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Hey Big Spender: An Ecological Momentary Assessment of Sports and Race Betting Expenditure by Gambler Characteristics

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Abstract

A major obstacle to understanding how expenditure varies among people who gamble is the difficulty of obtaining accurate expenditure data from individual gamblers. To overcome the shortcomings of retrospective self-reports, this study used a prospective ecological momentary assessment (EMA) design to capture these data every 24 or 48 hours. It aimed to examine (a) demographic, psychological, behavioural, and contextual characteristics of high-spending sports and race bettors and (b) the relationship between betting outlay and problem gambling severity. A baseline survey was completed by 320 regular sports bettors and 402 regular race bettors, followed by 15 EMA surveys over 3 non-consecutive weeks. Higher spending bettors were more likely to be male, place more of their bets online, have higher disposable incomes, have commenced betting at a younger age, have more accounts with betting operators, and bet when affected by alcohol. The analyses confirmed the strong link between problem gambling severity and financial outlay on betting. Regular sports bettors who were experiencing gambling problems spent 4 times more than their non-problem gambling counterparts did, and those at moderate risk spent 3 times more. Regular race bettors who were experiencing gambling problems spent 3 times more than the non-problem gambling race bettors did, and those at moderate risk spent twice as much. These results suggest that regulatory and other initiatives that help bettors to limit or reduce their financial outlay on betting should be central to harm minimization efforts in order to reduce the growing number of bettors who experience gambling problems and harm.

Keywords: betting, wagering, expenditure, gambling, problem gambling, gambling harm

Résumé

Un des principaux obstacles à la compréhension de la variation des dépenses entre les joueurs est la difficulté d'obtenir des données précises sur les dépenses de la part de joueurs individuels. Pour pallier les faiblesses d'auto-évaluations rétrospectives, cette étude visait à utiliser un modèle d'évaluation écologique momentanée (EMA) prospective pour saisir ces données toutes les 24 ou 48 heures, afin d'examiner 1) les caractéristiques démographiques, psychologiques, comportementales et contextuelles de gros parieurs de course et de paris sportifs et 2) la relation entre les dépenses de paris et la gravité du jeu problématique. Une enquête initiale a été réalisée auprès de 320 parieurs sportifs et de 402 parieurs de course réguliers, suivie de 15 sondages EMA sur trois semaines non consécutives. Les plus gros parieurs étaient plus susceptibles de: placer davantage de paris en ligne, d'avoir un revenu disponible plus élevé, d'avoir commencé à parier à un plus jeune âge, d'avoir davantage de comptes auprès d'opérateurs de paris et de parier sous l'influence de l'alcool. Les analyses ont confirmé le lien étroit qui existe entre la gravité du jeu problématique et les dépenses financières consacrées aux paris. Les parieurs sportifs réguliers aux prises avec des problèmes de jeu dépensaient quatre fois plus et ceux à risque modéré, trois fois plus, que leurs homologues sans problème de jeu. Les parieurs de course réguliers aux prises avec des problèmes de jeu dépensaient trois fois plus et ceux à risque modéré, deux fois plus, que leurs homologues sans problème de jeu. Ces résultats laissent entrevoir que les initiatives réglementaires et autres initiatives qui aident les parieurs à limiter ou à réduire leurs dépenses en paris devraient être au cœur des efforts de minimisation des préjudices, afin de réduire le nombre croissant de parieurs ayant des problèmes de jeu et de préjudices.

Introduction

Wagering on racing and sporting events has grown rapidly in many jurisdictions, fuelled by enabling legislation, online and mobile accessibility, expanded betting opportunities, and prolific advertising (Hing, Russell, Rockloff, et al., 2018b; Lopez-Gonzalez & Griffiths, 2018; Sproston, Hanley, Brook, Hing, & Gainsbury, 2015). In Australia, for example, race betting expenditure increased by 6.9% and sports betting expenditure by 15.3% in 2016–2017 over the previous year, with average per capita wagering expenditure being $175 for race betting and $56 for sports betting (Queensland Government Statistician's Office, 2018). However, these population-level statistics are based on all Australian adults and do not reflect average expenditure per bettor, as only a minority of the population bets on races and sports. These statistics also do not illuminate how expenditure might vary among bettors in different gambler risk groups and with varying demographic, income, and other characteristics.

A more detailed understanding of wagering expenditure by different types of bettors can be useful for several reasons. It can illuminate the relative contribution to industry revenue and government taxes made by vulnerable people in order to assess whether government policies and industry practices are socially responsible (Williams & Wood, 2004; Wood & Williams, 2007). Knowledge of the relationship between expenditure and problem gambling risk can inform systems used to detect problematic gambling from the online betting data of individual betting account holders (Chagas & Gomes, 2017; Gainsbury, 2011; PWC & Responsible Gambling Council, 2017). It may also assist in determining low-risk betting limits, such as those developed for total gambling expenditure (Currie, Hodgins, Wang, El-Guebaly, & Wynne, 2008; Currie, Hodgins, Wang, El-Guebaly, Wynne, & Miller, 2008; Currie, Miller, Hodgins, & Wang, 2009; Dowling et al., 2018) and for limit-setting defaults and options in pre-commitment systems (Auer & Griffiths, 2013; Griffiths, Wood, & Parke, 2009; Ladouceur, Blaszczynski, & Lalande, 2012). Further, identifying the characteristics of high-spending bettors, particularly those who are also experiencing gambling problems, can inform appropriate consumer messaging aimed at moderating expenditure. This is important, given that financial impacts are usually the first and most severe type of gambling harm experienced, typically leading to a cascade of detrimental consequences to mental and physical health, relationships, work, and study (Browne et al., 2016). In fact, financial hardship may be the common denominator underpinning all other harms associated with problem gambling (Blaszczynski et al., 2017). From a public health perspective, government policy and industry practices should be aligned with encouraging adherence to a level of expenditure that does not unduly increase the risk of gambling problems and harms.

However, several challenges must be faced to gain an accurate picture of variations in wagering expenditure among gamblers with different characteristics. One major obstacle is the difficulty of obtaining accurate expenditure data about individual gamblers. Prevalence studies rely on self-reports, but gambling expenditure estimates are known to be unreliable, having poor alignment with aggregate gambling industry revenues when compared with the same jurisdiction and time period (Volberg, Gerstein, Christiansen, & Baldridge, 2001; Williams & Wood, 2004). Self-reported expenditure has been significantly below revenues in some studies and significantly above revenues in others (Williams & Wood, 2004).

One reason for this mismatch relates to how accurately and consistently respondents interpret gambling expenditure questions. Blaszczynski, Dumlao, and Lange (1997) found that only two-thirds or less of a sample of 181 undergraduate students accurately calculated the amount spent on gambling in five case vignettes. In a replication study, half of the respondents calculated net expenditure and half calculated turnover when asked how much money the person in a vignette had spent gambling (Blaszczynski, Ladouceur, Goulet & Savard, 2006). Even when one group was instructed on how to calculate net expenditure and another group on how to calculate turnover, 30% did not follow these instructions in calculating their estimates. The researchers concluded that self-reported gambling expenditure estimates have questionable validity.

A further challenge is the absence of a gold standard measure of gambling expenditure. Wood and Williams (2007) found that that even slight variations in the wording of questions result in substantial differences in self-reported estimates. Of the 12 formats they tested, the question that produced estimates that most closely aligned with actual revenues was, "Roughly how much money do you spend on [specific gambling activity] in a typical month?," where totals from each activity were collected and then summed. Even providing more detailed instructions, such as clarifying that "spend" means "how much you are ahead or behind, or your net win or loss," did not yield greater accuracy.

Braverman, Tom, and Shaffer (2014) compared expenditure estimates collected data from 2,259 online gambling account holders with their actual expenditure as tracked by the operator. Approximately half of these participants underestimated their expenditure and 23%–48% overestimated it. Those who reported gambling problems had less accurate estimates, but were no more likely to underestimate expenditure than were those without problems. Similarly, in comparing online gambling data and self-reported gambling expenditure in the same individuals (N = 1,335), Auer and Griffiths (2017) noted that estimation bias increased with gambling losses. Estimation biases also increase with the length of the recall period (Auer & Griffiths, 2017; Braverman et al., 2014). Gambling expenditure estimates tend to be lower when collected retrospectively than via prospective daily records, such records being found to accurately reflect industry revenues (Blaszczynski, Ladouceur, Goulet & Savard, 2008; Williams & Wood, 2004). Social desirability bias may also influence self-reports because of the sensitivity of expenditure data. Although gambling prevalence studies are typically conducted by phone or face to face, requiring interaction with an interviewer, online and written surveys allow more privacy and anonymity, which should contribute to greater accuracy (Williams & Wood, 2004).

Expenditure data recorded by online operators, or in venues via player cards, are exempt from human recall biases, but are not readily available to researchers because they require cooperation of the operator for access. Even if available, these data cannot be correlated with other information about bettors, such as problem gambling severity, and do not account for gambling expenditure through other operators or modes of access. Thus, many studies still rely on self-report data.

The preceding review highlights several ways to optimize the accuracy of gambling expenditure estimates. Careful wording should ensure that expenditure questions are as unambiguous as possible to avoid confusion between expenditure and turnover. More accurate data are obtained when the expenditure on each gambling activity is asked separately. The recall period should be as short as possible. A private and anonymous data collection method is needed to minimize social desirability bias. The current study aimed to incorporate these considerations into a design that potentially minimizes ambiguity (by asking about betting outlay rather than expenditure) and recall bias (through its ecological momentary assessment [EMA] design) in order to examine (a) demographic, psychological, behavioural, and

contextual characteristics of high-spending sports and race bettors and (b) the relationship between betting outlay and problem gambling severity.

Several studies based on risk curve analysis have demonstrated a relationship between problem gambling severity and gambling expenditure, both for absolute and for relative (percentage of income) expenditure (Currie et al., 2006, 2008a, 2008b, 2009, 2012; Dowling et al., 2018). From a nationally representative Canadian survey (N = 19,012), we used receiver operating characteristic analysis to develop low-risk gambling expenditure limits of CAD500–1,000 and 1% of family income per annum (Currie et al., 2006). Exceeding the absolute expenditure limit increased the risk of gambling harm by a factor of 13.8% and by 10.5% for the relative limit. Later analyses of Canadian provincial survey data also supported the strong relationship between different levels of gambling harm (on the basis of the Problem Gambling Severity Index [PGSI]; Ferris & Wynne, 2001) and absolute and relative gambling expenditure (Currie et al., 2008b, 2009, 2012). Similar analyses based on some state population surveys in Australia developed absolute limits of AUD380–615 and relative limits of .83%–1.63% of gross personal income per year (Dowling et al., 2018). Most relevant to the current study, these limits were identified as AUD400 and .55%–.86% for sports betting and a relative limit of .55% for race betting, although the absolute limit for race betting was unclear. Expenditure in all of these studies was captured through retrospective self-reports of aggregate spend that involved a lengthy recall period.

Factors associated with higher betting expenditure have received little research attention, and so there is insufficient theoretical support to date to formulate specific research hypotheses. Instead, the current research is considered exploratory. However, studies that examine predictors of higher problem gambling severity among bettors can inform the current study because betting expenditure is strongly related to problem gambling severity. A survey of 639 Australian sports bettors found higher PGSI scores among those who were young, male, single, educated, a full-time employee or student; who had greater sports betting frequency and expenditure and bet more impulsively; and who had more exposure to normative influences from media advertising and significant others (Hing, Russell, Vitartas, & Lamont, 2016). Focusing only on online gambling, Hing, Russell, and Browne (2017) identified similar risk factors for problem or moderate-risk gambling among both race bettors and sports bettors: being male, younger, speaking a language other than English, and more frequent betting. Additional risk factors were higher psychological distress for sports bettors and illicit drug use while gambling among race bettors. Also using retrospective self-reports, Russell, Hing, Li, and Vitartas (2019) found that gambling expenditure, number of betting accounts, number of different types of promotions used, and impulsiveness predicted at-risk and problem gambling among 1,813 sports bettors. These previous findings informed the range of variables included in the current study as potential predictors of betting expenditure. In turn, we conceptualized betting expenditure as a determinant of problem gambling severity, in line with the causal direction that underpins research into low-risk gambling limits (discussed earlier). Accordingly, the current study extends previous research that

examined risk factors for problem gambling severity among bettors (Hing et al., 2016, 2017; Russell, Hing, Browne, & Rawat, 2018) by also examining predictors of betting expenditure as a determinant of gambling problems.

Method

Respondents

The study's participants comprised 320 sports bettors and 402 race bettors. Both samples were mostly male (92.5% sports bettors, 88.1% race bettors), aged 18–84 years for sports bettors (M = 40.74, SD = 14.11) and 18–74 years for race bettors (M = 41.32, SD = 13.74). Among sports bettors, 29.4% met the criteria for non-problem gambling on the PGSI (Ferris & Wynne, 2001), 25.4% for low-risk gambling, 29.4% for moderate-risk gambling, and 15.9% for problem gambling. Among the race bettors, these figures were 25.9%, 29.7%, 31.3%, and 13.1%, respectively.

Recruitment and Inclusion Criteria

We sent email invitations to respondents who had previously participated in our research and had consented to being re-contacted; an Australian-licensed wagering operator also sent email invitations to regular bettors among their account holders. The operator took no further part in the study and could not access the data.

Inclusion criteria were as follows: aged 18 years or older, bet on sports or races at least fortnightly, lived in Australia, consented to participate, provided us with their contact details (for invitations to the EMA surveys, see below), and had an Internet-connected smartphone to complete the surveys. Respondents were compensated (via electronic shopping vouchers) with $10 for completing the baseline survey and up to $100 for completing the EMA surveys, depending on how many they completed. Response rates for each EMA varied from 50% to 76%. For each of the 15 EMA surveys, between 50% and 70% of respondents completed the survey. Approximately one-third completed all 15 EMAs, and the majority completed 10 or more EMAs. Approximately one-quarter of the sample did not complete any EMAs and were excluded. Respondents who were excluded did not differ from those who were included in terms of gender or PGSI (largest chi-square = 1.93, p = .586), and no difference was observed in age for sports bettors, although excluded race bettors were significantly younger than were those who were included, $F(1, 400) = 24.92$, $p < .001$. Race bettors and sports bettors were recruited in two separate waves, several months apart, so that the EMA surveys could be conducted during peak racing and sports betting seasons.

Procedure

Respondents initially completed a baseline survey, which commenced with an informed consent preamble. If respondents consented and were eligible, they were asked for their mobile phone number. Respondents were then sent invitations to

short online EMA surveys via text message. Five EMA surveys were administered each week (Monday, Wednesday, Friday, Saturday, Sunday) for three non-consecutive weeks during 2017. We opted for five surveys each week, rather than seven, to reduce participant burden.

The EMA approach is an intensive longitudinal research methodology in which respondents report on their cognitions, behaviours, and contexts related to a particular type of experience as it occurs, or shortly afterwards, on multiple occasions (Bolger & Laurenceau, 2013; Csikszentmihalyi, 2014). A major reason for using EMA is to minimize the recall bias that is apparent in more global, retrospective self-reports that require participants to report on past behaviour and experiences over long time periods (Shiffman, Stone, & Hufford, 2008). EMA methodologies are particularly suited to assessing discrete episodic behaviours and have therefore been used in studies of cigarette smoking (Shiffman et al., 2002), binge eating (Haedt-Matt & Keel, 2011), alcohol use (Hussong, Hicks, Levy, & Curran, 2001; Litt, Cooney, & Morse, 2000), drug use (Freedman, Lester, McNamara, Milby, & Schumacher, 2006; Hopper et al., 2006), and gambling (Russell et al., 2018). As discussed earlier, aggregate gambling expenditure captured though prospective methods has been found to accurately reflect actual industry revenues (Blaszczynski et al., 2008; Williams & Wood, 2004), and so data collection via EMA was considered appropriate for this study.

Measures

Baseline survey

Demographics. Demographic information included gender, main language spoken at home, highest educational level, work status (recoded into employed or unemployed), income, and disposable income (income and disposable income both measured in income brackets).

Problem gambling severity. Problem gambling severity was measured with the PGSI (Ferris & Wynne, 2001), which contains nine questions with response options from "never" (0) to "almost always" (3). Scores were summed and original cutoffs were used: 0 = non-problem gambler, 1–2 = low-risk gambler, 3–7 = moderate-risk gambler, 8–27 = problem gambler. Cronbach's alphas were .92 (sports bettors) and .93 (race bettors).

Impulsiveness. Impulsiveness was measured with the Barratt Impulsiveness Scale (Steinberg, Sharp, Stanford, & Tharp, 2013), an eight-item scale with response options from "rarely/never" (1) to "almost always/always" (4). Mean scores are computed. Cronbach's alphas were .83 (sports bettors) and .80 (race bettors).

Psychological distress. The Kessler 6 measure (Kessler et al., 2002) asks about symptoms of nervousness, hopelessness, restlessness, depression, worthlessness, and effort. Response options are "none of the time" (0) to "all of the time" (4) and scores are summed. Cronbach's alpha was .91 for both samples.

Alcohol misuse. The Alcohol Use Disorders Identification Test–Consumption (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) measures alcohol consumption, including identification of hazardous or harmful drinking, and alcohol dependence. The first question asked for the frequency of drinking alcohol in the past year on a scale from "never" (0) to "4 or more times a week" (4). Respondents who drank alcohol in the past year were then asked for the number of alcoholic drinks consumed on a "typical day" when drinking (scored as 0 for none to two drinks; up to 4 for 10 or more drinks). Lastly, drinkers were asked "How often do you have six or more drinks on one occasion?" for the past year on a scale from "never" (0) to "daily or almost daily" (4). Scores were summed for a raw score out of 12.

Betting behaviour variables. Respondents were asked the age at which they started betting on sports or races regularly and the number of betting accounts.

EMA surveys. Each EMA survey asked, "How much money did you place on [sports or race] bets in the [24 or 48] hours prior to 5pm today?" We opted to ask for the amount placed on bets instead of net expenditure for several reasons. Asking the amount placed is far less likely to be misinterpreted and much simpler to calculate. Placing each bet is a discrete activity, involving completion of a betting slip that identifies the amount placed. Compared to the calculations required for continuous forms of gambling, such as gaming machines, it is relatively easy to identify and keep track of financial outlay on betting that does not involve the potential confusion of considering both outlay and return in calculating net expenditure. Accordingly, asking the amount placed was expected to circumvent the estimation issues described in the vignette work by Blaszczynski et al. (2006), which asked about the amount spent. In addition, outlay was asked only for sports betting or race betting, thus optimizing accuracy over surveys that ask for aggregate expenditure over all gambling activities (Williams & Wood, 2004). By administering the EMA surveys on 5 days of each survey week, we aimed to minimize the length of the recall period, which has been found to reduce estimation bias (Auer & Griffiths, 2017; Braverman et al., 2014). The surveys were administered online, rather than in person, to allow for privacy and anonymity, which Williams and Wood (2004) found contributed to greater accuracy.

Because outlay does not take into account any wins, it does not equate to net expenditure. However, outlay does reflect the amount of money that the bettor is prepared to risk on each bet. This is particularly important from a harm minimization perspective because bettors may place numerous bets before any results are known and therefore make betting decisions without knowing whether these previous bets have won or lost. This distinction is reflected in bet limiting functions on operator websites that provide options for limiting financial outlay on bets, such as deposit limits, play limits, and bet limits (Wood & Griffiths, 2010). Financial outlay over these EMA surveys was summed to calculate a weekly amount because key predictors in the models were asked only in the Sunday surveys in order to keep the EMA surveys short. Those who missed one or more EMA surveys each week (6–15 respondents) were asked in the Sunday survey for their weekly outlay, and this was used for these respondents in the analyses.

Sunday survey. A survey administered each Sunday asked about financial outlay on betting for the past 24 or 48 hours, and several questions asked about the respondent's betting during the past week:

Gambling behaviour variables. These variables comprised the proportion of bets placed on impulse and via different modes (smartphone, computer or tablet, telephone call, or land-based venue) with responses summing to 100%.

Contextual variables. These variables comprised the proportion of bets placed when alone, with family/friends/colleagues, or with acquaintances (responses summing to 100%); how frequently the respondents were affected by alcohol and by drugs when betting ("never" to "almost always"); and the location where they placed most of their bets. Most respondents placed most of their bets at home, with other options (e.g., work/university/school, licensed venue) receiving few responses each. This variable was recoded into "home" versus "other."

Data Analysis

Because respondents completed multiple EMA surveys, repeatedly capturing betting outlay, we analysed weekly outlay by using linear mixed effects models (using lmer in the lme4 package in R), with an anonymous respondent identifier as a random factor. Because betting outlay was skewed, we took the natural logarithm of outlay (+1) for these analyses. All variables were scaled prior to analysis. We considered transforming outlay to be a proportion of income, but this would introduce imprecision because income was captured in brackets. We thus explored bivariate analyses that predicted (log) betting outlay with and without controlling for income. Controlling for income made no difference to the bivariate results in terms of statistical significance, nor did our treatment of income (either categorical or continuous). We therefore opted to report the more parsimonious bivariate analyses without controlling for income.

Significant variables from these bivariate analyses were then considered for inclusion in a multivariate model. Collinearity issues were observed for modes of access for race bettors, and we thus excluded those with the lowest coefficients. Income and disposable income did not display tolerance issues, but we removed income for parsimony. The PGSI score was initially considered as a predictor in these analyses, but because it was highly correlated with outlay, few other variables remained significant in multivariate models. We therefore removed PGSI as a potential predictor and further justify this exclusion because gambling problems and harms are generally considered to be a consequence of high betting outlay, rather than a cause (Browne et al., 2016; Currie et al., 2006, 2008a, 2008b, 2009, 2012; Dowling et al., 2018). The relationship between outlay and PGSI was still of interest, however, and so we also conducted regressions between (log +1) betting outlay and (log +1) PGSI score. For these analyses, betting outlay was summed across the 3 weeks and regular linear regression was used because the dependent variable (PGSI) was not a repeated

measure. Analyses were conducted separately for sports and race bettors. An alpha of .05 was used throughout.

Results

Factors Associated with Risking More Money on Betting

Table 1 shows bivariate and multivariate analyses that predict the amount risked on sports and race betting.

Sports bettors. The bivariate analyses showed that higher spending sports bettors were significantly more likely to be older, male, have a higher income and a higher disposable income, have started betting at a younger age, have more betting accounts, and be affected by alcohol when gambling. They were less likely to place bets via smartphone. The multivariate model showed similar results when we controlled for all other variables in the model. Only age was no longer significant.

Race bettors. The bivariate results for race bettors were similar to those for sports bettors. Higher spending race bettors were significantly more likely to be older, male, have a higher income and a higher disposable income, have started betting at a younger age, and have more betting accounts. Unlike the sports bettors, they were significantly less likely to bet on impulse, by smartphone, or in land-based venues, but more likely to bet via computer or tablet. The multivariate analyses indicated that higher spending race bettors were more likely to be male, have a higher disposable income, have more betting accounts, and bet via computer or tablet.

Given the high proportion of males in both samples (which reflects these populations), we explored the multivariate models without gender as a predictor. All significant predictors in the original models remained significant. Additional significant predictors were being older (sports bettors) and first betting at a younger age (race bettors).

Relationship between Amount Risked on Betting and Problem Gambling Severity

As explained earlier, we conceptualized problem gambling severity as a consequence of betting outlay. We considered this relationship in two ways. First, we predicted (log + 1) the PGSI score by betting outlay (total across the 3 weeks). For both samples, higher expenditure predicted higher PGSI scores: sports bettors, $F(1, 277) = 10.80$, $p = .001$, beta = .194; race bettors, $F(1. 329) = 17.88$, $p < .001$, beta = .227.

Median outlays over the 3 weeks were then computed for each PGSI group (Table 2). Because outliers were likely to dominate the results, we winsorized weekly values above $10,000 to just $10,000. We summed these winsorized amounts over the 3 weeks, and divided them by 3 to calculate a weekly average by PGSI group (Table 2). The problem gambling groups risked nearly 4 times more on sports betting and over 3 times more on race betting than did their non-problem gambling counterparts.

Table 1

Bivariate and Multivariate Linear Mixed-Effects Models Predicting (log +1) Weekly Betting Outlay (Standardized Coefficients)

		Sports bettors				Race bettors			
Independent variables		Bivariate		Multivariate		Bivariate		Multivariate	
Fixed effects									
Demographics	Age (in years)	0.204***	(0.055)	0.095	(0.049)	0.254***	(0.052)	0.050	(0.044)
	Gender (reference = male)	-0.184***	(0.056)	-0.104*	(0.045)	-0.267***	(0.050)	-0.122**	(0.044)
	Main language spoken at home (reference = other than English)	-0.030	(0.052)			0.040	(0.055)		
	Education	0.051	(0.058)			0.097	(0.051)		
	Work status (reference = unemployed)	-0.081	(0.054)			0.004	(0.052)		
	Income	0.111*	(0.055)	^		0.185***	(0.052)	^	
	Disposable income	0.218***	(0.054)	0.153***	(0.046)	0.311***	(0.048)	0.239***	(0.039)
Psychological and comorbidity	Impulsiveness (BIS Brief)	-0.061	(0.057)			-0.037	(0.052)		
	Psychological distress (Kessler 6)	0.057	(0.055)			-0.058	(0.051)		
	Alcohol misuse (AUDIT-C)	-0.001	(0.056)			-0.004	(0.052)		
Sports/race betting behaviour	Age when started betting	-0.151**	(0.056)	-0.116*	(0.047)	-0.201***	(0.050)	-0.068	(0.042)
	Number of accounts with different operators	0.242***	(0.055)	0.217***	(0.046)	0.388***	(0.044)	0.228***	(0.038)
	Percentage of bets placed on impulse	-0.013	(0.021)			-0.059*	(0.026)	-0.017	(0.025)
	Mode – smartphone @	-0.079**	(0.030)	-0.076*	(0.030)	-0.065*	(0.029)	^	
	Mode – computer or tablet	0.052	(0.030)			0.135***	(0.031)	0.086**	(0.031)
	Mode – telephone call	0.052	(0.028)			-0.003	(0.023)		
	Mode – land-based venue	0.023	(0.023)			-0.067**	(0.025)	^	
Contextual	Alone	0.016	(0.021)			0.006	(0.023)		
	With friends, family, colleagues	-0.017	(0.021)			-0.005	(0.023)		
	With acquaintances	0.001	(0.015)			-0.001	(0.022)		
	Betting when affected by alcohol	0.056**	(0.021)	0.055**	(0.021)	0.025	(0.024)		

Table 1 Continued.

Independent variables		Sports bettors				Race bettors			
		Bivariate		Multivariate		Bivariate		Multivariate	
	Betting when affected by drugs	0.039	(0.025)			0.009	(0.028)		
	Location for most bets (elsewhere vs. home)	-0.022	(0.018)			0.026	(0.021)		
Constant				0.116**	(0.045)			0.062	(0.040)
Random effect	ID (variance, intercept)			0.468				0.358	
Observations				630				732	
Log likelihood				-449.92				-598.90	
Akaike information criterion				919.847				1,217.795	
Bayesian information criterion				964.305				1,263.752	

Note. ^ indicates excluded because of multicollinearity issues. @ log taken for race betting multivariate only. All fixed effects variables scaled prior to analysis. BIS Brief = Barratt Impulsiveness Scale–Brief; AUDIT-C = Alcohol Use Disorders Identification Test–Consumption.
*$p < .05$. **$p < .01$. ***$p < .001$.

Table 2
Median Weekly Betting Outlay by PGSI Group for Sports and Race Bettors in AU$

	Regular sports bettors		Regular race bettors	
PGSI group	Median outlay	Ratio of NPGs	Median outlay	Ratio of NPGs
Non-problem gamblers	70.50	1.00	109.67	1.00
Low-risk gamblers	116.67	1.65	195.00	1.78
Moderate-risk gamblers	217.50	3.09	211.67	1.93
Problem gamblers	276.67	3.92	353.33	3.22

Note. Weekly values above $10,000 expenditure were winsorized to $10,000. Weekly expenditure was then summed over the 3 weeks and divided by 3 to calculate a weekly estimate. PGSI = Problem Gambling Severity Index; NPGs = non-problem gamblers.

Although the results are winsorized, the figures presented in Table 2 are median values and thus are not altered by this procedure.

Discussion

This study used a two-step process to analyse factors associated with greater financial outlay on betting and its relationship with problem gambling severity. A strength of the study was the use of spend data with high expected accuracy. We minimized recall bias by collecting betting outlay every 24 or 48 hours, as short recall periods are known to greatly enhance accuracy (Auer & Griffiths, 2017; Blaszczynski et al., 2008; Williams & Wood, 2004). We attempted to reduce social desirability bias by using a private medium (smartphone survey) to enhance anonymity, as participants recorded data without needing to engage with anyone else (Williams & Wood, 2004). Our surveys focused solely on sports or race betting, as more accurate expenditure is estimated when gambling activities are asked about individually (Wood & Williams, 2007). We greatly simplified the expenditure question by asking the amount placed on bets as a reflection of the money that bettors are prepared to risk.

Betting outlay strongly predicted the PGSI score, as expected from previous studies (Currie et al., 2006, 2008a, 2008b, 2009, 2012; Dowling et al., 2018). Sports bettors who were experiencing problem gambling spent 4 times more than their non-problem gambling counterparts did, and those at moderate risk spent three times more. Race bettors who were experiencing problem gambling spent 3 times more than the non-problem gambling race bettors did, and those at moderate risk spent twice as much. These results suggest that initiatives to help bettors moderate their spending should be a major focus of harm minimization efforts among the 41% of at-least monthly bettors in Australia who experience one or more gambling problems (Armstrong & Carroll, 2017a, 2017b). Responsible gambling efforts should not just aim to encourage informed consent (Blaszczynski, Ladouceur, & Shaffer, 2004), but should also aim for gambling to be controlled, affordable, and free from harm (Hing, Russell, & Hronis, 2018a). Financial losses are a major contributor to gambling harm and typically catalyse additional harms (Blaszczynski et al., 2017; Browne et al., 2016). Reducing gambling losses would therefore reduce gambling-related harms across

numerous domains, as well as in aggregate across the population of people who bet and affect others.

In this study, non-problem gamblers contained their median betting outlay to $23–$37 per week, compared with $92–$118 per week for those in the problem gambling group. These average financial outlays might inform limit-setting defaults and options in pre-commitment systems (which are typically based on outlay rather than net expenditure) and in operator systems to detect at-risk and problem gambling (Auer & Griffiths, 2013; Gainsbury, 2011; Griffiths, Wood, & Parke, 2009; PWC & Responsible Gambling Council, 2017). They could also inform consumer advice on appropriate self-limits for betting. Consumer education on moderating betting expenditure is best directed at those who bet online and includes bettors with higher disposable incomes. Bettors could also be warned against the consequences of commencing gambling at a young age, having accounts with multiple operators, and betting when affected by alcohol, with these behaviours also predicting higher betting outlay.

Banning the use of operator credit (now banned in Australia) and personal credit cards for betting are promising measures to help bettors limit their spend, given that both practices are linked to impaired control over betting expenditure that results in large financial losses. For example, Australian financial counselling agencies have revealed staggering losses and financial ruin that results from betting by using operator-provided credit (Financial Counselling Australia [FCA], 2015). This credit provision occurred in the absence of assessing the capacity to repay without experiencing financial hardship and was exempt from credit regulations because no interest is charged. In addition to prohibiting operator credit, the FCA (2015) recommended several measures for policy makers to consider to help prevent devastating financial losses from betting. These measures include requiring customers to set maximum bet amounts when opening betting accounts; banning advertising links between payday lenders and betting sites; requiring operators to regularly issue paper statements showing losses, wins, and totals; and a national self-exclusion register. The ability of customers to use their own credit cards for online betting has also been criticized for magnifying financial losses, as this again provides gamblers with the ability to gamble with money they do not have and to accumulate large debts (Department of Broadband, Communication and the Digital Economy, 2013). These reasons underpin the banning of credit betting in other forms of gambling. Financial institutions could also enable customers to exert more control by setting daily or weekly limits on debit and credit card payments to betting operators. Financial inducements to bet, such as bonus bets, stake-back offers, and cash-out early incentives, have also been found to increase betting expenditure (Hing et al., 2018b). Actual amounts placed increased from an average of $33 per day when no inducements were seen to $67–$78 when five or more types of inducements were seen. Tighter restrictions on financial inducements may therefore assist bettors to contain their betting expenditure.

Data linking betting expenditure to gambling problems further support a need for regulation to reduce gambling-related harm. Self-reported data from a nationally representative sample of at-least monthly Australian bettors indicate that 23% of

sports betting expenditure comes from the small number of bettors with severe problem gambling, 23% from those at moderate risk, and 15% from those at low risk (Armstrong & Carroll, 2017b). This represents over 60% of expenditure being derived from gamblers who are experiencing some level of gambling problems. These figures are 15%, 26%, and 19%, respectively, for race bettors (Armstrong & Carroll, 2017a), again totalling 60% of expenditure. Although with the current study we cannot independently confirm these figures, given the convenience sampling, we also found substantially elevated betting expenditure as problem gambling severity increased. This supports Armstrong and Carroll's findings (2017a, 2017b) that a large proportion of industry revenues and gambling taxes is derived from people who are experiencing gambling problems. This reliance on vulnerable gamblers undermines the stated industry and government commitment to responsible gambling, which aims to minimize gambling harm.

This study was limited to a convenience sample of at-least fortnightly bettors, with more involved gamblers more likely to either overestimate or underestimate their expenditure (Auer & Griffiths, 2017; Braverman et al., 2014). However, the short recall period arising from prospective measures recorded every 24 or 48 hours and the focus on financial outlay should have helped to minimize any bias, although these expenditure estimates could not be independently validated. The study also measured betting outlay, rather than net expenditure, for the reasons explained earlier. Whether the net expenditure of bettors who are experiencing problem gambling is also 3 to 4 times higher than that of non-problem gamblers cannot be ascertained from this study. The study was also limited by collecting betting spend over only 3 weeks. Although these weeks did not feature signature sporting or racing events (e.g., football grand finals), they may not be representative of all betting weeks. The burden on participants of completing regular surveys necessitated restricting the number of surveys, which we considered a reasonable trade-off for expecting more accurate financial data. As not all respondents completed all surveys, there are limitations in terms of the generalizability of the data; however, the analytical technique used somewhat reduces these concerns.

Conclusion

This study has confirmed the strong link between problem gambling severity and financial outlay on betting by using prospective spend data that should be more accurate than the retrospective data that most previous studies have used. This result suggests that regulatory and other initiatives that help bettors limit or reduce their financial outlay on betting should be central to harm minimization efforts. The study also identified specific characteristics of high-spending bettors, which can inform how these efforts are tailored and targeted. These bettors are more likely to bet online, have higher disposable incomes, have commenced betting at a younger age, have more betting accounts, and bet when affected by alcohol. Tackling gambling problems and harms among sports and race bettors is critical in Australia (and elsewhere), given that gambling help services report growing numbers of clients who present with betting-related problems (Hunt, 2017) and that nearly one-quarter of at-least monthly

sports bettors and race bettors experience moderate to severe gambling problems (Armstrong & Carroll, 2017a, 2017b).

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