distribution of spending (fewer extreme spenders and no net winners) and not the mean, since the cash flow between players evens out, after rake, as poker is a zero-sum game.

Certain methodological limitations of the present study should be noted. As is the case with all self-report data, there is potential for social desirability bias. Despite the large number of cases, OPD-UHH data are limited in terms of market coverage as it does not comprise all available online poker websites. Specifically, the inclusion of *Espacejeux* in the 2013 data could have strengthened findings. While poker remains the most popular form of online gambling, the OPD-UHH is limited by its singular focus on this form of gambling. Nevertheless, poker does represent the majority of online gamblers and the largest share of online gambling activity. Similar research on other forms of online gambling could contribute to a more thorough understanding of the effects of *Espacejeux* on Québec's online gambling market.

Conclusion

Results clearly demonstrate that the introduction of a regulated offering by the state monopoly into Québec's online gambling market was not associated with significant change in online gambling and online poker participation. Most players continued to play on unregulated sites despite the introduction of a state monopoly operator, indicating a partial channelling of online gambling from unregulated websites to the available regulated site. The triangulation of survey and behavioural data provides a more complete picture as self-reported data were supported with objective behavioural data provided by online gambling websites. The absence of channeling of gamblers to *Espacejeux* calls for future discussion of other forms of regulation and governance of gambling offerings such as a licensing system. Furthermore, the increased revenues associated with the migration of gamblers to the state monopoly website raise a fundamental question on whether this substantial revenue is being put to use in a responsible manner. Still, longitudinal analyses are needed to fully disentangle the effects of legalization of online gambling.

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Gambling Habits of People With Parkinson's Disease: An Exploratory Study

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Abstract

The development of pathological gambling (PG) among people with Parkinson's disease (PD) is increasingly reported. The intake of dopamine agonists is most often associated with the emergence of this addiction. Although it is known that gambling habits contribute to the onset of gambling problems in the general population, these habits have not yet been studied in individuals with PD. Thus, this study aimed to explore gambling habits in people with PD. Twenty-five individuals with PD and 8 caregivers participated. Thirteen gamblers took part in a semi-structured interview regarding their gambling habits and the presence of a gambling problem and other impulse-control disorders. The results show that gamblers mainly play lotteries and slot machines. Most gamble for pleasure, but some reported wanting to win money to finance a cure for their PD. None of the gamblers involved a caregiver in their gambling activities and no gambler currently presented a gambling problem. However, 2 at-risk gamblers reported having developed a gambling problem in the past. This study sheds light on factors that may contribute to the development of PG among patients with PD, namely, the emergence of new reasons for gambling after a PD diagnosis, erroneous beliefs about gambling, and discretion about gambling habits. Prevention strategies are discussed in view of these results. However, given the small sample size, further studies examining the gambling habits of people with PD are required.

Keywords: Parkinson's disease, pathological gambling, gambling habits

Résumé

De plus en plus, on observe le développement du jeu pathologique (JP) chez les personnes atteintes de la maladie de Parkinson (MP). La prise d'agonistes de la

dopamine est le plus souvent associée à l'émergence de cette dépendance. Bien qu'il soit connu que les habitudes de jeu contribuent à l'apparition de problèmes de jeu dans la population en général, ces habitudes n'ont pas encore été étudiées chez les personnes atteintes de la maladie de Parkinson (MP). Dans cette optique, cette étude explore les habitudes de jeu chez les personnes atteintes de la MP. Vingt-cinq personnes atteintes de la maladie de Parkinson et huit soignants y ont participé. Treize joueurs ont participé à une entrevue semi-structurée concernant leurs habitudes de jeu et la présence d'un problème de jeu et d'autres troubles liés au contrôle des impulsions. Les résultats montrent que les joueurs jouent principalement aux loteries et aux machines à sous. La plupart jouent par plaisir, mais certains ont déclaré vouloir gagner de l'argent pour financer une thérapie contre la maladie. Aucun des joueurs n'avait avec lui un fournisseur de soins dans ses activités de jeu et aucun joueur ne présentait actuellement de problème de jeu. Cependant, deux joueurs à risque ont déclaré en avoir développé un par le passé. Cette étude met en lumière les facteurs qui peuvent contribuer au développement du jeu pathologique chez les personnes atteintes de Parkinson, à savoir l'émergence de nouvelles raisons pour le jeu après un diagnostic de MP, les croyances erronées sur le jeu et la discrétion sur les habitudes de jeu. Compte tenu de ces résultats, des stratégies de prévention sont analysées. Cependant, étant donné la petite taille de l'échantillon, d'autres études examinant les habitudes de jeu des personnes atteintes de cette maladie sont nécessaires.

Introduction

Idiopathic Parkinson's disease (PD), which affects nearly 1% of people over the age of 60, is defined as a chronic and progressive neurodegenerative disease (Fritsch et al., 2012). By the time the disease is diagnosed, there is, among other things, a lack of dopamine in the striatum, which is caused by the degeneration of neurons that produce this molecule in the substantia nigra pars compacta (Jellinger, 2012, for a review). The neurochemical dysfunctions and pathological anomalies in PD cause motor symptoms such as tremors, bradykinesia, and postural instability, which hinder the accomplishment of daily and domestic life activities (Dural, Atay, Akbostanci, & Kucukdeveci, 2003). Psychological and behavioural symptoms are also reported. Along these lines, the development of problems related to impulse control, including hypersexuality, binge eating, compulsive shopping, and pathological gambling (PG), has captured the attention of researchers for over a decade. The largest significant study that specifically addressed the prevalence of these problems included data from interviews with 3,090 people with PD from various regions in Canada and the United States (Weintraub et al., 2010). The results revealed that 13.6% of the sample presented at least one of these four impulse-control problems within the 6 months preceding data collection and that PG was reported among 5% of the sample. For comparative purposes, the rate of PG (moderate risk and probable PG) in the general population of Quebec (Canada) is 1.8% (Kairouz & Nadeau, 2014).

Some studies suggest that dopamine agonists (DAs), a medication generally prescribed to reduce motor symptoms among people with PD, are often associated with the emergence of PG (Santagelo, Barone, Trojano, & Vitale, 2013; Weintraub et al., 2010). One of the current hypotheses that attempts to explain this link is that DA overstimulates the mesolimbic pathway, a neuronal circuit that is known for its involvement in the reward system (Santagelo et al., 2013). However, taking anti-Parkinson's medication does not necessarily lead to the development of a gambling problem, as most patients treated with DA do not develop one (Weintraub et al., 2010). In fact, the development of a gambling problem is multifactorial. In addition to DA, factors such as age at the time of PD diagnosis and pre-morbid impulsivity have a role in its development (Callesen, Weintraub, Damholdt, & Moller, 2014). In this regard, further knowledge about the development of PG in the general population could enhance comprehension of this problem among people with PD.

Gambling Problems

Gambling involves irreversible betting of money or valuable objects on an outcome that is essentially based on chance (Nower & Blaszczynski, 2010). Although most people gamble on an occasional basis (Kairouz & Nadeau, 2014), some will develop a maladaptive, persistent, and repeated practice of gambling (American Psychiatric Association, 2013). Cognitive behavioural models emphasize contextual and psychological variables to explain the development of PG, such as the type of gambling activity, amounts of money bet, and reasons and motivations to gamble (Sharpe, 2002). The analysis of gambling habits also considers the involvement of family and friends, such as offering transportation to a casino.

Characteristics and Types of Gambling Activities

An overview of the literature shows that non-problem and problem gamblers are distinguishable by the amounts bet and the preferred types of gambling activities. In Quebec, a median amount of CAN\$120 per year is spent on gambling by non-problem gamblers. Among moderate-risk gamblers (i.e., those who do not meet the minimum number of diagnostic criteria for PG but who still experience various negative consequences of gambling), the median annual amount spent is CAN\$1,560 and rise to CAN\$5,344 among probable pathological gamblers (Kairouz & Nadeau, 2014). This prevalence study also reports that the proportion of at-risk and probable pathological gamblers differs from one gambling activity to another: 2.7% among lottery players, 5.8% among bingo players, 7.9% among poker players, 8.7% among casino slot machine players, and 16.4% among video lottery terminal players. In a large-scale study conducted by Hodgins et al. (2012) with 1,372 adults from the general population in Alberta (Canada), pathological gamblers mostly played on slot machines and video lottery terminals. The structural characteristics of these machines make them highly addictive, chiefly because of the presence of intermittent reinforcement and the impression stimulated in gamblers that they "almost won" (Clark, Crooks, Clarke, Aitken, & Dunn, 2012). Hence, certain types of gambling activities may be related to a greater incidence of problem gambling. To better

understand how PG develops among people with PD, it is essential to find out whether this relationship is applicable. Do people with PD gamble in games with addictive characteristics? Little data are available on the subject. In fact, many studies that aimed to understand the development of problem gambling among this population did not evaluate the types of games played or the amounts spent (see Callesen, Scheel-Kruger, Kringelbach, & Moller, 2013; Callesen et al., 2014; Voon et al., 2011; Weintraub et al., 2010).

Reasons for Gambling

The most frequently reported motives to gamble among the general population are for pleasure, to take part in an activity with friends or family, to socialize, and to experience excitement (Francis, Dowling, Jackson, Christensen, & Wardle, 2015; Nower & Blaszczynski, 2010; Wardle et al., 2011). In contrast, the results of a study by Francis et al. (2015) show that problem gamblers endorse significantly more financial reasons for gambling and significantly fewer social motives. Nower and Blaszczynski (2010) also point out that at-risk and pathological gamblers may gamble to cope with negative feelings. Further, certain subgroups of individuals may gamble for reasons specific to their respective realities. For example, people who are 55 years and over report gambling to win money to pay for a trip (Hagen, Nixon, & Solowoniuk, 2005) or to solve financial problems (Vander Bilt, Dodge, Pandav, Shaffer, & Ganguli, 2004). They are also attracted by the social occasion that certain gambling activities offer, such as bingo and casino games (Desai, Maciejewski, Dausey, Caldarone, & Potenza, 2004; Giroux et al., 2013). The onset of an illness that limits physical abilities is also a reason to gamble evoked by gamblers who are 55 years and over (Giroux et al., 2013). Given the extent of problems and limitations caused by PD, it is likely to be associated with increased gambling habits. Thus, could the progressive deterioration of physical capabilities among people with PD motivate them to gamble? Do they gamble to meet needs related to their disease? The answers to these questions will determine whether they present motivations to gamble that place them at risk for developing PG.

The Implication of Friends and Family

There is evidence that gambling problem severity is positively associated with gambling frequency and expenditure of one's close social network (Fortune et al., 2013). Moreover, problem gambling is more common among individuals whose relatives also have a gambling problem (Black, Monahan, Temkit, & Shaw, 2006; Langhinrichsen-Rohling, Rohde, Seeley, & Rohling, 2004). Relatives' attitudes may also influence gambling behaviour. Oei and Raylu (2004) demonstrated that parents' beliefs toward gambling had a direct impact on their children's gambling beliefs and, in turn, on their gambling behaviour. These observations must be explored in relation to people with a chronic disease such as PD, insofar as they often rely on caregivers. Data from Statistics Canada indicate that 56% of people with PD depend on the aid of a caregiver (Wong, Gilmour, & Ramage-Morin, 2014). For 84% of them, the caregiver is their partner, a friend, or a neighbour. Since caregivers dedicate much of their time to ensure

the well-being of the person with PD, this raises the question of whether they could also be involved in the person's gambling habits. The current literature does not provide answers to this crucial question. If caregivers are indeed involved in the gambling habits of their close one affected by PD, they should be provided with information on their potential contribution to the development of problem gambling among patients with PD.

Research Objectives

The development of PG in the general population is associated with many variables that have never been specifically assessed in patients with PD. Research on these variables could shed further light on the current understanding of PG in these patients. Hence, the main objective of this study was to explore the gambling habits of people with PD. Types of games, amounts bet, the context within which gambling behaviours began, reasons for gambling, and involvement and perception of caregivers were investigated. Gambling habits were assessed over the past 6 months. This time frame was chosen because this study is part of a larger research project that evaluated the evolution of the participants' gambling habits over the course of a year. However, these data are not included in this paper. Two other research questions were explored: (a) Do the gamblers present gambling problems and different comorbidities (alcohol and drug-related problems, compulsive shopping, hypersexualization) that are often encountered among patients with PD suffering from PG? (b) Are changes in the gambling habits of people with PD retrospectively reported after beginning PD medication? In addition, we aimed to compare the study variables with those obtained in a sample of 300 gamblers from the province of Quebec aged 55 years and older without PD (Giroux et al., 2013) in order to explore possible differences between them.

Method

Participants

Participants were recruited from the patients under the medical responsibility of the neurologist involved in the study. To be admissible to the study, participants had to have mild to moderate stage idiopathic PD (Stages 1 to 3 of Hoehn & Yahr, 1967), as diagnosed by the neurologist. The diagnostic criteria used for PD were those of the United Kingdom Parkinson's Disease Society Brain Research Centre (Hughes, Daniel, Kilford, & Lee, 1992). Participants with severe PD (Stages 4 to 5 of Hoehn & Yahr, 1967) were excluded because of the severity of their motor and elocution difficulties, which would cause complications during the data collection interview. Moreover, participants were excluded if they presented a psychotic disorder or dementia, or if they had undergone neurosurgery, as noted in their medical files. From the list of people with PD receiving care from the neurologist, 52 met the inclusion criteria. These individuals were invited to participate via a postal letter informing them of the study, to which eight people with PD replied with interest. The 44 others who did not reply were contacted by phone to request their participation.

Of these 44 individuals, 17 agreed to participate. Those who refused to participate ($n = 10$) evoked discomfort about talking about gambling and did not wish to take part in a face-to-face interview, and the remaining 17 could not be reached. In total, 25 people who agreed to participate were admissible to the study. Among them, 15 were considered gamblers and 10 were non-gamblers. Table 1 presents the sociodemographic characteristics of the sample. Only one statistical difference was observed between gamblers and non-gamblers: The data show that gamblers were diagnosed with PD at 54.69 years, whereas non-players received the diagnosis at 65.90 years, a statistically significant difference ($p < .05$).

As presented in Table 2, almost all participants (95%) were taking at least one prescription medication of the L-dopa family: 41% took a DA, 45% took another type of medication for PD, and 36% took a psychotropic medication. Data on medication were available for only 22 of the 25 participants.

Caregivers

A caregiver is defined as a friend, family member, or neighbour who assists a person with an illness in the execution of daily and domestic activities (Wong et al., 2014). In this study, caregivers who were hired by a company offering home care or health professionals from the public health system were excluded. Caregivers were recruited via the gambler's interview. Eight gamblers agreed to their caregiver being contacted, and all caregivers who were contacted accepted the invitation to participate in the study. Gamblers who refused to allow their caregiver to be contacted expressed concerns regarding confidentiality. Four caregivers had been the partner of the patient for an average of 39 years. Two caregivers were children, one was a sibling, and one was a friend who had known the patient for over 40 years. The mean age of the caregivers was 67 years.

Instruments

Gambling Habits Questionnaire. Based on the Diagnostic Interview on Pathological Gambling – Revised (Ladouceur et al., 2000), this questionnaire comprises 12 items that evaluate participation in gambling activities and associated expenses for 12 types of gambling games over the past 6 months, using yes/no questions. Two versions were used: one for the participant and one for the caregivers.

The Pathological Gambling Severity Index (PGSI). This tool, a subscale of the Canadian Problem Gambling Index, was used to screen for probable PG over the past 6 months (Ferris & Wynne, 2001). Items are rated on a 4-point Likert-type scale. The total score obtained refers to four possible categories of gambling problem severity (0 = non-problem gambling, 1 or 2 = low risk, between 3 and 7 = moderate risk, more than 8 = probable PG). The tool has good internal consistency with a Cronbach's alpha of .84. Two versions of the PGSI were used for this study: one for the participant and one for the caregivers.

Table 1
Sociodemographic Characteristics of the Sample

	Gamblers <i>n</i> = 15		Non-gamblers <i>n</i> = 10		Total <i>N</i> = 25		Study by Giroux et al. (2013) <i>N</i> = 300	
Continuous variables	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	65.20	6.88	73.20	10.96	68.40	9.42	65.92	6.66
Age at PD diagnosis	54.69*	2.26	65.90*	3.94	59.56	11.49	NA	NA
MMSE score	28	1.56	28.50	0.70	28.08	1.44	NA	NA
Categorical variables	<i>n</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
Women	3	20.0	6	60.0	9	36.0	141	47.0
Men	12	80.0	4	40.0	16	64.0	159	53.0
Civil status								
Single	4	26.6	0	0.0	4	16.0	42	14.0
Separated/divorced	1	6.0	1	10.0	2	8.0	78	26.0
Widowed	0	0.0	2	20.0	2	8.0		
Married	8	53.3	5	50.0	13	52.0	180	60.0
Common-law	2	13.3	2	20.0	4	16.0		
Education								
Grade school	4	26.6	0	0.0	2	8.0	101	33.67
High school	4	26.6	3	30.0	9	36.0	98	32.67
College	1	6.0	1	10.0	2	8.0	44	14.67
University – bachelor's	4	26.6	3	30.0	7	28.0	57	19.0
University – master's	2	13.3	1	10.0	3	12.0		
University – doctorate	0	0.0	2	20.0	2	8.0		
Main occupation								
Working	3	20.0	0	0.0	3	12	85 ^a	28.8 ^a
Not working	1	6.67	0	0.0	1	4	210 ^a	71.2 ^a
Homemaker	1	6.67	0	0.0	1	4		
Retired	10	66.67	10	100	20	80		
Income								
Less than CAN\$15,000	1	6.0	0	0.0	1	4.0	NC	NC
Between CAN\$15,000 and \$25,000	0	0.0	0	0.0	0	0.0	NC	NC
Between CAN\$25,000 and \$35,000	1	6.0	1	10.0	2	8.0	NC	NC
Between CAN\$35,000 and \$50,000	6	40.0	2	20.0	8	32.0	NC	NC
Between CAN\$50,000 and \$75,000	3	20.0	1	10.0	4	16.0	NC	NC
CAN\$75,000 or more	0	0.0	0	0.0	0	0.0	NC	NC
Refusal	3	20.0	5	50.0	8	32.0	NC	NC
Do not know	1	6.0	1	10.0	2	8.0	NC	NC

Note. PD = Parkinson's disease; MMSE = Mini-Mental State Examination; NA = not available; NC = non-comparable.

^a *N* = 295.

**p* > .05.

Table 2
Type of Medication and Dose in the Sample

Type of medication	Gamblers <i>n</i> = 13		Non-gamblers <i>n</i> = 9		Total <i>N</i> = 22	
	<i>n</i>	Dose (mg/day)	<i>n</i>	Dose (mg/day)	<i>n</i>	Dose (mg/day)
L-dopa	13	250.96	8	234.37	21	244.64
Sinemet	11	192.04	7	182.14	18	188.19
Sinemet CR	5	40.00	0	-	5	40.00
Carbidopa-levodopa-entacapone	1	600.00	1	600.00	2	600.00
Levodopa-carbidopa	1	350.00	0	-	1	350.00
Dopamine agonist	5	2.45	4	3.00	9	2.61
Pramipexole	3	2.31	4	3.00	7	2.54
Ropinirole	2	3.00	0	-	2	3.00
Other Parkinson's disease medication	8	NC	2	NC	10	NC
Anticholinergic (trihexyphenidyl)	5	3.60	0	-	5	3.60
Catechol-O-methyltransferase inhibitor (entacapone)	2	1200.00	1	800.00	3	1066.67
Monoamine-oxidase inhibitor (rasagiline, selegiline)	6	4.50	1	1.00	7	4.00
NMDA glutamate receptor antagonist (amantadine)	2	300.00	0	-	2	300.00
Psychotropic medication	7	NC	1	NC	8	NC
Antipsychotic (teva-quetiapine)	0	-	1	25.00	1	25.00
Antidepressant (venlafaxine)	2	18.75	0	-	2	18.75
Anxiolytic (clonazepam)	5	1.67	1	NA	6	1.67

Note. Data regarding prescription medication were not available for two gamblers and one non-gambler. NA = not available; NC = not calculated because doses within this category are not comparable; NMDA = N-methyl-D-aspartate.

Gambling Habits Interview. Also based on the Diagnostic Interview on Pathological Gambling – Revised (Ladouceur et al., 2000), this instrument comprises 21 questions that aim to provide a more in-depth portrait of current and past gambling habits. Reasons for gambling, onset of gambling behaviour, and involvement of one's social network are first questioned through multiple choice response questions, followed by open-ended questions to obtain further details. Two versions were used: one for the participant and one for the caregivers.

Diagnostic and Statistical Manual of Mental Disorders (4th ed., text rev.; DSM-IV-TR; American Psychiatric Association, 2000) criteria for PG. A questionnaire based on the *DSM-IV-TR* criteria for PG was specifically created for this study to evaluate the presence of PG. The *DSM-IV-TR* criteria were transformed into yes/no questions. This questionnaire was administered only if the gambler had obtained a score of 3 or more on the PGSI.

The Alcohol And Drug Screening And Assistance Needs Assessment questionnaire. This questionnaire includes 50 dichotomous and Likert-type scale items that aim to evaluate the presence of an alcohol problem, a drug problem, or both (Tremblay & Blanchette-Martin, 2009). Developed in French, this instrument has good validity;

internal consistency is .87 for the section on alcohol-related problems and .72 for the section on drug-related problems.

Lejoyeux's Compulsive Shopping Questionnaire. This instrument comprises 19 dichotomous items that evaluate the presence of a compulsive shopping problem over the last 6 months (Lejoyeux, Tassain, Solomon, & Ades, 1997). The psychometric qualities of this instrument had yet not been evaluated while this paper was being written.

The Hypersexuality Questionnaire. This instrument is composed of five dichotomous (yes/no) items. The psychometric qualities of this tool had not been evaluated while this paper was being written. However, it was developed within the scope of a study that specifically evaluated impulsivity problems among people with PD (Voon et al., 2006).

Procedure

The study procedure is presented in Figure 1. Recruitment and data collection were conducted from March to October 2010 by the first author. An individual telephone interview of approximately 30 min was conducted with each of the 25 participants. This interview aimed to evaluate the types of gambling games played and the amounts spent gambling over the past 6 months, as well as the presence of at-risk and problem gambling habits. Non-gamblers (i.e., those who revealed they had not gambled over the past 6 months) were questioned about their reasons for not gambling. Gamblers (i.e., those who reported having gambled at least once over the past 6 months) were invited to take part in a face-to-face interview lasting around 2 hours at their home or the university. Every instrument was administered verbally. The interviewer (first author) read the questions, named the response choices when available, and wrote down the responses. The interviews were not recorded, but the interviewer noted responses to the open-ended questions as precisely as possible. At the end of the interview, a gift certificate worth CAN\$10 and a list of help resources on gambling were offered. Finally, individual face-to-face interviews of approximately 30 min were conducted with caregivers.

Data Analysis

Descriptive analyses were first performed, followed by non-parametric analyses of variance (Mann-Whitney *U*) to compare continuous data. Proportion tests (Pearson chi-square test and Fisher's exact test) were also conducted on categorical data. SPSS version 20 software was used. The selected alpha threshold was .05. Further, a qualitative analysis was conducted with the responses obtained on the open-ended questions of the semi-structured interview. There were no verbatim transcriptions of these data, as they were not audio-recorded. However, to ensure validity of the data, we subjected them to a rigorous thematic analysis (Braun & Clarke, 2006; Piercy, 2004). This analysis procedure consisted of five steps. First, raw data for each of the questions were gathered into computerized documents on Microsoft Word software.

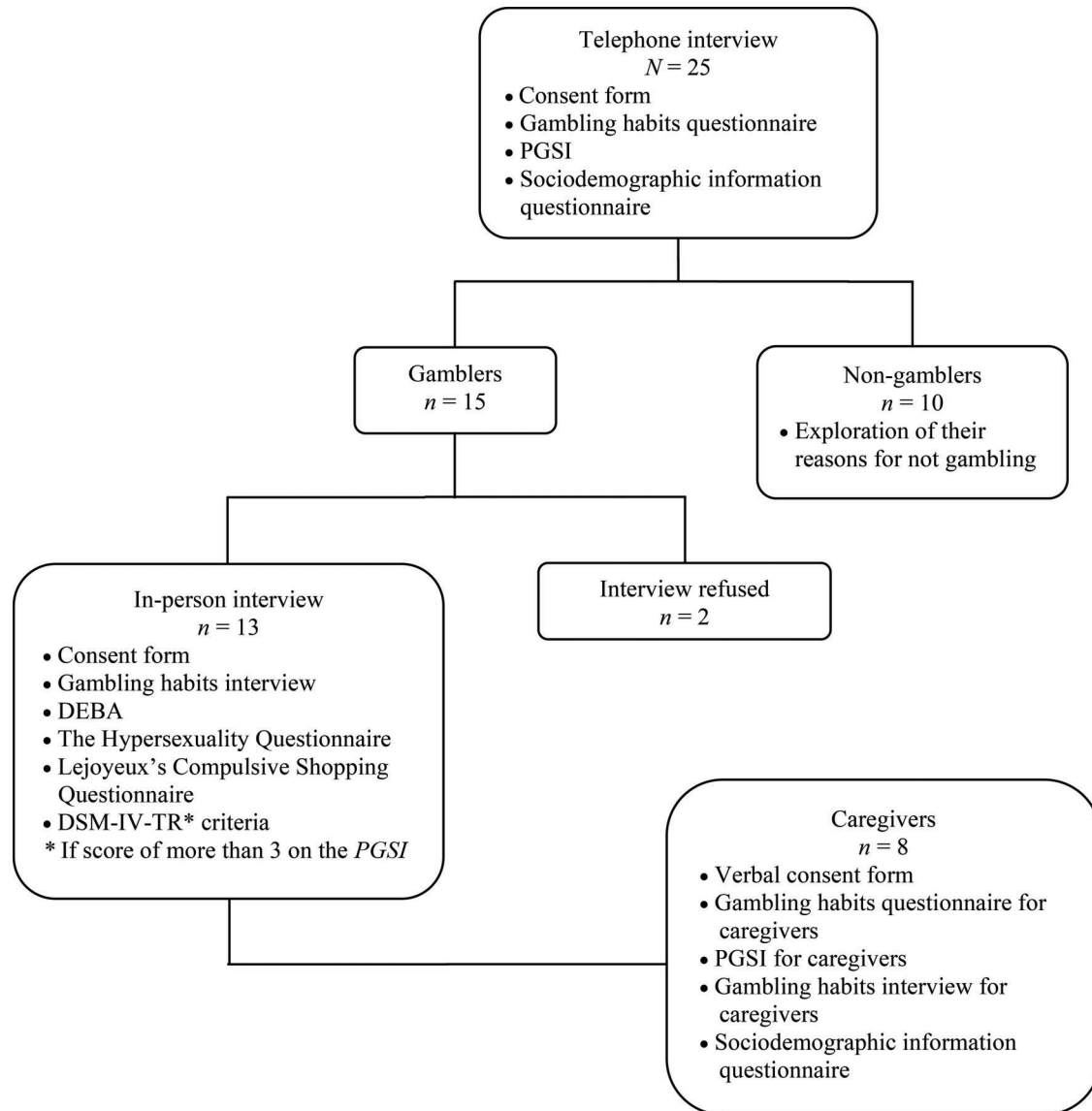


Figure 1. Study procedure sequence. DEBA = Alcohol and drug screening and assistance needs assessment questionnaire; *DSM-IV-TR* = *Diagnostic and Statistical Manual of Mental Disorders*, 4th ed., text rev.; PGSI = Pathological Gambling Severity Index.

Second, raw data were carefully read several times by the first author and a doctoral level research assistant to identify categories for grouping similar content. Third, categories were revised and refined by the first author and the doctoral research assistant. Fourth, raw data were carefully read and assigned to the proper category. This task was performed by the first author and the doctoral research assistant in a double-blind independent process. Finally, to ensure the validity of the identified categories, an inter-rater agreement statistic (93%) was calculated on all content. According to Lombard, Snyder-Duch, and Bracken (2002), this rate is satisfactory.

A post hoc theoretical comparative analysis (Pearson chi-square) was conducted to compare certain study variables (gambling practice proportions, at-risk gambler

proportions) with those obtained in a sample of 300 gamblers from the province of Quebec who were 55 years and older without PD (Giroux et al., 2013). Data collection for the latter study was conducted in 2011; the PGSI was also used to assess gambling problem severity. Participants were recruited in the province of Quebec (Canada) through advertisements on message boards and in newspapers. Forty-seven percent of the sample were men, 35% had a college education or higher, 28% were employed, and 60% were in a relationship. The mean age of the 300 participants in this sample was 65.92 years ($SE = 6.66$). Among the sociodemographic variables, one significant difference was found between the current study sample and that of Giroux et al. (2013) for gender: The sample in the current study contained significantly more men than did the reference group, $\chi^2(1, N = 15) = 6.624, p = .01$.

Results

Gambling Problem

Among the gamblers in this study ($n = 15$), none were problem gamblers. However, three gamblers met the criteria for low-risk gambling and one gambler met the criteria for moderate-risk gambling. These four gamblers were men and represented 26.7% of the sample. Two of them reported having developed a gambling problem in the past associated with DA use. A thorough description of these two gamblers is presented in the subsection Changes Reported Following the Introduction of a DA. For exploratory purposes, the proportion of at-risk gamblers in the study was compared with the proportion obtained by using the same instrument among 300 gamblers aged 55 years and older recruited in the province of Quebec (33.4%; Giroux et al., 2013). The distributions did not differ statistically, $\chi^2(1, N = 15) = 0.039, p = .578$.

Types of Games and Amounts Spent

As presented in Table 3, the lottery was the most popular game among gamblers ($n = 15$). The tickets purchased were bi-weekly lottery draws (86%), instant lotteries (scratch and win; 36%), and fundraising lottery tickets (7%). Gambling on slot machines in casinos was the second most popular game, representing the preference for five gamblers. The third most popular game was cards for money (two gamblers) followed by bingo, which was played by one gambler. Bets on games of skill (billiards) and sports were also played by one gambler. Seven gamblers played two or more games. The mean monthly amount of money spent per gambler was CAN\$33.96.

For exploratory purposes, the proportion of participation in the various games played by the gamblers with PD was compared with that of a comparison sample of gamblers aged 55 years and over (Giroux et al., 2013). No significant differences were found between the proportion of gamblers in the present study and that of the reference group for lottery tickets (93.3% vs. 88.3%, respectively), card games (13.3% vs. 26.1%, respectively), playing and betting on games of skill (6.7% vs. 2.3%, respectively), and sports betting (6.7% vs. 3.4%, respectively). However, significantly fewer participants in the present study than in the comparison sample gambled on

Table 3
Games Played and Mean Monthly Amount Spent by Gamblers

Type of game	Gamblers, $n = 15$			
	Participation		Amount spent ^a	
	n	% ^b	M	SD
Lottery tickets	14	93.33	29.30	32.21
Video lottery terminals	0	0.0	0	0.0
Casino (slot machines)	5	33.33	27.00	15.56
Bingo	1	6.67	20.00	-
Card games	2	13.33	7.50	3.53
Internet	0	0.0	0	0.0
Races	0	0.0	0	0.0
Stock market	0	0.0	0	0.0
Games of skill	1	6.67	100.00	-
Dice	0	0.0	0	0.0
Sports betting	1	6.67	20.00	-

^a Values are in Canadian dollars.

^b Percentages are not mutually exclusive.

slot machines (33% vs. 61.9%, respectively), $\chi^2(1, N = 15) = 5.281, p = .022$, and bingo (6.67% vs. 30.14%, respectively), $\chi^2(1, N = 15) = 3.987, p = .046$.

The four at-risk gamblers in this study spent a monthly mean of CAN\$46.75 in lottery tickets. Two of them played on slot machines in a casino and spent on average CAN\$66.67 per month. Finally, only one at-risk gambler bet on a game of skill (billiards) and sports results, with mean monthly amounts spent of CAN\$100 and CAN\$20, respectively.

Onset of Gambling Behaviour

Most gamblers interviewed (77%) reported having begun gambling before receiving the PD diagnosis. Only three participants (33%) began gambling after the PD diagnosis. All at-risk gamblers interviewed reported having begun gambling before receiving their PD diagnosis.

Reasons for Gambling and Context of Gambling Behaviours

Most gamblers interviewed (53.8%) reported gambling with the hope of winning money, and almost one quarter (23.1%) reported doing so for pleasure. Three participants (23.1%) named other reasons: voluntary tax to help finance the state and habit. Regarding the context of gambling behaviours, most participants gambled alone (69.2%). Forty-six percent of the gamblers mentioned having minimal interest in gambling and said they were rather indifferent to the activity. These same gamblers reported that their gambling depended on the state of their finances: When they considered themselves to be in a good financial situation, they felt more at ease to

gamble, but they stopped gambling when their finances were less satisfactory. Further, some gamblers (31%) mentioned gambling to participate in a social outing. Helping others or even the community (e.g., donations to organizations) with earnings from gambling was a theme mentioned by 31% of the gamblers. For some participants, new reasons for gambling surfaced after they received the PD diagnosis. These reasons included wanting to win money to find a means to cure PD, which was identified by 31% of the gamblers. Notably, half of the gamblers who mentioned this theme were at-risk gamblers. This same proportion of gamblers (31%) mentioned wanting to win money to hire a person to perform daily domestic tasks and to travel.

Furthermore, the at-risk gamblers mentioned themes that were unique to them. Two gamblers referred to erroneous beliefs about gambling, such as the beliefs that only those who gamble often will win and that wins will compensate for losses. They all mentioned being preoccupied by gambling, enjoying the sensations induced by gambling, having difficulty delaying gambling or the verification of results, and not setting limits. They also reported that a significant win in the past motivated them to pursue their gambling habits and to purchase lottery tickets when there was a large amount of money to be won—the greater the pot, the more they spent.

Reasons for Not Gambling

The 10 non-gamblers revealed that they did not gamble because they did not believe in chance (7), did not feel the desire to gamble (6), considered it a mathematical loss to gamble (5), did not want to lose their money (3), and feared a loss of control (1). Among these 10 non-gamblers, seven had never gambled in their lives. The three other non-gamblers had not gambled for over 20 years. At the time, their gambling behaviour consisted of purchasing a few lottery tickets.

Comorbidities

Among the 13 gamblers, there were no problems related to alcohol or drug use or to binge eating. However, one gambler presented a hypersexuality problem and another presented a compulsive shopping problem; these two people were at-risk gamblers.

Caregivers

None of the eight caregivers reported having been asked by their close one with PD to participate in his or her gambling practices. In fact, two caregivers mentioned not knowing whether their loved one gambled (25%). The six other caregivers (75%) were aware of their close one's gambling habits. A comparison of the amount of money bet as reported by the gamblers with PD ($M = \text{CAN\$}33.96$; $SD = \text{CAN\$}33.43$) and the amount estimated by the caregivers ($M = \text{CAN\$}20.6$; $SD = \text{CAN\$}16.17$) revealed a 39.26% underestimation by the caregivers. One caregiver reported having observed changes in the gambling habits of an at-risk gambler following the introduction of a DA. This caregiver noticed an increase in time spent gambling and amounts bet since beginning the medication.

Changes Reported Following the Introduction of a DA

Of the 13 gamblers interviewed, only two at-risk gamblers reported developing PG following the introduction of a DA. In the first case, problem gambling lasted nearly 4 years and the gambler never informed his relatives. This patient's partner, who was included in the study as a caregiver, was never informed of her partner's problem gambling behaviour and never suspected it. Before taking a DA (pramipexole), this gambler bought only a few lottery tickets (mean of CAN\$2/month). Upon introduction of the medication (he described the urge to gamble as having developed quickly, within a few weeks), this gambler would play the slot machines twice a day, spending roughly CAN\$1,800/month. He mentioned having started to gamble for fun and because the venue was close to his residence. Gambling, however, became what he described as an uncontrollable obsession after a few weeks and his reason for gambling changed; he started to gamble to chase his losses. He also highlighted his difficulty in stopping gambling during each session. The participant described a certain "loss of contact with reality" during which he was highly concentrated on gambling (as if he were in his own bubble) and unaware of the time passing. This difficulty in stopping gambling was also associated with a certain feverishness. Problem gambling stopped when the patient attended a conference given by an individual with PD who explained how he had developed problem gambling because of the medication. The participant then informed his neurologist, who adjusted the medication according to evidence-based recommendations (withdrawal of DA); problem gambling subsided in the following weeks. The patient described having abruptly lost the urge to gamble and completely stopping gambling on slot machines. He did, however, continue to buy lottery tickets (mean of CAN\$2/month).

In the second case, problem gambling lasted around 6 months and the gambler never informed his relatives. This gambler was not assisted by a caregiver in his daily life. Before taking DA, the patient would gamble on slot machines, play cards for money, and purchase lottery tickets. After the introduction of the medication, his gambling habits remained the same, but he began spending higher amounts quickly (lottery tickets: CAN\$100/month, slot machines: CAN\$400/month, cards for money: CAN\$150/month). Although he originally used to gamble for pleasure, he mentioned that gambling became an enjoyable source of physical excitement and that he developed an uncontrollable craving for the unknown. Much like the first participant described, this gambler also reported difficulty in stopping gambling during each session. According to the participant, this difficulty was associated with physical excitement experienced while gambling. Problem gambling stopped when the patient was informed by a friend with PD of a case in which another patient had possibly developed a gambling problem because of the medication. The participant then informed his neurologist, who re-evaluated the medication dosage according to evidence-based recommendations (withdrawal of DA), and the problematic gambling behaviour subsided in the following days. The patient described having suddenly lost the urge to gamble and having completely stopped gambling on slot machines and card games. He continued to buy lottery tickets, but spent significantly smaller amounts (mean of CAN\$10/month).

Discussion

This study aimed to explore the gambling habits of individuals with PD by questioning them about the games they played, the amounts they bet, their reasons for gambling, and the context within which they began to gamble. The perceptions and involvement of a close friend or family member were also evaluated, as well as the presence of PG and other disorders. Changes in gambling habits following the introduction of a DA were also assessed.

The absence of pathological gamblers in the sample is surprising considering that the prevalence of PG among individuals with PD is 5% (Weintraub et al., 2010). The small sample size may explain this observation. Although the proportion of at-risk gamblers (13%) does not differ significantly from the proportion observed in the comparison sample (33.4%; Giroux et al., 2013), this shows that certain patients with PD may present problematic gambling habits without reaching the clinical threshold for PG. Because the subgroup of at-risk gamblers is not considered in most studies on this subject, it is possible that a large proportion of individuals with PD experience difficulties with gambling. Hence, it would be interesting if future studies were to include at-risk gamblers to obtain a more precise portrait of patients with problematic gambling habits.

The game most often played was the lottery, in which participation began before the PD diagnosis. The participants' preference for the lottery is not surprising, as it was also found to be the preferred game in the general population of Quebec (Kairouz & Nadeau, 2014) and in a sample of gamblers aged 55 years and older (Giroux et al., 2013). This game can easily blend into the daily life habits of people, for example, who buy tickets at the grocery store. Slot machines were the second most popular game with participants, but they were played less often than in the normative sample from Giroux et al. (2013). Bingo was also less popular in the present study sample compared with the normative sample. This can be explained by the fact that, in order to play these games, it is necessary to go to gambling sites. Hence, the physical limitations caused by PD (Dural et al., 2003) may explain why fewer participants in this study played bingo and slot machines. Nevertheless, the results show that slot machines are the game at which the greatest amount of money was spent by the two gamblers who revealed having developed PG in the past. These gamblers were already playing the slot machines before the PD diagnosis. In light of these data, it seems relevant to further understand slot machine gambling among people with PD.

Slot machines are known to be the most addictive game because of intermittent reinforcement (Clark et al., 2012). Interestingly, studies tend to show that DAs are molecules that influence the neuronal processes involved in reinforcement. A study conducted among 14 people with PD taking a DA and 14 control subjects who participated in an experimental gambling task showed that the former group presented a positive bias toward risk taking when positive reinforcements were presented to them and that this bias was explained by DA intake (Voon et al., 2011).

Furthermore, when a person faces a possible monetary gain, DA is considered to be a molecule that increases the emotional response through the bilateral overactivation of the nucleus accumbens (Ye, Hammer, Camara, & Munte, 2011). In light of these findings, there is reason to believe that patients with PD who gamble on slot machines and while taking a DA may be more sensitive to intermittent reinforcement provoked by these machines. However, the small sample size of this study warrants careful interpretation regarding the negative impact of slot machine gambling on the gambling behaviours of patients with PD. Studies that directly assess the effect of this molecule in large samples of patients with PD while they play the slot machines would be pertinent. If people with PD present a greater risk of developing PG when playing slot machines, it would be relevant for the medical team to pay specific attention to the types of games played by these individuals.

In addition to slot machines, other factors could be considered. Interestingly, the results show that gamblers received their PD diagnosis at a significantly younger age than non-gamblers did. This difference could be because the sample of gamblers in the study comprised those who had a gambling problem during their PD. In the literature on this topic, patients affected by PD who have a gambling problem received their PD diagnosis at a significantly younger age than did individuals with PD who did not have a gambling problem (Gallagher, O'Sullivan, Evans, Lees, & Schrag, 2007; Voon et al., 2007; Weintraub et al., 2010). Moreover, gamblers identified their desire to win money to find a means to cure PD. Faced with powerlessness before their gradual loss of autonomy, the dream of a cure may be alluring and gambling may appear to be a means to obtain money to accomplish this dream. This result is consistent with observations drawn from studies with seniors who mention gambling as a way to cope with illness (Poupard, 2013) or even to stimulate their cognitive functions (Hong, Sacco, & Cunningham-Williams, 2009; Laditka et al., 2009; Southwell, Boreham, & Laffan, 2008). Indeed, the literature indicates that addictions may serve as dysfunctional coping mechanisms in response to the consequences of aging (Clarke & Clarkson, 2009; Stewart & Oslin, 2001). Hence, gambling to win money in order to pay a doctor who claims to cure PD can become a motivation for these individuals to gamble and then potentially develop problematic gambling habits, especially if they play the slot machines, in consideration of the addictiveness of this game (Clark et al., 2012; Griffiths, 1999).

This study also revealed that caregivers are little informed and thus not involved in the gambling habits of their loved ones with PD. The two gamblers who had PG in the past mentioned not having informed their family about this problem because of feelings of shame. This result is in line with recent observations pointing out that people with PD significantly underestimate the excessive nature of certain of their behaviours and that inclusion of caregivers allows a more valid evaluation of the problems affecting people with PD (Baumann-Vogel, Valko, Eisele, & Baumann, 2015). These findings support the importance of providing caregivers with tools to monitor behaviour changes in their loved one with PD. From a preventive standpoint, informative brochures about potential behaviour changes in people with PD could be handed out to caregivers. Thus, well-informed caregivers could

intervene earlier by informing the neurologist about signs of potential problem gambling.

Some results that specifically concern at-risk gamblers with PD may help extend knowledge about the development and maintenance of PG in this population. At-risk gamblers from this study mentioned erroneous beliefs commonly found in pathological gamblers, such as believing that wins always offset losses and that only those who gamble heavily can win (Joukhador, Maccallum, & Blaszczyński, 2003). Notably, non-problem gamblers did not verbalize such beliefs but stated accurate beliefs regarding randomness and the low odds of winning. Could these adequate beliefs represent a protection factor against the development of a gambling problem, whereas the erroneous beliefs represent a risk factor? This interpretation is limited, as erroneous beliefs were not formally assessed by a validated questionnaire but rather observed via an analysis of open-ended questions. Nonetheless, this study is the first to report this type of belief within a population of patients with PD. Future studies should use standardized measures to better understand the gambling-related beliefs of these patients.

Participants who developed PG from DA intake in the past but retained at-risk gambling habits after DA withdrawal is a concerning finding. This observation is consistent with results from a recent study that explored the gambling history of patients with PD and its connections with medication (Olley, Blaszczyński, & Lewis, 2015). These researchers pointed out that some patients with PD and a history of PG related to DA intake continue to experience difficulties following a change of medication, though to a lesser extent. These results, in conjunction with those from the current study, raise concerns about the type of pharmacological treatment offered to individuals with PD. To date, DA withdrawal is the most common method used to treat PG among PD's patients XXX (Tanwani, Fernie, Nikcevic, & Spada, 2015). However, given recent observations, the inclusion of a psychological intervention such as cognitive behavioural therapy could be relevant to provide these people with proper tools to control their gambling habits and even correct erroneous beliefs. This type of treatment could be promising. A recent study has shown a decrease in gambling disorder symptoms in people with PD after cognitive behavioural therapy (Jimenez-Murcia et al., 2012).

This study contains methodological limitations that should be considered. The small sample size limits generalization of the findings, and the absence of a verbatim transcription of the data limits the possible interpretation of the qualitative analyses. Moreover, the self-selection recruitment processes may have distorted the observed frequency of gamblers and problem gamblers in the PD group. Thus, the results must be considered as explorative data. Furthermore, a comparison of the data to those of another study (Giroux et al., 2013) entails certain limitations given that the populations are different and the data were not obtained during the same period. In addition, the financial compensation offered to participants may have introduced significant recruitment bias given the nature of the study, as some participants were gambling to earn money to fund personal projects. Despite these limitations,

conducting semi-structured interviews with each of the gamblers allowed us to collect rich and nuanced information.

The findings of this study pave the way to explore new variables and their role in the development of problem gambling in patients with PD. They also emphasize the potential role of different gambling habits in the development of PG among people with PD, which could in turn serve to elaborate diverse gambling prevention strategies.

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brief report

Psychometric Properties of the Swedish Version of the Reasons for Gambling Questionnaire (RGQ)

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Abstract

The Reasons for Gambling Questionnaire (RGQ) is a self-report instrument containing 15 items to assess individual motives or reasons to gamble. This study presents psychometric data on the Swedish version of the instrument with a focus on factor structure. A Swedish sample ($N = 19,530$) was screened for risk gambling with the Lie/Bet questionnaire, the effective study sample ($n = 237$) consisting of respondents with a positive answer on this questionnaire who agreed to participate in an additional postal questionnaire and had no missing items on the RGQ. The originally proposed subscales of the instrument fit the data poorly and a slightly different five-factor solution was suggested. We conclude that the RGQ needs further revision and that the dimensionality of gambling motives is a question that deserves further attention.

Keywords: assessment, gambling motives, psychometrics

Résumé

Le questionnaire sur les raisons du jeu (RGQ) est un instrument d'auto-évaluation proposant quinze points d'évaluation des motivations ou raisons de jouer. Cette étude présente quelques données psychométriques sur la version suédoise du questionnaire en mettant l'accent sur la structure factorielle. Un échantillon suédois ($n = 19\ 530$) a été soumis à l'examen pour déterminer le jeu à risque à l'aide du questionnaire Lie-Bet, et l'échantillon efficace ($N = 237$) était formé de répondants ayant obtenu un résultat positif au questionnaire Lie-Bet, ayant accepté de participer à un questionnaire supplémentaire par la poste et n'ayant omis aucun élément dans le RGQ. La sous-échelle du questionnaire proposée à l'origine a mal adapté les données, et on a proposé une solution à cinq facteurs légèrement différente. En conclusion, le RGQ doit être révisé, et la dimensionnalité des raisons du jeu est une question qui mérite une attention accrue.

Introduction

Excessive gambling seems to be a heterogeneous phenomenon, and classifying individuals on the basis of the severity of their problems might not be sufficient to understand the character of an individual's gambling habits. An important part of understanding an individual's problem relates to the reasons, motives, or drives to play. Differences in gambling motives can illustrate that there are different types of gamblers (cf. the pathways model; Blaszczynski & Nower, 2002), and their drives to play discriminate the different types to some extent. On the other hand, there is also reason to believe that the motives to gamble change during an individual's gambling career, with a focus on social and stimulating reasons early on and a focus on coping and relief of negative affect later.

The Reasons for Gambling Questionnaire (RGQ) was originally developed to be used in the British Gambling Prevalence Survey (Wardle et al., 2011). The instrument was derived from other similar instruments such as the Gambling Motives Questionnaire (GMQ; Stewart & Zack, 2008) and the Gambling Motives Scale (Chantal, Vallerand, & Vallieres, 1995). The instrument comprises 15 items with five subscales. Based on differences in the results from factor analyses, slightly different ways to subscale the instrument have been proposed. In the work by Wardle and colleagues (2011) and in the psychometric evaluation by Canale, Santinello, and Griffiths (2015), a five-factor model was used that omitted one of the items. In the latter study, the model showed a reasonable fit in a confirmatory factor analysis, but in a study by Francis, Dowling, Jackson, Christensen, and Wardle (2015), this model showed a poor fit to data. As a consequence of the poor fit, Francis et al. conducted an exploratory factor analysis of the RGQ, with a slightly different five-factor solution that also omitted one item. Further, in a qualitative study by Cripps and Blake (2009), suggestions were made on how to change and classify the items, and these suggestions were later adapted in a study by Sundqvist, Jonsson, and Wennberg (2016). In summary, there seem to exist at least three ways to subscale the instrument. In this study, we compared these three ways with respect to how well they fit the data in a sample ranging from mild risk gamblers to gamblers with more severe problems.

This study aimed to examine the psychometric properties of the Swedish version of the RGQ, with a focus on the factor structure of the instrument and comparing the previously suggested subscale alternatives of the RGQ.

Method

Recruitment and Participants

Recruitment of study participants was done in two steps. In a large, randomly selected, population-based sample ($N = 19,530$), respondents were screened in telephone interviews for risky gambling habits by using the Lie/Bet instrument.

Of these respondents, 607 (3.1%) screened positive on the Lie/Bet and of those who did, about 63% gave their informed consent for participation in a postal questionnaire. In all, 257 individuals returned the postal questionnaire, which, in addition to the RGQ, included other questions on gambling, personality, and more. Since there was also an internal dropout of some items on the RGQ, the effective data sample comprised 239 participants. A more detailed description of the questionnaire and the recruitment procedure has been described elsewhere (see Sundqvist et al., 2016). The mean age in the sample was 49 years (ranging from 17 to 82 years) and 70% were males. The severity of their gambling problem ranged from very mild (a single gambling-related symptom either on the Lie/Bet or on the National Opinion Research Center DSM-IV Screen for Gambling Problems – Preoccupation/Escape/Risked Relationships/Chasing [NODS-PERC]) to severe (four of four symptoms on the NODS-PERC).

Translation

Translation of the RGQ from English to Swedish was done by using a procedure sometimes called committee translation. The two authors (PW and KS) translated the instrument independently and the two translations were compared and discussed to reach consensus.

Data Analysis

Item endorsement and mean scores for each item are presented. Three different factor models were compared with confirmatory factor analyses. Estimation was done by using the asymptotic distribution free function as a robust alternative to maximum likelihood, as it does not require multivariate normality in the data. The fit of the three models was summarized with standardized factor loadings, as well as chi-square and common fit statistics: root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker Lewis index (TLI). As a rule of thumb, a RMSEA below 0.05 suggests a close fit between the model and the data and a RMSEA between 0.05 and 0.08 suggests a reasonable fit; for CFI and TLI, a value above 0.95 suggests a good fit (Bowen & Guo, 2011). Covariance between latent variables was allowed for if statistically significant (i.e., had modification indices above 3.84). Unfortunately, the sample size did not allow for tests of structural invariance across sex or age. In addition, internal consistency (Cronbach's alpha and Guttman's lambda 2) was calculated for each set of subscales. Finally, the model with the best fit in the confirmatory factor analyses was cross-validated against other measures as a test of convergent and divergent validity. The analyses were done in SPSS v24 and Stata v14.

Results

Descriptive Data

The English wording of the items and endorsement rates are presented in Table 1. As the sample consisted of risk gamblers, too low endorsement did not occur in any of

Table 1
Item Endorsement and Mean Scores in the RGQ (n=239)

Item	Response (%)			
	Never	Sometimes	Most of the time	Almost always
1. For the chance of winning big money	14.2	34.7	28.0	23.0
2. Because it's fun	9.6	25.1	38.1	27.2
3. As a hobby or past-time	40.2	25.9	21.3	12.6
4. To escape boredom or to fill your time	53.1	28.0	17.2	1.7
5. To compete with others (e.g. bookmaker, other gamblers)	58.2	29.7	10.0	2.1
6. Because I am worried about not winning if I don't play	72.0	19.7	5.9	2.5
7. Because it's exciting	13.8	33.9	31.0	21.3
8. For the challenge or to learn about the game or activity	46.0	34.3	14.2	5.4
9. Because of the sense of achievement I get when I win	57.3	24.7	13.8	4.2
10. To impress other people	78.2	17.2	2.1	2.5
11. To be sociable	53.6	30.5	12.6	3.3
12. Because it helps when I am feeling tense	85.4	10.5	3.3	0.8
13. To make money	28.0	32.2	22.2	17.6
14. To relax	74.1	19.2	5.4	1.3
15. Because it's what I usually do with friends or family	45.2	38.9	9.6	6.3

Note. RGQ = Reasons for Gambling Questionnaire.

the items. Items 6, 12, and 14 showed the highest level of difficulty in terms of item endorsement.

Factor Structure

Factor loadings, fit statistics, and internal consistency are presented in Table 2. Despite the low number of items, internal consistency (Cronbach's alpha) was satisfactory in most of the subscales and models. In Model 1, all presented factor loadings were statistically significant ($p < .001$), but two of the loadings in the Escape subscale in Model 1 were low (Items 6 and 12) and one item in the Social subscale was rather low (Item 10). Item 6, which was omitted in Models 2 and 3, appeared as a weak item in Model 1. In addition to the low factor loadings in the Escape subscale, internal consistency was higher in that subscale without Item 6 (alpha rising from .73 to .75).

Models 2 and 3 showed a worse fit to the data in terms of fit indices. In addition to these three models, other models were tested, but no five-factor model showed a better fit than did Model 1. In addition, a four-factor model that included the motive dimensions social reasons, negative affect regulation, positive affect, and monetary reasons was tested, but also showed a worse fit to data than did Model 1. We also

Table 2
Fit Statistics and Factor Loadings for Three Models in Confirmatory Factor Analyses (n=239)

	Subscale	Item	Standardized factor loading	Reliability (Cronbach's α)	Reliability (Guttman's λ_2)
Model 1 (Sundqvist et al., 2016, based on Cripps & Blake, 2009)	Social	3	0.77	0.62	0.64
		10	0.48		
		11	0.72		
		15	0.63		
	Monetary	1	0.77	0.77	0.77
		13	1.0		
	Excitement/ Amusement	2	0.85	0.77	0.77
		7	0.84		
	Challenge	5	0.68	0.74	0.76
		8	0.80		
		9	0.72		
	Escape	4	0.89	0.73	0.74
		6	0.27		
		12	0.36		
		14	0.64		
Fit statistics					
χ^2 (df 81) = 216.3 ($p < .001$); RMSEA = 0.084 (90% CI [0.070, 0.097]; CFI = 0.83; TLI = 0.77					
Model 2 (see Francis et al., 2015)	Money	1	0.79	0.77	0.77
		13	0.91		
	Positive feelings	2	0.0	0.79	0.80
		3	0.55		
		7	0.20		
		9	0.65		
	Regulate internal state	4	0.67	0.75	0.76
		12	0.70		
		14	0.85		
	Social	11	0.86	0.71	0.71
		15	0.50		

Table 2 Continued.

	Subscale	Item	Standardized factor loading	Reliability (Cronbach's α)	Reliability (Guttman's λ_2)
Fit statistics Model 3 (see Wardle et al., 2011; Canale et al., 2015)	Challenge	5	0.62	0.66	0.67
		8	0.70		
		10	0.67		
	Enhancement				
		5	0.40	0.77	0.77
		7	0.75		
		8	0.73		
		9	0.50		
		2	0.79		
		3	0.80		
Fit statistics	Recreation	4	0.67	0.73	0.75
		14	0.54		
		11	0.79		
	Social	15	0.73	0.71	0.71
		10	-0.11		
	Coping	12	0.40	0.45	0.45
		1	0.75		
	Money	13	1.0	0.77	0.77
	Fit statistics				

Note. RMSEA = root mean square error of approximation; CFI = comparative fit index; TLI = Tucker Lewis index.

tested a hierarchical model of Model 1 in which excitement, challenge, and escape/coping were subfactors of the latent trait affect regulation, but that model also showed a worse fit than did the original Model 1. A three-factor model was tested that included the dimensions autonomous/intrinsic (Items 2, 4, 6, 7, 8, 9, 12, and 14), controlled/extrinsic (Items 3, 5, 10, 11, and 15), and monetary (Items 1 and 13). However, this model also did not fit the data satisfactorily (chi-square = 300.1, $df = 87$, $p < .001$; RMSEA = 0.101, 90% confidence interval [CI] [0.089, 0.114]; CFI = 0.73; TLI = 0.67). Finally, we tested a one-dimensional model as an indicator of the general motivation to gamble or perhaps the number of reasons to gamble. However, that model showed a poor fit to the data (chi-square = 90, $df = 90$, $p < .001$; RMSEA = 0.123, 90% CI [0.111, 0.135]; CFI = 0.58; TLI = 0.51).

Discussion

This study described psychometric properties of the Swedish version of the RGQ with a special focus on the factor structure of the instrument. The results showed that all items were sufficiently endorsed. The originally proposed subscales of the instrument fit the data rather poorly and subscales based on the suggestions by Cripps and Blake (2009) and adapted by Sundqvist et al. (2016) showed a better (but still not satisfactory) fit to the data.

Two items (Items 6 and 12) showed worse psychometric properties than did the other items. These two items showed lower endorsement rates and factor loadings generally. Item 6 (“because I am worried about not winning if I don’t play”) was omitted from the analysis in the studies by Francis et al. (2015) and Canale et al. (2015) because of its psychometric properties, but neither of these studies showed the same problems with Item 12.

Although the three suggested methods for the subscales of the instrument show large similarities, there are some differences. One such difference concerns Item 4 (“to escape boredom or to fill your time”). This item is located in the Escape factor in Model 1 and in the Regulate internal state factor in Model 2, and both of these factors can be expected to be associated with problem gambling (cf. Myrseth & Notelaers, 2017). However, in Model 3, the item is located in the Recreation factor, a factor with a weaker association with problem gambling.

This study has strengths and limitations. The recruitment procedure was based on a large sample of the general Swedish population, giving us reason to believe that the responding gamblers were fairly representative and covered a wide span of gambling severity. Unfortunately, the low sample size did not allow us to test for structural invariants across sex, age, or gambling severity (as done by Canale et al., 2015).

In conclusion, the RGQ is an instrument that covers important aspect of motives to gamble, but because of some weak items and unclear dimensionality, it would benefit from further development. Considering some of the psychometric problems with the RGQ reported here, other instruments may be preferable. On the other hand, the

RGQ covers the aspect of gambling for the challenge, a factor that differentiated high-risk gamblers from low-risk gamblers in a previous study (Sundqvist et al., 2016), and this is a factor lacking in similar instruments such as the Gambling Motives Questionnaire. Finally, previous research and the present study give support to the idea that the dimensionality of gambling motives is still a question that deserves further attention.

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