

JGI Scholar's Award, Category B

Sports Bettors: A Systematic Review

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Abstract

Sports betting is associated with problematic gambling behaviours. However, little is known about the profile of sports bettors. Also, it is still unclear if there are useful abilities in sports betting. This systematic review aims to describe gambling habits and cognitions of sports bettors, and determine the roles of chance and skill in sports betting. Addressing the chance and skill distinction in sports betting would be helpful to identify which of sports bettors' cognitions are erroneous. Out of 991 studies identified in the databanks, 31 met the inclusion criteria of this review. Results indicate that these studies are mostly conducted with male samples aged from 30 to 50 years. These gamblers bet many times per week, with weekly averages ranging from 100 to 200\$ CAD. Five studies examined the roles of chance and skill in sports betting, among which three showed that sports bettors perform better than chance in predicting results accurately, but they do not win more money than they would with a random selection, due to the structure of the game. The 11 studies that focused on cognitions indicate that sports bettors overestimate the influence of skill on the outcome of the game. These results support the need to further study the role of cognitions in the behaviours of sports bettors. It also offers insights concerning the distinction between chance and skill in sports betting.

Keywords: chance, cognitions, gambling, horseracing, fantasy league, skill, sports betting, sports lotteries

Résumé

Les paris sportifs sont associés à des comportements de jeu problématiques. Cependant, on sait peu de choses sur le profil des parieurs sportifs. De plus, il est difficile de statuer si certaines habiletés seraient utiles dans les paris sportifs. Cette revue systématique vise à décrire les habitudes de jeu, les cognitions des parieurs sportifs, et à déterminer le rôle du hasard et des habiletés dans ces paris. Examiner la distinction entre le hasard et les habiletés aux paris sportifs serait utile afin de déterminer quelles cognitions entretenues par les parieurs sportifs sont erronées. Sur 991 études repérées dans les banques de données, 31 répondaient aux critères d'inclusion de cette revue. Les résultats indiquent que ces études sont principalement menées auprès d'échantillons masculins âgés de 30 à 50 ans. Ces joueurs parient plusieurs fois par semaine et misent en moyenne de 100 \$ à 200 \$ CA par semaine. Cinq études ont examiné les rôles du hasard et des habiletés dans les paris sportifs, parmi lesquels trois ont montré que les parieurs sportifs prédisent mieux les résultats sportifs que le hasard, mais ils ne gagnent pas plus d'argent qu'avec une sélection aléatoire, en raison de la structure du jeu. Les onze études portant sur les cognitions indiquent que les parieurs sportifs surestiment l'influence des habiletés sur l'issue du jeu. Ces résultats confirment la nécessité d'approfondir le rôle des cognitions dans les comportements des parieurs sportifs. Ils donnent également des pistes sur la distinction entre le hasard et les habiletés dans les paris sportifs.

Introduction

Sports betting is a form of gambling activity where the bet is made on the result of one or various sport events (Rice, Healy, & Rigway, 2012). Sports betting generate around 15% of the gambling industry's returns throughout the world (Global Betting and Betting Consultants, 2013). In Canada, a report including results of prevalence studies conducted between 2001 and 2014 reveals that 0.4 to 12.2% of Canadians have participated in at least one form of sports betting on an annual basis (Canadian Partnership for Responsible Gambling, 2014). Horseracing betting, sports lotteries and pools are examples of sports betting activities offered in Canada (Canadian Partnership for Responsible Gambling, 2014).

Prevalence studies conducted in Canada (Canadian Partnership for Responsible Gambling, 2014), in the United States (Kessler et al., 2008), in England (Wardle & Seabury, 2012), in South Korea (Williams, Lee, & Back, 2013) and in Australia (Productivity Commission, 2010) show that sports bettors are mostly men. However, due to divergences in the classification of sports betting activities, it is difficult to get a clear picture of sports bettors' characteristics. Indeed, some studies distinguish every type of sports betting (e.g., horseracing betting, sports events, sports lotteries: See Kessler et al., 2008; Productivity Commission, 2010; Wardle & Seabury, 2012),

whereas others group them in one category – sports betting (see Abbot, Romild, & Volberg, 2014; Williams & Volberg, 2013). Consequently, except for their sex, it is difficult to determine the specific characteristics (e.g., age, gambling frequency) of sports bettors based on available prevalence studies. This lack of information on sports bettors makes it difficult to establish their profile as gamblers. It is a cause of concern since those profiles could help to determine adequate prevention or treatment strategies considering that sports betting is associated with problem gambling (Williams, Volberg, & Stevens, 2012).

Williams and collaborators (2012) conducted a systematic review of gambling prevalence studies on an international scale that were published between 1975 and 2012. Out of the 68 studies collected, 24 (35.3%) associate sports betting with gambling problems. After video-lottery terminals, sports betting is the second most frequently associated gambling activity with gambling problems in national prevalence studies (28 studies, 41.2%). Though many studies highlight this association, they usually do not present specific information pertaining to risk factors in sports betting.

Recently, Hing, Russell, Vitartas and Lamont (2016) aimed to identify contributing variables to problem gambling in a sample of 639 sports bettors. Their results reveal an association between being young, male, single, educated, having a full-time job or being a full-time student, and having a high score on the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). The sports bettors' gambling habits, namely gambling frequency and amounts of money spent in sports betting, were also significantly associated with a high score on the PGSI.

Empirical evidence suggests that high gambling frequency and amounts of money spent in gambling activities are associated with gambling problems (Ferris & Wynne, 2001; Marshall & Wynne, 2003; Wiebe, Single, & Falkowski-Ham, 2001). Recently, it has been shown that risk of problem gambling increases with greater frequency and expenditure on sports betting (Hing et al., 2016). However, little information is available concerning specific gambling habits of sports bettors (e.g., amounts of money spent, gambling frequency). Indeed, prevalence studies report detailed information regarding gambling behaviours in general, but they do not present specific information with respect to gambling activity type. In this context, conducting a review of studies that include samples of sports bettors, collecting data relative to their gambling habits, and reporting it by type of sport betting would be helpful to determine if these gamblers show potentially harmful behaviours. This information could help target specific behaviours in a prevention program (e.g. reducing the frequency of gambling or the number of weekly bets).

Many authors propose that gamblers' cognitions, particularly gambling-related thoughts or perceptions, play a central role in the development and the maintenance of problematic gambling habits (Blaszczynski & Nower, 2002; Fortune & Goodie, 2012; Griffiths, 1994; Ladouceur et al., 2001; Petry, 2005; Walker, 1992). Indeed, certain thoughts in gamblers may not be realistic, nor take into account basic

concepts in gambling (e.g., statistics, probabilities, independence of gambling events). These thoughts are generally labelled as cognitive distortions or erroneous perceptions (Ladouceur et al., 2001). Studies suggest that skill games (e.g., poker, sports betting) gamblers present a higher number of erroneous perceptions compared to gamblers with a preference for pure chance games (Myrseth, Brunborg, & Eidem, 2010; Toneatto, BlitzMiller, Calderwood, Dragonetti, & Tsanos, 1997). Sports bettors' thoughts could be reinforced due to the active role they play in the game, namely by seeking and analyzing sports information. Gathering studies conducted with sports bettors to document their specific thoughts would allow a more accurate depiction of their specific cognitions.

Based on current knowledge, it is difficult to determine the influence of skill on the performance of sports bettors. Some studies carried out with horseracing bettors (Ladouceur, Giroux, & Jacques, 1998) and hockey bettors (Cantinotti, Ladouceur, & Jacques, 2004) indicate that financial gains generated by sports bettors' predictions are not superior to those of a random selection. Thus, the authors suggest that the belief that skill increases the probabilities of winning in sports betting constitutes an erroneous perception. Since no review to date has gathered all studies that have attempted to distinguish the influences of chance and skill on performance in sports betting, it is difficult to draw conclusions on the erroneous nature of this perception. Hence, gathering these studies would allow us to compare data on sports bettors' cognitions with data that discriminate the parts of chance and skill involved in sports betting.

Objective

The aim of this systematic review is to collect all empirical studies that include samples of sports bettors to answer the following questions:

- 1) What types of sports betting do they participate in, at what frequency and how much money do they spend gambling in sports betting or other types of gambling activities?
- 2) What beliefs do sports bettors hold about sports betting?
- 3) What conclusions were drawn from studies that attempted to distinguish the roles of chance and skill involved in sports betting?

This synthesis of current knowledge will also describe sociodemographic characteristics of the samples of the retained studies.

Method

Research strategy

Literature on sports bettors was identified with combinations of terms entered in the following search engines: PsycNet, PubMed, SportDiscuss and FRANCIS. The first combination was constituted of two sets of generic keywords that include themes

relative to gambling and sports: (betting OR bettor* OR gambl* OR lotter* OR wager*) AND (sport OR sports OR "fantasy league*" OR league* OR horse* OR dog*).

This research strategy was conducted with the abstract of the article in PsycInfo, SportDiscuss and FRANCIS, and with the title and the abstract in PubMed.

The second combination was formed with terms from the thesaurus of PsycInfo and SportDiscuss, as well as with MESH terms in PubMed. The search combination used in PsycInfo and PubMed was the following: ("Sports" and "Gambling"). In SportDiscuss, the following criterion was used: "Sports betting". Since FRANCIS does not include a thesaurus, this strategy was not employed.

To maximize the amount of retrieved publications, a literature research was conducted with the keywords from the first search strategy in Google Scholar. The 200 first results were consulted. Finally, the reference list of these articles was consulted.

Inclusion criteria

Publications that satisfied the following criteria were retained: (1) published in English or French, (2) published between January 1980 (i.e., year that pathological gambling was recognized as a psychiatric disorder; See American Psychiatric Association, 1980) and December 2014, (3) included a sample of sports bettors or described a subgroup of sports bettors, (4) contained either data on gambling habits, gambling-related beliefs, or on the part of chance and skill involved in sports betting, and (5) relied on a research protocol, with or without random assignment (e.g., experimental, longitudinal, cross-sectional).

Reference selection

After excluding 284 duplicates, the literature research gathered 707 publications. During the screening process, 591 publications were excluded after reading the title and abstract. At the eligibility process, 116 articles were read completely by two graduate students in psychology who then conducted an inter-rater agreement process. Disagreements were discussed until a consensus was reached; the final agreement was of 87.9%. Finally, a total of 31 publications were included in the review (see figure 1).

Quality assessment

The Effective Public Health Practice Project Assessment Tool (EPHPP; Thomas, Ciliska, Dobbins, & Micucci, 2004) allows to assess the scientific quality of the studies. The EPHPP tool can be used on observational, cross-sectional, before and after studies and randomized controlled trials (RCT). Six of the eight domains evaluated by this tool are mainly used for the appraisal of intervention studies. Since no intervention studies were included in this review, only the selection bias and the data collection methods of the EPHPP were evaluated. The first author and a psychology

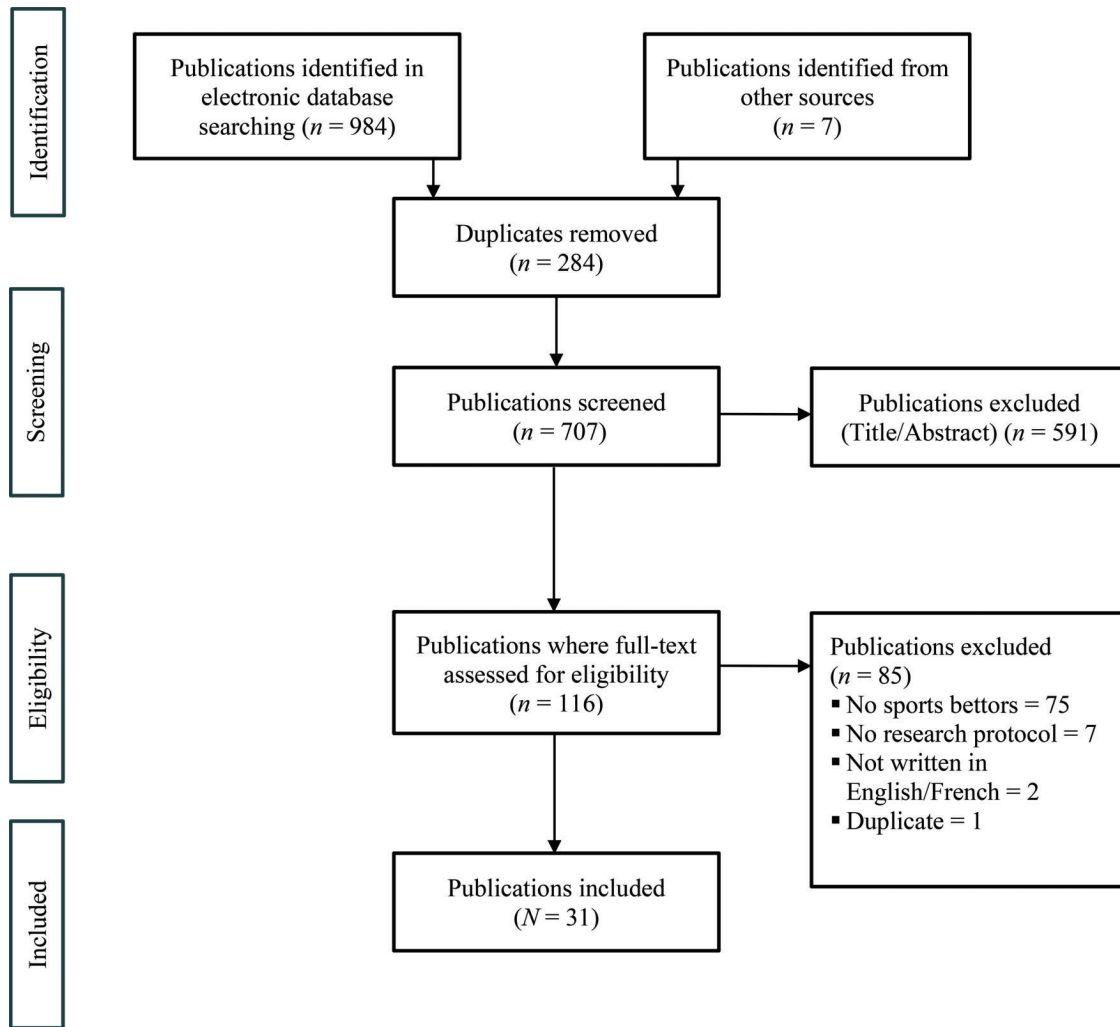


Figure 1. Flow Diagram of Study Identification, Inclusion, and Exclusion

doctoral student rated those components individually and discussed the disagreement until they reached a consensus.

Data analysis

Information retrieved for descriptive analysis were related to seven themes: (1) study type, (2) objectives, (3) method, (4) participants description (gambling problem severity, sex, age, etc.), (5) gambling habits description (e.g., amounts spent, gambling frequency, other gambling activities), (6) gambling-related beliefs, (7) data concerning the influence of chance and skill on the gamblers' performance. To simplify the monetary data presented in this study, they were converted to the Canadian dollar (CAD) based on the exchange rate that was in effect during the recruitment period of the retained studies. The term *sports events bettors* (SEB) is used to refer to gamblers who bet on sports events other than horseraces, and who do not bet on sports pools/fantasy leagues. The latter consists in selecting a number of athletes from a sport (e.g., hockey) depending on constraints (e.g., salary cap) in order to

build a “competitive team”. A membership fee (i.e. bet) is required to create the pool that will be taken by the winner at the end of the pool season. Extracted data were counter-verified by the first author and an undergraduate student in psychology.

Results

Eighteen (58.1%) of the 31 retained studies were conducted exclusively with horseracing bettors, four (12.9%) with horseracing bettors and SEB, eight (25.8%) exclusively with SEB, and one (3.2%) exclusively with pool/fantasy league bettors. For all 31 studies, the sociodemographic characteristics, gambling habits, cognitions related to gambling and main results on the distinction between chance and skill present in sports betting are reported in Table 1 according to type of sports bettors.

Horseracing bettors

Sociodemographic characteristics. Among 22 studies involving horseracing bettors, the number of participants varied from 13 to 354 for a total of 1,800. All studies were conducted with samples composed of men from 51.7 to 100%. Almost a quarter of these studies included male participants only. Participants’ age varied from 16 to 85, with an average between 25 and 48. However, half of the studies reported mean ages from 41 to 48.

Horseracing betting habits or other gambling activities. Twenty-one studies out of 22 (95.5%) presented data on horseracing bettors’ gambling habits. Nine studies had inclusion criteria that required a minimal horseracing gambling frequency of one to three times per week. These bettors gambled on average four to five days per week. For studies that did not have inclusion criteria for gambling frequency, one indicated that 42% of their participants gambled many times per week on horseraces (Noriega & Lin, 2003), and one specified that their participants could spend 12 to 14 hours per day at the racetrack (Rosecrance, 1988). Two studies did not specify gambling frequency but indicated that participants gambled at least once per week (Ladouceur et al., 1998) or per month (Oliveira & Silva, 2001) on horseraces. Two other studies presented data on gambling frequency, but did not specify whether this frequency was exclusive to horseracing betting or concerned all types of gambling activities (Coventry & Norman, 1997; Petry, 2003). One of the latter studies indicated that 72% of their participants gambled at least once per week (Coventry & Norman, 1997), and the other specified that they gambled on average 15 days per month for all types of gambling activities (Petry, 2003).

Six studies out of 22 (27.3%) reported data for money spent on gambling. Two presented money spent per session of horseracing betting. One of these studies conducted with gamblers who bet at least once a month indicated that approximately 70% made maximum bids up to 150\$ CAD, and 30% made maximum bids superior to this amount on a single gambling occasion (Oliveira & Silva, 2001). The other study reported that gamblers spent 157 to 314\$ CAD per gambling session on horseraces, and half of them gambled many times per week (Noriega & Lin, 2003).

Table 1
Main Results for Gambling Behaviours and Cognitions of Sports Bettors and Data Relating to the Parts of Chance and Skill in Sports Betting

Author(s), Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Horsereading bettors				
Bonnaire, Bungener, & Varescon, 2006, France	To study the sensation seeking personality trait in two groups of French PG: one group who play games available in cafe's ($n=57$) and one group who bet on horses at the racetrack ($n=42$).	Design: Cross-sectional Inclusion criteria: 1. Men aged from 18 to 45 2. Gambling more than once a week 3. PG diagnosis (DSM-IV) Exclusion criteria: 1. Gambling less than once a week Measures: BDI-13, DSM-IV criteria for PG, SSS Form V (French Version), SOGS.	Type: Horsereading N = 42 Severity: PG Age M (SD): 29.1 (7.9) Male %: 100 Education: - Employed %: 78.6	Gambling behaviour- NSG ^a : <ul style="list-style-type: none"> • More likely to bet on horses, sports, and card games than cafes gamblers* • Less likely to play various games than cafes gamblers* • Racetrack betting only: 42.9% • Various games: 57.1% Cognitions: - Chance vs skill: -
Bonnaire, Varescon, & Bungener, 2007, France	To examine sensation seeking trait in two groups of French gamblers who bet on horses at the racetrack: one group of PGs ($n=42$; 58%) and one of RGs ($n=30$; 42%).	Design: Cross-sectional Inclusion criteria: 1. Men aged from 18 to 45 Exclusion criteria: - Measures: BDI-13, DSM-IV criteria for PG, SSS Form V (French Version), SOGS.	Group 1 Type: Horsereading N = 42 Severity: PG Age M (SD): 29.1 (7.9) Male %: 100 Education: - Employed %: 78.6 Group 2 Type: Horsereading N = 30 Severity: RG Age M (SD): 28.0 (5.9) Male %: 100 Education: - Employed %: 83.0	Gambling behaviour-NSG <ul style="list-style-type: none"> • Only horsereading betting: <ul style="list-style-type: none"> ◦ PG: 38% ◦ RG: 63** • More PGs play on slot machines compared to RGs* Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Bonnaire, Bungener, & Varescon, 2009, France	To confirm the existence of Blaszczyński and Nower's subtypes of pathological gamblers among the French general population of gamblers and to measure their sensation seeking alexithymia and depression score.	Design: Cross-sectional Inclusion criteria: 1. Men aged from 18 to 45 2. Gambling more than once a week Exclusion criteria: 1. Gambling less than once a week Measures: BDI-13, DSM-IV criteria for PG, SOGS, the French version of the SSS Form V.	Type: Horseracing N = 42 Severity: PG Age <i>M (SD)</i> : 29.1 (7.9) Male %: 100 Education: - Employed %: 79	Gambling behaviour- NSG: • Frequency/week <i>M (SD)</i> = 4.6 (2.2) • Age of onset <i>M (SD)</i> = 15.4 (4.0) • No. regular games <i>M (SD)</i> = 2.6 (1.9) Cognitions: - Chance vs skill: -
Chantal & Vallerand, 1996, Canada	To test the skill/luck distinction among gambling games by comparing the motivations underlying participation in a skill (horse racing) and a chance (lottery) betting activity.	Design: Cross-sectional Inclusion criteria: • French-Canadian gamblers Exclusion criteria: - Measures: GMS (French version), gambling habits questionnaire.	Type: Horseracing N = 60 Severity: - Age <i>M (SD)</i> : 48 (-) Male %: 51.7 Education: - Employed %: -	Gambling behaviour- Horseracing: • Money spent/week <i>M</i> = 196\$ CAD • Years of experience <i>M</i> = 15 Cognitions: • Reasons to gamble: ◦ Acquiring game knowledge ◦ Accomplishing themselves as efficient gamblers ◦ Being stimulated by the races Chance vs skill: -
Chantal, Vallerand, & Vallières, 1995, Canada	To assess how motivation relates to involvement in gambling.	Design: Cross-sectional Inclusion criteria: 1. French-Canadian gamblers who bet on horses. Exclusion criteria: - Measures: GMS, GII.	Type: Horseracing N = 245 Severity: - Age <i>M (SD)</i> : 48.3 (-) Male %: 75.9 Education: - Employed %: 75	Gambling behaviour- Horseracing: • Males were more involved in gambling than the female participants*** Cognitions: - Chance vs skill: -
Coco, Sharpe, & Blaszczyński, 1995, Australia	To investigate the applicability of reversal theory to problem gambling.	Design: Cross-sectional Inclusion criteria: 1. PG 2. Exclusive preference for horserace betting Exclusion criteria: - Measures: BPS, DSM-III-R, TDS, Trait Scale of the STAI (Form Y).	Type: Horseracing N = 13 Severity: PG Age <i>M (SD)</i> : 41.2 (9.1) Male %: 92.3 Education: - Employed %: -	Gambling behaviour- Horseracing: • Age of onset <i>M</i> = 17.5 Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Coventry & Norman, 1997, United Kingdom	To measure heart rate, sensation seeking and loss of control during off-course betting, while controlling for factors that may have caused serious confounding effects in previous heart rate studies.	Design: Quasi-experimental Inclusion criteria: - Exclusion criteria: - Measures: Small ambulatory heart rate monitor (Type TP-200), TAS subscale of the SSS, gambling behaviour questionnaire.	Type: Horseracing N = 32 Severity: - Age <i>M (SD)</i> : 25 (9.3) Male %: 100 Education: - Employed %: -	Gambling behaviour- NSG • Frequency = 72% more than once/week • Nb bet/week <i>M (SD)</i> = 9.6 (13.5) Cognitions: - Chance vs skill: -
1 st study: Franco, 2008, United States 2 nd study: Franco, Paris, Wulfert, & Frye, 2010, United States	(1) To elucidate the physiological and subjective reactivity to gambling cues by studying HR and subjective ratings of excitement with social gamblers in a real gambling environment and to examine whether this reactivity is mode-specific and (2) to examine whether there are gender differences in HPA response to gambling in a naturalistic setting among horse-race and scratch-off lottery bettors.	Design: Quasi-experimental Inclusion criteria: 1. 18 years and older 2. Gambling at least twice/week 3. Must say that their gambling does not currently generate problems. Exclusion criteria: 1. Having received treatment for a gambling-related problem within the past year. Measures: EIQ, GBQ, MAS, MM, NODS, Physiological measures, POMS-SF, SOGS.	Type: Horseracing N = 32 Severity: 44 % PPG Age <i>M (SD)</i> : 45.8 (11.9) Male %: 66 Education: - Employed %: 68	Gambling behaviour- Horseracing: • Frequency/week <i>M (SD)</i> = 3.4 (2.0) • Years of experience <i>M</i> = 19.9 (11.9) Cognitions: - Chance vs skill: -
Hartley, 2005, United States	To examine whether reactivity to gambling-related cues is mode specific and to elucidate the role of money in gambling behaviour.	Design: Quasi-experimental Inclusion criteria: 1. 18 years and older 2. Gambling at least three times/week Exclusion criteria: 1. Having received a treatment for gambling-related problems Measures: MAS, NODS, Physiological measures, RCI, SOGS.	Type: Horseracing N = 49 Severity: - Age <i>M (SD)</i> : 44.2 (14.3) Male %: 88 Education: 82% college or more Employed %: 65	Gambling behaviour- Horseracing • Frequency/week <i>M (SD)</i> = 4.5 (1.3) • Years of experience <i>M (SD)</i> = 22.2 (14.0) Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Ladouceur, Giroux, & Jacques, 1998, Canada	1 st study: To test the specific hypothesis that experts' predictions bring significantly more wins and better monetary outcomes than random choices. 2 nd study: To test if gamblers' choices and experts' predictions perform significantly better than random selection on the frequency of picking the winning horses and on the rate of return on bets.	Design: Quasi-experimental Inclusion criteria: 1. Being a horse-race gambler Exclusion criteria: - Measures: Expertise questionnaire (9 points Likert-type scale)	Type: Horseracing N = 16 Severity: - Age <i>M</i> (<i>SD</i>): 32.3 (10.4) Male %: 56.3 Education: - Employed %: -	Gambling behaviour- Horseracing: • Frequency <i>M</i> : At least once a week Cognitions <i>M</i> (ET) • Considered themselves experts vs non-horsing bettors = 3.4 (1.9) • Did not consider themselves better than other horse-race gamblers = 2.5 (1.4) • Convinced that they could better predict the winning horses than a random selection could = 4.7 (1.8) Chance vs skill: • Monetary outcomes: Experts vs racetrack program vs random selection vs newspapers = nsd • No. good predictions = Experts are better than random selection***
Lau & Ranyard, 2005, United Kingdom	To examine the behavioural implications of cultural differences in probabilistic thinking and whether they relate to risk taking in gambling.	Design: Cross-sectional Inclusion criteria: 1. Men aged from 20 to 60. 2. Gambling at least once/week on horseracing or on other gambling activities at least once a week and betting on horses occasionally Exclusion criteria: - Measures: HRT (Total amount of Bet [TS], Sum of expected losses [SEL]), VUQ	Type: Horseracing N = 120 Severity: - Age <i>M</i> (<i>SD</i>): - Male %: 100 Education: - Employed %: -	Gambling behaviour- Horseracing: • TS: ◦ 62.5% bet the maximum amount ◦ English vs Chinese players (nsd) ◦ Gamblers vs non-gamblers (nsd) • SEL: ◦ Mean score higher for Chinese vs English* ◦ Gamblers vs non-gamblers (nsd) Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Morvannou et al., 2012, France	To describe the cognitive distortions and the incidence of structural characteristics in horseracing punters.	Design: Cross-sectional Inclusion criteria: 1. 18 to 65 years old 2. Betting on horse races Exclusion criteria: 1. Non-French speakers Measures: GRSC, Structural characteristics questionnaire, SOGS	Type: Horseracing N = 100 Severity %: RG: 45, PbG: 43, PPG: 12 Age <i>M (SD)</i> : RG: 46.5 (15), PbG: 45.2 (16), PG: 37 (12.3) Male %: RG: 77.8, PbG: 67.4, PG: 100 Education: - Employed %: -	Gambling behaviour: - Cognitions: • Positive association between structural characteristics and the severity of gambling* • Overrepresentation of predictive control and illusion of control* Chance vs skill: -
O'Connor & Dickerson, 2003 Australia	To investigate and compare subjectively reported impaired control in two forms of gambling: off-course Totalizator Agency Board (TAB) horse/dog racing and electronic gaming machines (EGMs). Additionally, gender differences in EGM players were investigated.	Design: Cross-sectional Inclusion criteria: 1. Men aged 18 years and older 2. Gambling at least once/week Exclusion criteria: - Measures: Gambling involvement questionnaire, SGC (shortened)	Type: Horse/dog racing bettors N = 84 Severity: - Age <i>M (SD)</i> : 41.2 (14.8) Male %: 100 Education: 63.1% completed high school Employed %: 64.3	Gambling behaviour- NSG: • Money spent/week <i>M</i> = 288\$ AUS • Frequency = 506 minutes/week • Years of experience <i>M (SD)</i> = 19.9 (15.6) • Age of onset <i>M (SD)</i> = 21.5 (6.9) Cognitions: - Chance vs skill: -
Oliveira & Silva, 2001, Brazil	To compare sociodemographic variables, gambling behaviour and use of alcohol and other drugs among bingo, video poker, and horse-race gamblers, contacted at their gambling venue.	Design: Cross-sectional Inclusion criteria: - Exclusion criteria: - Measures: SOGS (Portuguese version)	Type: Horseracing N = 63 Severity: 39.7% PPG Age: 45 (median) Male %: 93 Education: 40% college Employed %: 85	Gambling behaviour- Horse racing • Highest bet (Single betting day): ◦ About 70%: 0-100 USD ◦ About 20%: 100-1,000 USD ◦ About 10%: + than 1,000 USD • Frequency: 100% at least once/month • Other games: ◦ 23%: Stock market ◦ 60%: Lotteries ◦ 36%: Bingo Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Peltzer et al., 2006, South Africa	To ascertain the frequency of gambling involvement and the prevalence of problem gambling among horse race gamblers and to discover whether problem gambling in this sample is associated with a history of trauma.	Design: Cross-sectional Inclusion criteria: - Exclusion criteria: - Measures: SOGS, THQ	Type: Horseracing N = 266 Severity: PbG: 19.9% PPG: 31.2% Age <i>M (SD)</i> : 46.8 (13.9) Male %: 94 Education: <i>M (SD)</i> = 9.4 years (3.5) Employed: 85	Gambling behaviour- JHA: • Main game: 82% horseracing • Other games: ◦ Lotteries/scratch (35%) ◦ Sports lotteries (23%) ◦ Casino (18%) Cognitions: - Chance vs skill: -
Rosecrance, 1988, United States	To describe and analyze the work activities of professional horserace gamblers.	Design: Cross-sectional Inclusion criteria: 1. Professional horserace gamblers (major source of income is derived from gambling on horse races) Exclusion criteria: - Measures: Interviews, observations	Type: Horseracing N = 27 Severity: - Age: 25-78 years Male %: 100 Education: - Employed %: -	Gambling behaviour- Horseracing: • Can put 12-14 hours per day in gambling activities. Cognitions: • Similarities between gamblers: ◦ Commitment ◦ Discipline ◦ Ability to deal with ambiguity Chance vs skill: • Suggest that it is possible to be a professional horseracing gambler
Wulfert, Maxson & Jardin, 2009, United States	To elucidate whether heart rate, subjective excitement, and urge to gamble are cue-specific and elicited by stimuli associated with an individual's preferred gambling activity or whether they are generalized and elicited by any gambling-related cue.	Design: Quasi-experimental Inclusion criteria: 1. 18 years and older 2. Exclusive or predominant horseracing bettor 3. Betting at least 3 times/week 4. Not receiving a treatment for gambling problems Exclusion criteria: - Measures: Excitement and urge to play scales, NODS, SOGS	Type: Horseracing N = 47 Severity: RG: 42.6%, PbG= 14.9%, PPG= 42.6% Age <i>M (SD)</i> : 46 (-) Male %: - Education: - Employed %: -	Gambling behaviour-NSG: • Frequency/week <i>M (SD)</i> = 4.6 (1.4) Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Horsereading and SEB				
Arcan & Karanci, 2013, Turkey	To adapt and to test the validity and the reliability of the Turkish version of the Gambling-Related Cognitions Scale (GRCS-T) that was developed by Raylu and Oei (2004)	Design: Cross-sectional Inclusion criteria: - Exclusion criteria: - Measures: EPQR-A, GRCS, GRIF, PANAS, SOGS	Type: Horsereading & SEB N = 354 Severity: 11.6% PbG Age <i>M</i> (<i>SD</i>): 35.8 (13.5) Male %: 100 Education: 39.2% college or more Employed %: -	Gambling behaviour- Horsereading & SEB • Frequency/week <i>M</i> (<i>SD</i>) = 4.7 (2.2) • Hours devoted to gambling/week <i>M</i> (<i>SD</i>) = 9.9 (13.2) • Duration gambling behaviour <i>M</i> (<i>SD</i>) = 108.5 months (111.6) Cognitions: - Chance vs skill: -
Chevalier et al., 2004, Canada	To evaluate the prevalence of at-risk and pathological gambling among Quebec population and to evaluate gamblers' characteristics.	Design: Cross-sectional Inclusion criteria: 18 years and older Exclusion criteria: - Measures: Four sections phone interview: 1) Gambling participation 2) severity of gambling problem (SOGS or CPGI), 3) associated problems and 4) general information.	Type: Horsereading N = 168 Severity: 11.4 PPG Age: 77% (25 to 64) Male %: 60.4 Education: 54.4% college or more Employed %: 66.3 Type: SEB N = 216 Severity: 12.8% PPG Age: 82.9% (18 to 44) Male %: 88.6 Education: 57.4% college or more Employed %: 68.6	Horsereading Gambling behaviour- Horsereading • Amount/year <i>M</i> = 826\$ CAD Cognitions (vs non-bettors): • Independent events*: Stronger agreement among bettors = 19.8% • Systems are helpful*: Stronger agreement among bettors = 31.1% Chance vs skill: - SEB Gambling behaviour-SEB: • Amount/year <i>M</i> = 472\$ CAD Cognitions (vs non-bettors): • Independent events*: Stronger agreement among bettors = 16.3% • Systems are helpful*: Stronger agreement among bettors = 30.1% Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Noriega & Lin, 2003, United States	To examine the behavior of gamblers who attend different types of gaming outlets or prefer different types of games, and to determine the differences among these individuals in their behavior and attitudes toward that particular event.	Design: Cross-sectional Inclusion criteria: - Exclusion criteria: - Measures: Self-reported questionnaire about behaviour and attitudes toward gambling.	Type: Horsereading N = 26 Severity: - Age: 61.6% (41 to 60) Male %: - Education: - Employed %: - PES N = 16 Severity: - Age: 100% (41 to 60) Male %: - Education: - Employed %: -	Horsereading Gambling behaviour: Horsereading <ul style="list-style-type: none"> Average budget/occasion: <ul style="list-style-type: none"> 15.4% = less than 100 USD 69.2% = between 100-200 USD 15.4% = between 200-300 USD M frequency: <ul style="list-style-type: none"> 42.3% = Several times a week 57.7% = between twice/month and once/week Cognitions: <ul style="list-style-type: none"> 57.7% considered themselves average and 11.5% better than average. Chance vs skill: - SEB Gambling behaviour: SEB Average budget/occasion: <ul style="list-style-type: none"> 12.5% = between 50-100 USD 62.5% = between 100-200 USD 25% = between 200-500 USD M frequency: <ul style="list-style-type: none"> 50% = Several times a week 50% = About 3 times/month Cognitions: <ul style="list-style-type: none"> 57.7% considered themselves average and 18.8% better than average. Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Petry, 2003, United States	To evaluate whether treatment-seeking gamblers differ based upon their most problematic gambling activity.	Design: Cross-sectional Inclusion criteria: 1. PG (DSM-IV diagnosis) 2. At least one gambling day in the last month Exclusion criteria: 1. Uncontrolled major psychiatric disorder 2. Non-English speaking Measures: ASI, SOGS	Type: Horseracing N = 26 Severity: PG Age <i>M (SD)</i> : 43.7 (2.2) Male %: 100 Education: <i>M</i> years = 11.8 Employed %: 76.9 Type: SEB N = 29 Severity: PG Age <i>M (SD)</i> : 34.1 (1.7) Male %: 96.6 Education: <i>M</i> years = 13.2 Employed %: 65.5	Horseracing Gambling behaviour-NSG: • Amount/month <i>M (SD)</i> = 9,830 USD (1,600) • Days/month <i>M (SD)</i> = 14.8 (2.1) • Age of onset <i>M (SD)</i> = 21.8 (2.3) Cognitions: - Chance vs skill: - SEB Gambling behaviour-NSG: • Amount/month <i>M (SD)</i> = 4,870 USD (1,490) • Days/month <i>M (SD)</i> = 13.3 (2.0) • Age of onset <i>M (SD)</i> = 25.2 (2.1) Cognitions: - Chance vs skill: -
SEB				
Andersson, Memmert, & Popowize, 2009	To investigate the ability of sports experts, defined as bettors, and laypeople to predict the outcome of a worldwide sporting event.	Design: Quasi-experimental Inclusion criteria: - Exclusion criteria: - Measures: Four-part questionnaire: 1) Knowledge about the teams qualified for the World Cup (2006), 2) Outcome prediction of the first stage of the event (Task A), 3) Specific prediction task (Task B-C) and 4) General questions about characteristics and interests.	Type: SEB N = 85 Severity: - Age <i>M (SD)</i> : 27.3 (8.0) Male %: 83.5 Education: - Employed %: -	Gambling behaviour: - Cognitions: • Confidence level: Bettors and students in sports science are more confident than art students*. Chance vs skill: • Easy task: nsd between groups • Difficult task: Bettors and students in sports science predict better than art students*.

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Braverman, Labrie, & Shaffer, 2011, United States	To determine whether we can represent the characteristics of extreme gambling as qualitatively distinct (i.e., taxonomic) or as a point along a dimension.	Design: Longitudinal Inclusion criteria: 1. Having an account with Bwin IE AG (Feb. 2005) 2. Top 5% of the total sample (N= 48 114) on one or more of these variables (i.e., total amount wagered or lost, No. of bets and bets per day). Exclusion criteria: - Measures: Records of betting behaviour	Type: Online SEB N = 4 595 Severity: - Age <i>M (SD)</i> : 32.0 (10.2) Male %: 91 Education: - Employed %: -	Gambling behaviour- SEB: On a two year period: • Total amount wagered <i>M (SD)</i> = €26,511 (€58,735) • Total amount lost <i>M (SD)</i> = € 2,307 (€5,313) • Total number of bets <i>M (SD)</i> = 2,601 (4,683) • Bets per day <i>M (SD)</i> = 17 (19) Cognitions: - Chance vs skill: -
Broda et al., 2008, United States	To reduce harm related to gambling problems, an Internet sports betting service provider, bwin IE AG, imposes limits on the amount of money that users can deposit into their online gambling accounts. The aim of this research is to examine the effects of these limits on gambling behaviour.	Design: Longitudinal Inclusion criteria: 1. People who registered with bwin IE AG between February 1 and February 28, 2005, and who deposited money in their accounts before February 28, 2007. Exclusion criteria: 1. Did not engage in FOB or LAB Measures: Dataset of the actual Internet sports gambling behaviour of this cohort.	Type: Online SEB N = 47,000 Severity: - Age <i>M (SD)</i> : 30.3 (9.9) Male %: 92 Education: - Employed %: - Bettors who exceeded the deposit limits (BEDL): N = 160 Severity: - Age <i>M (SD)</i> : 30.8 (9.2) Male %: 96.9 Education: - Employed %: -	Gambling behaviour- SEB: Bettors who respected the deposit limits (BEDL): • % of active betting days <i>M (SD)</i> : FOB = 25 (29); LAB= 31 (37) • Nb bets/active day <i>M (SD)</i> : FOB = 4 (7); LAB = 4 (5) • Size of the bet in € <i>M (SD)</i> = FOB = 11 (30); LAB = 11 (25) Bettors who exceeded the deposit limits (BEDL): • % of active betting days <i>M (SD)</i> = FOB= 21 (20); LAB= 26 (28) • No. bets/active day <i>M (SD)</i> = FOB* = 7 (13); LAB* = 8 (14) • Size of the bet in € <i>M (SD)</i> : FOB* = 25 (55); LAB* = 27 (41) Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s), Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Cantinotti, Ladouceur, & Jacques, 2004, Canada	To examine (a) whether expert hockey bettors could make better predictions than chance, (b) whether expert hockey bettors could achieve greater monetary gains than chance, and (c) what kind of strategies hockey gamblers rely on when betting.	Design: Quasi-experimental Inclusion criteria: 1. Regular sport (hockey) bettors 2. Must have bet on Mise-O-Jeu (sports lotteries) at least twice a month 3. Speak French Exclusion criteria: 1. Excessive gamblers (SOGS) Measures: Questionnaire containing 21 items on hockey gambling (10-point Likert scale [0= not at all; 100= extremely]), SOGS.	Type: SEB N = 30 Severity: - Age <i>M (SD)</i> : 28.6 (9.4) Male %: 100 Education: - Employed %: -	Gambling behaviour- SEB: <ul style="list-style-type: none"> • <i>M</i> frequency %: <ul style="list-style-type: none"> ◦ Several times/week = 36.7 ◦ Weekly basis = 33.3 ◦ Two-three times/month = 30 Cognitions: <ul style="list-style-type: none"> • They can slightly improve themselves = 33.1% • Knowledge heightens winning chances = 62.5% • Majority believed that after a streak of poor performances, a “good” team was due to win. Chance vs skill: <ul style="list-style-type: none"> • Accuracy of wagers: Bettors are more accurate than random selection* • nsd in monetary gains
D'Astous & Di Gasparo, 2013, Canada	To evaluate the return-on-investment (ROI) performance of online sports bettors and the determinants of their performance.	Design: Cross-sectional Inclusion criteria: 1. 18 years and older 2. Speak French 3. Online sports gamblers Exclusion criteria: 1. Uncompleted ROI index Measures: ATRS, data of their last 20 bets (ROI), LOCS, questions on information search and analysis, RICS, subjective measure of experience.	Type: Online SEB N = 158 Severity: - Age <i>M (SD)</i> : 27.5 (-) Male %: 98.1 Education: - Employed %: -	Gambling behaviour- SEB: <ul style="list-style-type: none"> • Amount/bet <i>M</i> = €7.13 • Bets/week <i>M</i> = 18.7 Cognitions: - Chance vs skill: <ul style="list-style-type: none"> • Experience = positively associated to ROI* • ROI = 11.1%

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Labrie, Laplante, Nelson, Schumann, & Shaffer, 2007, United States	To describe the Internet gambling behavior of sports bettors during 8 months and to examine the behaviour of empirically determined groups of heavily involved bettors whose activity exceeded that of 99% of the sample.	Design: Longitudinal Inclusion criteria: 1. People who registered with Bwin IE AG between February 1 and February 27, 2005. Exclusion criteria: 1. Did not deposit their own money in their accounts. 2. Did not gamble with their own money before September 30, 2005. Measures: Daily aggregates of betting activity records, participants' monetary deposits to and withdrawals from their wagering accounts.	Type: Online SEB N = 40,499 Severity: - Age <i>M</i> (<i>SD</i>): 31 (10.0) Male %: 91.6 Education: - Employed %: -	Gambling behaviour-SEB: • Frequency % <i>M</i> (<i>SD</i>) FOB = 32 (27), LAB = 42 (37) • Bets/day <i>M</i> (<i>SD</i>): FOB = 4.1 (7.7), LAB = 4.3 (5.0) • Euros/ Bet <i>M</i> (<i>SD</i>): FOB = 12 (32), LAB = 11 (25) • % Lost <i>M</i> (<i>SD</i>): FOB = 32 (62), LAB = 23 (61) • Other results: Women had more betting days within a shorter interval of betting and had smaller net losses despite making larger bets, suggests women exhibit more effective sports gambling behaviour than men. Cognitions: - Chance vs skill: -
Laplante, Schumann, Labrie, & Shaffer, 2008, United States	To examine the online gambling participation and activity among a population of newly subscribed Internet bettors.	Design: Longitudinal Inclusion criteria: 1. People who registered with Bwin IE AG during February 2005. Exclusion criteria: 1. Did not gamble with their own money before August 31, 2006. 2. Did not wager on sports. 3. Individuals having exceptional financial means (<i>N</i> =6) Measures: Aggregates of betting activity	Type: Online SEB N = 46,339 Severity: - Age <i>M</i> (<i>SD</i>): 30.4 (9.9) Male %: 91.9 Education: - Employed %: -	Gambling behaviour-SEB: • 66.1% played both FOB and LAB at least once, 32.3% only FOB and 1.6% only LAB. • The highest betting activity of the sample occurred almost immediately, followed by a short increase in bets, and then a broader decrease in betting activity. Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s), Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Li, Zang, Mao, & Min, 2012, China	To identify and examine consumer perceptions of corporate social responsibility associated with sports lottery in China and their influence on consumption behavior.	Design: Cross-Sectional Inclusion criteria: 1. Bought one or more sports lottery tickets in the past 12 months prior to participating in the study. Exclusion criteria: - Measures: SSLA	Type: SEB N = 4,980 Severity: - Age: 56.3% (20 to 40) Male %: 77.3 Education: 35.4% college or more Employed %: 70.8	Gambling behaviour- PES: <ul style="list-style-type: none"> • Amount (Chinese Yuan)/week: <ul style="list-style-type: none"> ◦ Below 20 = 29.5% ◦ 21-50 = 33.3 ◦ 51-100 = 19.1% ◦ More than 101 = 18.1% • Frequency/week: <ul style="list-style-type: none"> ◦ Once or less (15%) ◦ 2 à 5 times (53.2) ◦ More than 6 times (31.8%) • Other gambling activities (%): <ul style="list-style-type: none"> ◦ Sport Lotto = 79.5 ◦ Sports betting = 23.8 ◦ High frequent game = 15.1 ◦ Scratch-off game = 32.7 Cognitions: - Chance vs skill: -

Table 1 Continued.

Author(s) Year, Country	Aim(s)	Design, inclusion and exclusion criteria, measures	Type of bettors and characteristics	Main results
Pool/Fantasy League Weiss, Denski, & Backen, 2011, United States	The primary aim of the current study is to determine whether there is merit in claims that fantasy sports are gambling. Such claims will be contrasted with the perceptions of fantasy sports players and non-players, as well as actual outcomes reflected in fantasy baseball league records.	Design: Quasi-experimental Inclusion criteria: 1. Be a member of a fantasy league. Exclusion criteria: - Measures: A questionnaire that contains demographic information questions about features of skill and chance.	Type: Fantasy league N = 56 Severity: - Age <i>M (SD)</i> : 32.5 (1.1) Male %: 98.2 Education: - Employed %: -	Gambling behaviour: - Cognitions: • The player's estimates of skill-to-chance ratio were higher than those of the non-players. • Three chance themes identified: ◦ Unpredictable player performance: 68% ◦ League procedures: 23% ◦ Miscellaneous chance factors: 9% • Three skill themes identified: ◦ Ability to select good players: 66% ◦ Effective player scheduling: 17% ◦ Miscellaneous skills: 17% Chance vs skill: No specific data about gambling or monetary return but the results suggest that some players are better than other players at this game.

Note : ASI: Addiction Severity Index; ATRS: Attitude Toward Risk; BDI-13: Beck depression inventory; BPS: Boredom Proneness Scale; CPGI: Canadian Problem Gambling Index; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; EIQ: Eysenck Impulsiveness Questionnaire; EPQR-A: Eysenck Personality Questionnaire-Revised & Abbreviated; FOB: Fixed odds bets; GBQ: Gambling Beliefs Questionnaire; GII: Gambling Involvement Index; GMS: Gambling Motivation Scale; GRCS: The Gambling-Related Cognitions Scale; GRIF: Gambling-Related Information Form; HRT: Horse Race Task; IE: Interactive Entertainment; LAB: Live action bets; M= Mean; MAS: Money Attitude Scale; MM: Big-Five Mini Markers; No.: Number; NODS: NORC DSM Screen; nsd: No significant difference; NSG= Non-specific games; PANAS: The Positive Affect Negative Affect Scale; PG: Pathological gambler; PbG: Problem Gambler; PPG: Probable pathological gambler; POMS-SF: Profile of Mood States-Short Form; RCI: Revised Competitiveness Index; RG: Regular gambler; RICS: Rational-intuitive cognitive style; ROI : Return-over-investment; SD: Standard deviation; SSLA: Scale of Sport Lottery Administration; SOGS: South Oaks Gambling Screen; SSS Form V: Sensation seeking scale; STAI: State-Trait Anxiety Inventory; TAS: Thrill and Adventure Seeking; TDS: Telic Dominance Scale; THQ: Trauma History Questionnaire; vs= versus; VUQ: View of Uncertainty Questionnaire; -: Data unavailable; + : More; * : $p < .05$; ** : $p < .01$; *** : $p < .001$

One study reported spending weekly amounts of 196\$ CAD on horseraces (Chantal & Vallerand, 1996) and one specified an average annual amount of 826\$ CAD (Chevalier et al., 2004). Two studies presented data for money spent gambling, though without specifying data exclusively for horseraces. The first study indicated that gamblers in their sample spent an average of 240\$ CAD per week (O'Connor & Dickerson, 2003), while the horseracing bettors of the second study conducted with gamblers in treatment reported an average amount spent of 14,968\$ CAD per month (Petry, 2003).

Cognitions relating to horseracing and skill. Six studies reported data relating to horseracing bettors' cognitions on skill. They perceived participation in horseracing betting as a means to acquire knowledge (Chantal & Vallerand, 1996) and considered that a talented gambler must be task-driven, disciplined and possess a good ability to tolerate ambiguity (Rosecrance, 1988). On a nine-point Likert scale, (0 = not at all, 9 = a lot more), participants in one study considered themselves "experts" compared to non-gamblers ($M = 3.4$, $SD = 1.9$) and believed that they can better predict horserace results than chance ($M = 4.7$, $SD = 1.4$; Ladouceur et al., 1998). Another study indicated that 11.5% of their sample considered themselves better than other horseracing bettors (Noriega & Lin, 2003). Morvannou and collaborators (2012) revealed that horseracing bettors in their sample presented some cognitive distortions concerning gambling in general as identified by the Gambling-Related Cognitions Scale (Raylu, & Ćei, 2004), namely overestimation of predictive control and illusion of control. The last study on cognitions indicated that compared to non-gamblers, horseracing bettors agreed more with the statements that when a loss is incurred, the odds of winning increase, and that a game strategy for gambling can be beneficial (Chevalier et al., 2004).

Chance and skill in horseracing betting. Two publications attempted to distinguish the parts of chance and skill involved in horseracing betting. The first reported that gamblers made significantly more accurate predictions than a random selection, but there was no significant difference for financial returns due to the structure of the game (Ladouceur et al., 1998). The second suggested that it was possible to become an expert in horseracing betting and become better than horseracing officials (Rosecrance, 1988). This interpretation was based on the subjective personal experience of the author, observations of professional gamblers and interviews with professional gamblers.

Sports events bettors (SEB)

Sociodemographic characteristics. In the 12 studies involving SEB, the number of participants varied from 16 to 47,000. All studies (100%) were constituted of mostly male samples, where the percentage varied from 77.3 to 100%. None of these studies had specific inclusion criteria for participants' gender. Participants' age in these studies ranged from 18 to 73, with an average age between 27 and 36.

Gambling habits for SEB and other gambling activities. Eleven studies (91.7%) out of 12 presented data on gambling habits for SEB. More specifically, six studies reported data for offline SEB and five for online SEB.

Seven studies (58.3%) out of 12 presented data for gambling frequency, and seven (58.3%) reported data for money spent by SEB. One study indicated that SEB gambled on average 4.7 times per week (Arcan & Karanci, 2013). Three studies did not report data for average gambling frequency for SEB and other gambling activities, but indicated that 36.7% (Cantinotti et al., 2004) to 85.0% (Li, Zang, Mao, & Min, 2012) of their sample gambled many times per week. One of these three studies revealed that 62.5% of gamblers spent from 157 to 314\$ CAD per session, and half of them gambled many times per week (Noriega & Lin, 2003). Another study that reported specific data for gambling habits of SEB revealed that they bet on average 19 times per week, where each bet was valued around 10\$ CAD (D'Astous & Di Gaspero, 2013).

Three observations could be made regarding the gambling habits of approximately 50,000 online SEB. The first was that they were active during the first month of their membership, but their activity level decreased substantially over the following months (Laplante, Schumann, Labrie, & Shaffer, 2008). The second was that women gambled over a shorter period, made higher bids and less risky bets, and lost significantly less money than men (Labrie, Laplante, Nelson, Schumann, & Shaffer, 2007). The third was that gamblers who attempted to exceed the limit permitted by the website bet significantly higher amounts than gamblers who respected it, and had significantly more odds of belonging to the group of most involved gamblers (upper 5% for the seven variables of the study [e.g., total amounts of bets, frequency]; Broda et al., 2008). For these gamblers, a mean amount of 37,000\$ CAD over two years was spent, with mean losses of 3,200\$ (Braverman, Labrie, & Schaffer, 2011)

Finally, one study was conducted with SEB in treatment and reported general data relating to their gambling habits. They spent a mean amount of 7,415\$ CAD per month and gambled an average of 13 days per month (Petry, 2003).

Cognitions relating to gambling and skill. Four studies (33.3%) out of 12 reported results for cognitions of SEB. In the first, results indicated that in comparison to non-gamblers, SEB agreed more with the statements that after a series of losses, the odds of winning increase, and that a game strategy in gambling can be useful (Chevalier et al., 2004). In the second, 18.8% of participants considered that they had above average skills (Noriega & Lin, 2003). The third compared participants' confidence in their predictions based on their group. Results indicated that SEB were just as confident in their predictions as students in sports science, and significantly more confident than art students in their predictions of the winner of the soccer world cup (Andersson, Memmert, & Popowicz, 2009). The last study was carried out with hockey bettors. Among these gamblers, 33.1% believed that they could improve their performance, 62.5% believed that their knowledge increased with their odds of gains, 75% believed that assessing their past scores and the

location of the match was helpful, and 93.7% believed that ties were more difficult to predict. Most of these participants indicated relying on recent sports results to prepare their bets (Cantinotti et al., 2004).

Chance and skill. Three studies discussed the parts of chance and skill involved in sports events betting. The influence of experience on the accuracy of sports results was assessed in two studies. Results indicated that experienced gamblers performed significantly better than chance in making accurate predictions. One of these studies focused on the accuracy of participants' predictions based on complexity level and group. The data showed that as predictions became more complex, SEB predicted results as equally well as university students in sports sciences (understanding the impact of sports on people and society), and significantly more than art students (Andersson, Memmert, & Popowicz, 2009). A study carried out with SEB that bet regularly on hockey indicated that they made significantly more accurate predictions than a random selection. However, there was no significant difference for financial gains between SEB selections and random selections (Cantinotti et al., 2004). One study rather indicated the opposite for financial gains: there was a positive association between gamblers' experience (measured subjectively) and financial investment returns ($[(\text{Sum of gains} - \text{Sum of bets}) / \text{Sum of bets}] \times 100$). The sample of SEB obtained investment returns of 11.1% on the average of their 20 last bets (D'astous & Di Gaspero, 2013).

Pool/fantasy league bettors

Only one study focused on pool/fantasy league bettors (Weiss, Demski, & Backen, 2011). Participants ($N = 56$) were mostly men (98.2%), with a mean age of 32.5 years, and bet on baseball. Data on gambling habits were not available. Compared to non-gamblers, gamblers considered that skill had more impact than chance on sports pool bets. The authors asked participants to identify the components of skill and chance in the game. The majority (68%) proposed that the gambler's unpredictable performance was the main component of chance, followed by the league's procedures (23%) and other elements such as suspensions (9%). Moreover, most participants (66%) identified the gamblers' selection process as the main component of skill, followed by the strategies employed (17%), for example the choice of opponents, and other various skills (17%). This study did not present data on the distinction between chance and skill inherent to gambling, but suggested that some players were better than others.

Quality assessment rating

Table 2 presents the evaluation of the selection bias, the quality of the data collection methods used, and the significance of the rating. For the selection bias, eight studies obtained a strong score, 10 a moderate score, and 13 a weak score. For the data collection methods, 18 studies obtained a strong score, two a moderate score, and 11 a weak score.

Table 2
Selection Bias and Data Collection Methods Ratings by Study

Author(s)	Selection bias	Data collection methods
Bonnaire, Bungener, & Varescon, 2006	Moderate	Strong
Bonnaire, Varescon, & Bungener, 2007	Moderate	Strong
Bonnaire, Varescon, & Bungener, 2009	Moderate	Strong
Chantal & Vallerand, 1996	Moderate	Moderate
Chantal, Vallerand, & Vallières, 2001	Moderate	Moderate
Coco, Sharpe, & Blaszczynski, 1995	Moderate	Strong
Coventry & Norman, 1997	Weak	Strong
Franco, 2008	Weak	Strong
Franco, Paris, Wulfert, & Frye, 2010	Weak	Strong
Hartley, 2005	Weak	Strong
Ladouceur, Giroux, & Jacques, 1998	Weak	Strong
Lau & Ranyard, 2005	Weak	Strong
Morvannou et al., 2012	Moderate	Strong
O'Connor & Dickerson, 2003	Weak	Moderate
Oliveira & Silva, 2001	Weak	Weak
Pelzer et al., 2006	Moderate	Strong
Rosecrance, 1988	Weak	Weak
Wulfert, Maxson, & Jardin, 2009	Moderate	Strong
Chevalier et al., 2004	Strong	Moderate
Arcan & Karanci, 2013	Strong	Weak
Noriega & Lin, 2003	Weak	Weak
Petry, 2003	Moderate	Strong
Andersson, Memmert, & Popowicz, 2009	Strong	Weak
Braveman, Labrie, & Schaffer, 2011	Strong	Strong
Broda et al., 2008	Strong	Strong
Cantinotti, Ladouceur, & Jacques, 2004	Weak	Weak
D'Astous & Di Gaspero, 2013	Weak	Strong
Labrie, Laplante, Nelson, Schumann, & Shaffer, 2007	Strong	Strong
Laplante, Schumann, Labrie, & Shaffer, 2008	Strong	Strong
Li, Zang, Mao, & Min, 2012	Strong	Weak
Weiss, Demski, & Backen, 2011	Weak	Weak

Note. Selection bias: Strong: The selected individuals are very likely to be representative of the target population and there is greater than 80% participation. Moderate: The selected individuals are at least somewhat likely to be representative of the target population and there is 60 - 79% participation. Weak: The selected individuals are not likely to be representative of the target population or there is less than 60% participation or selection is not described and the level of participation is not described. Data collection method: Strong: The data collection tools have been shown to be valid and the data collection tools have been shown to be reliable; Moderate: The data collection tools have been shown to be valid and the data collection tools have not been shown to be reliable or reliability is not described; Weak: The data collection tools have not been shown to be valid or both reliability and validity are not described.

Discussion

This systematic review is the first to focus specifically on gambling habits and cognitions of sports bettors. Likewise, it is the only review that gathers empirical data regarding the roles of chance and skill in sports betting.

The first aim of this paper was to determine gambling habits of sports bettors, namely the type of sports betting, gambling frequency and money spent. Over two

thirds of the studies retained for this review focused on horseracing bettors, and only one concerned pool bettors. This overrepresentation of studies on horseracing bettors in comparison to other types of sports bettors may be explained by its popularity over time, though it appears to have decreased in the past decade (European Gaming and Betting Association, 2017). Although interest in SEB seems recent, this sports betting activity is rising rapidly in popularity. It is estimated that profits brought in by SEB will increase from 58 billion US dollars in 2012 to 70 billion in 2016 (Hing et al., 2016). This illustrates the increasing popularity of SEB, which may be explained by the increased accessibility offered with Internet and mobile technology and, in turn, may motivate researchers to further study SEB in the future. Concerning sports pool betting, the rarity of studies on this topic could be due to the fact that it is not regulated by gambling laws. Indeed, many pool bets were made between friends or colleagues rather than through official sports betting platforms. However, this type of gambling activity may be perceived as less harmful due to its structure that involves betting only once in the beginning of a season, thus limiting the bettor's financial investment.

Regarding gambling frequency, both horseracing bettors and SEB gambled many times per week. This high frequency may be explained by inclusion criteria of the retained studies, of which half required participants who gambled at least once a week. Thus, the conclusions of these studies with frequent gamblers cannot be generalized to occasional gamblers. Concerning money spent gambling, horseracing bettors appeared to have similar habits to those of SEB: both groups generally bet over 100\$ CAD per week. Overall, information on gambling frequency and money spent presented in the retained studies indicated that they exceeded the threshold of low risk gambling proposed by Currie and collaborators (2006). The authors suggested that an optimal frequency would be of two to three sessions per month, with annual bets of 500 to 1,000\$ CAD. Considering this, the seemingly excessive gambling habits of sports bettors as observed in this review may be the result of an overrepresentation of gamblers with problematic gambling behaviours in the samples. Indeed, one in four studies in this review had participants who were probable pathological gamblers or frequent gamblers (i.e. gambled a least two or three times a week). This might be a volunteer bias, as problem gamblers were found to show more interest in participating in gambling research than non-problem gamblers (Chrétien et al., 2013).

The second aim was to identify beliefs held by sports bettors. Findings were similar for all types of sports bettors (i.e., horseracing, SEB and pools). Although only 11 studies focused on this topic, they all reported that bettors had thoughts that minimize the role of chance in favour of skill on the outcome of the game. These results are consistent with the idea that gamblers who play games of skill overestimate their personal ability to win (Bjerg, 2010; Dufour, Brunelle, & Roy, 2015; Toneatto et al., 1997; Walker, 1992). For example, some gamblers believed that accumulating information on past statistics or bets would give them an advantage to make a profitable bet. These potentially risky thoughts are preoccupying as significant empirical data emphasized the potential role of this type of thought in the

development and maintenance of problematic gambling behaviours (Cunningham, Hodgins, & Toneatto, 2014; Ladouceur & Dubé, 1997; Toneatto, 1999).

The third aim was to explore how studies distinguished the roles of chance and skill in sports betting. The results converge toward the same conclusion for horseracing bettors and SEB: most of the studies indicated that personal skill enabled gamblers to make more accurate unique predictions. However, most sports betting games are structured in a way that requires gamblers to combine several accurate predictions in order to win money. When gamblers have to combine these predictions, they do not perform better (i.e., they do not win more money) than bets made by random selection. Hence, the belief that sports literacy increases odds of winning in sports betting may reinforce illusions of control (Cantinotti et al., 2004). Only one study reported data suggesting that gamblers' skill is associated with financial gains. However, the authors indicated that the use of a self-report measure and an under-representation of gamblers with a negative balance of gains may have influenced their results. In sum, although most of the retained studies showed that sports bettors' skill was not associated with financial gain, only five out of 31 studies focused on this question and conclusions were contradictory. Consequently, it remains difficult to quantify the part of chance and skill in sports betting, and to clearly distinguish the influence of each on gamblers' efficiency. Likewise, it is impossible to determine the erroneous nature of certain thoughts relative to skill held by sports bettors. These thoughts may however encourage gamblers to adopt problematic gambling behaviours in the hope that their personal skills may help them control the outcome of the game.

Strengths and limitations

A limitation of this review lies in the quantity of studies conducted that allowed to answer the research questions. Only 11 studies out of 31 contained data on sports bettors' cognitions. In addition, only five studies addressed the distinction between chance and skill in sports betting. The conclusions of this study must be interpreted carefully in light of this limitation. It also illustrates the lack of empirical information on components that are essential to better understand sports bettors' behaviours. A second limitation that warrants careful interpretation of the results concerns the variation in methodological quality of the retained studies. Sports betting has seldom been studied and no randomized controlled studies seem to have been conducted. Consequently, this review is mainly constituted of cross-sectional studies with potential biases. However, the inclusion of these studies regardless of their methodological quality allows for a wider and richer perspective on research that has been conducted on this topic so far.

This review is the first to address the specific characteristics of sports bettors, namely their gambling habits and cognitions. It is also the first to assess available data on the roles of chance and skill involved in sports betting. Finally, the scientific rigor employed during the selection and data extraction processes constitutes a strength of this study.

Recommendations for future research

It is essential to continue research on gambling cognitions as a risk factor in order to determine their impact on gambling habits of sports bettors. Since it is difficult to determine the part of skill involved in sports betting, it is also difficult to determine whether sports bettors' thoughts regarding the influence of skill on the outcome of the game are erroneous or not. Future research could attempt to conceptualize sports bettors' thoughts as "at-risk" instead of "erroneous". However, this particularity could complicate the task of therapists as they generally work with erroneous thoughts (Ladouceur et al., 2001). From a clinical standpoint, counsellors could emphasize financial consequences related to gambling rather than focusing therapeutic work on erroneous thoughts. Gamblers may be more inclined to observe the objective financial consequences of their gambling behaviours rather than recognize the erroneous nature of their thoughts due to the ambiguity that subsists regarding the part of skill involved in sports betting. A longitudinal design would be necessary to verify if there are helpful abilities in sports betting. The first step would be to identify gamblers with a positive return over investment (ROI) and extract their characteristics (i.e., years of experience, knowledge on sports, gambling habits). The second step would be to follow these players over time to see if they can maintain a positive ROI, and to compare the characteristics of players who keep a positive ROI with that of players who do not. Finally, future studies could address pool and fantasy league bettors in order to acquire further knowledge on their specific characteristics. The structure of sports pools is different from that of horseracing and SEB, namely due to the single investment that it requires at the beginning of a season and the months it takes before finding out the results that determine whether the bet is a winning or losing one. It is possible that thoughts and consequences related to gambling in sports pools differ from those seen in horseracing betting or SEB, but few studies have addressed these elements.

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Submitted May 29, 2017; accepted October 9, 2017. This article was peer reviewed. All URLs were available at the time of submission.

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Competing interests: None declared (all authors).

Ethics approval: None required.

Acknowledgements: The study was funded by the Fonds de recherche du Québec –Société et culture (FRQ-SC) in partnership with the ministère de la Santé et des Services sociaux du Québec. The authors would like to thank Marie-Claude Mailhot, Dominic Nadeau, Pierre-Yves Bergeron, Alexandre Hamel and Édith Gosselin for their collaboration in the data collection phase of this study. We also wish to thank Mélanie Dixon and Catherine Boudreault for their contribution in the last revision of the English version of this paper.