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What proportion of gambling is problem gambling? Estimates from the 2010 British Gambling Prevalence Survey

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The paper reports secondary analysis of data from the 2010 British Gambling Prevalence Survey, a household survey of a representative sample of the population aged 16 years and over (N = 7756). Responses to questions about frequency of gambling and average monthly spend on each of 15 forms of gambling, and responses to two different problem gambling screens (DSM-IV and PGSI), were used to derive estimates, for each form of gambling separately, of the percentage of (1) all days play (two estimates), and (2) all spend (four estimates), attributable to problem gamblers. Although these estimates must be treated as approximations only, they demonstrate that problem gamblers make a far greater contribution to total gambling attendances and losses than problem gambling prevalence figures would suggest. There are certain forms of British gambling to which problem gamblers may be contributing as much as 20–30% of all days play and spend, and moderate risk gamblers a possible further 10–20%.

Keywords: United Kingdom; expenditure; economics; epidemiology; problem gambling

Introduction

To answer the question 'What proportion of gambling is problem gambling?' it is customary to ask a representative sample of the general population to answer a number of questions that constitute a screening instrument for the detection of problem gambling. To date, three British Gambling Prevalence Surveys (BGPSs), carried out in 1999/2000, 2006/07 and 2009/10, have used such an approach (Sproston, Erens, & Orford, 2000; Wardle et al., 2007; Wardle et al., 2011). In each of those surveys, two problem gambling screening instruments were employed. For the most recent 2010 survey, they comprised a 10-item scale based on the fourth edition of the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-IV: American Psychiatric Association, 1994) and the nine-item Canadian Problem Gambling Severity Index (PGSI: Ferris & Wynne, 2001). These produce estimates of the proportion of the adult population who are thought to have been above the threshold for problem gambling during the last 12 months.

Those prevalence estimates from the 2010 British Gambling Prevalence Survey (BGPS10) data were 0.9% (+/− 0.3) according to the DSM-IV scale and 0.7% (+/− 0.3) according to the PGSI (Wardle et al., 2011). These are arguably large figures in public health terms. They equate to around one-third to a half million adults in Britain and in

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magnitude they are similar to or greater than figures for other physical or mental health problems that are taken more seriously and for which it is expected that sufficient services of good quality are available in all areas of the country (e.g. addiction to opiate drugs). In percentage terms, the problem gambling prevalence estimates from BGPS10 are larger still if the roughly one-quarter of the population who report having engaged in no gambling at all in the previous 12 months are excluded (1.3% and 1.0% according to the DSM-IV and PGSI scales respectively).

However, those estimates constitute only one approach to estimating what proportion of gambling is problem gambling. For instance, the proportion of individuals in the general population who have recently experienced gambling problems is not necessarily the same as the proportion of the clientele of gambling establishments who have gambling problems. It is reasonable to assume that problem gamblers visit gambling establishments more frequently than non-problem gamblers and, therefore, that the proportion of customer attendances made by players who have gambling problems would be greater than the proportion of problem gamblers in the general population. For example, on the basis of her study of a representative sample of forty British casinos, Fisher (1996, 2000) estimated that of all those people who frequented British casinos at any time in a single year, around 7% had gambling problems, a figure more than 10 times higher than the 1999/2000 BGPS general population estimate of the prevalence of problem gambling among all adults. However, the figure was even higher if the fact that casino patrons with gambling problems visited casinos more frequently than casino clients without such problems was taken into account. Fisher estimated that at any one time, around 16% of patrons present in the casinos were likely to have gambling problems.

If the overall question posed in the present paper is interpreted to mean 'What proportion of operator takings are contributed by those with gambling problems?', then the answer is likely to be different again. If, as might be assumed, those customers with gambling problems, when they are present in a gambling establishment or when engaged in gambling, contribute disproportionately much to gambling operator takings, then the proportion of gambling which is problem gambling might appear to be even greater. This way of critically examining the question has been most thoroughly adopted in the report of the Australian Productivity Commission (APC, 2010). That report used data from seven different Australian state surveys carried out between 2003 and 2009, and used seven different methods of estimating the proportion of gambling spend contributed by those with gambling problems. This produced 12 independent estimates ranging from 26% to 54% with a median of 36%. These figures are the best estimates available and they indeed suggest that the proportion of gambling operator takings that come from problem gamblers can, in some circumstances, be very substantial – estimated to be perhaps of the order of one-third, and therefore significantly higher than the percentage of problem gamblers in the general population.

However, the Australian figures have a number of limitations. The first, which is particularly a limitation for those in other countries such as Britain, is the concentration of the Australian analysis on play on electronic gaming machines (EGMs) of the 'poker machine' type which are widespread in most Australian states and territories and which have caused great concern in Australia. Gambling opportunities in Britain are very diverse and it must be presumed that answers to the question posed here will vary considerably from one form of gambling to another. It might be supposed, for example, that problem gambling and problem gamblers would be more prominent in table game casino gambling than gambling on a bi-weekly lottery draw. The APC (2010) report cites supportive evidence from Canadian provincial surveys that estimated the proportion of gambling revenues derived from problem gamblers to lie between 19% and 33%, averaging 28% (Williams & Wood, 2004).

Further limitations of the Australian estimates relate to the assumptions that were necessary in order to arrive at estimates. None of the seven estimation methods was free of such assumptions. Several of the methods relied on respondents' answers to questions about losses (their biggest loss; the number of times they lost AU$50 or more last year; and loss within the last gambling session), or questions about EGM playing style (including numbers of lines, credits and sessions), with assumptions then required about how those answers translated into spend. The most direct method, possible in the case of one data set only, used players' own estimates of their spend, but the estimate asked for was that of annual spend, which, given limitations about recall accuracy, can only be very approximate. The main difficulty in estimating the proportion of takings attributed to problem gamblers lies in the notorious conceptual and measurement difficulties associated with estimating gambling 'spend' (Blaszczynski, Dumlao, & Lange, 1997; Blaszczynski, Ladouceur, Goulet, & Savard, 2006, 2008; Wardle et al., 2007). It cannot be assumed with any certainty that when respondents provide answers to questions about spending on gambling, they are providing accurate answers that can be interpreted as net spend (i.e. stakes minus winnings) which can be equated with operator takings.

The BGPS10 data provide the best opportunity to date, to attempt an answer for Britain to the question about the proportion of gambling that is problem gambling. For the first time in the earlier 2006/07 survey, respondents were asked to estimate, for each form of gambling separately, how frequently they had engaged in gambling in the 12 months prior to the survey. In the 2010 survey, for the first time, those engaging in a form of gambling at least monthly were asked in addition to estimate how much on average they spent on that form of gambling per month. Although a number of assumptions (to be described later) have to be made, these data enable rough estimates to be made, for 15 separate forms of gambling, of the proportion of gambling attendances, and operator takings, contributed by problem gamblers. Use of the PGSI also allows estimates to be made of proportions of attendances and takings attributable to those in the 'moderate risk' gambling category. The APC (2010) report produced estimates of spend between 7% and 26% (median 20%) attributable to moderate risk gamblers.

Method

The 2010 British Gambling Prevalence Survey (BGPS10)

BGPS10 was a survey of a nationally representative sample of people aged 16 years and over living in private households in England, Scotland and Wales, carried out for the Gambling Commission (the British gambling regulator) by the National Centre for Social Research (NatCen). The sampling frame was the small user Postcode Address File. Twenty-five addresses were randomly selected from each of 391 postcode sectors selected to be nationally representative in terms of region, socio-economic category and proportions of white/non-white ethnic groups. In total, 8791 residential addresses were selected. Each address was then visited by an experienced and fully briefed NatCen interviewer who attempted to gain a face-to-face interview with an adult at that address to collect information about the household. Such interviews were achieved at 4842 households (a response rate of 55.1%). Computer-assisted self-completion questionnaires were completed by 7756 (out of 9104) people residing within those households (an individual response rate of 85.2%). The overall response rate is therefore 46.9% which may be a conservative estimate since non-responding households are likely to contain fewer adults. The survey was entitled 'Leisure Time: Lottery and Recreation Study 2010'. The data were collected between November 2009 and June 2010.

The present analysis is based on responses to the following questions:

Frequency of engagement in each form of gambling in the last twelve months

This question was asked of each of the 15 forms of gambling shown in Tables 1–4 with the following eight response options: Everyday/almost every day; 4–5 days a week; 2–3 days a week; about once a week; 2–3 days a month; about once a month; 6–11 times a year; 1–5 times a year. A 16th form of gambling (spread betting) was also asked about, but results are not included here because of the small numbers of respondents who reported this type of gambling. The exact form of each question was designed to clarify the distinctions between the different forms of gambling. For example, the exact form of the question about poker was as follows: 'In the last twelve months, how often have you spent money playing poker in a pub tournament/league or at a club? Do not include: any poker played online, in a casino or privately with friends/family/others.'

Table 1. Prevalence of DSM problem gambling (PG) and percentage of days gambling and gambling spend attributable to DSM PGs, by type of gambling.

Type of gambling	% prevalence of DSM PG	% days play attributable to DSM PGs	% spend attributable to DSM PGs Estimate A % prevalence adjusted for greater spend by PGs	% spend attributable to DSM PGs Estimate B % days adjusted for spread of spend over days play
National Lottery (N = 4636)	1.3	1.97	1.78	1.65
Another lottery (N = 1987)	1.3	3.12	1.73	1.71
Scratch cards (N = 1882)	2.5	8.10	11.25	4.56
Football pools (N = 315)	7.5	9.78	4.43	8.51
Bingo[a] (N = 697)	2.9	3.88	2.55	3.57
Slot machines (N = 943)	4.0	16.15	18.30	9.00
FOBTs (N = 290)	8.8	24.70	27.28	21.60
Horse races[b] (N = 1234)	2.9	14.10	9.16	7.42
Dog races[b] (N = 318)	7.1	24.53	40.75	16.31
Sports betting[b] (N = 594)	4.4	15.47	11.34	9.25
Betting on non-sporting events[b] (N = 309)	7.8	15.93	13.42	10.46
Casino games[c] (N = 366)	6.8	32.90	10.47	11.40
Poker (N = 136)	12.8	24.24	10.29	19.24
Online slot machine style games (N = 198)	9.1	20.05	11.19	13.03
Private betting (N = 816)	3.1	15.03	5.89	4.80

Ns are unweighted numbers

(a) Includes bingo played at a club or online (the prevalence of playing bingo online was less than 1%).

(b) Includes bets made online, by telephone, or in person, with a bookmaker or a betting exchange.

(c) Includes casino games (such as roulette, poker, blackjack) played in a casino or online (prevalence rates of playing casino games online in the last year was 3% overall).

Table 2. Prevalence of PGSI problem gambling (PG) and percentage of days gambling and gambling spend attributable to PGSI PGs, by type of gambling.

Type of gambling	% prevalence of PGSI PG	% days play attributable to PGSI PGs	% spend attributable to PGSI PGs Estimate A % prevalence adjusted for greater spend by PGs	% spend attributable to PGSI PGs Estimate B % days adjusted for spread of spend over days play
National Lottery (N = 4636)	0.92	1.49	1.39	1.21
Another lottery (N = 1987)	1.18	2.41	1.50	1.43
Scratch cards (N = 1882)	1.74	5.45	7.20	3.29
Football pools (N = 315)	4.36	5.83	3.44	5.24
Bingo[a] (N = 697)	2.06	5.86	6.55	3.91
Slot machines (N = 943)	3.43	11.82	13.65	6.93
FOBTs (N = 290)	9.31	26.62	20.85	21.93
Horse races[b] (N = 1234)	2.23	9.50	6.31	5.25
Dog races[b] (N = 318)	6.09	19.86	36.36	15.45
Sports betting[b] (N = 594)	4.75	14.10	10.55	9.67
Betting on non-sporting events[b] (N = 309)	7.12	12.19	13.29	8.72
Casino games[c] (N = 366)	5.57	29.52	12.76	9.48
Poker (N = 136)	5.81	11.81	5.69	9.34
Online slot machine style games (N = 198)	7.31	14.06	11.11	10.36
Private betting (N = 816)	3.38	10.07	4.66	4.89

Ns are unweighted numbers
(a) Includes bingo played at a club or online (the prevalence of playing bingo online was less than 1%).
(b) Includes bets made online, by telephone, or in person, with a bookmaker or a betting exchange.
(c) Includes casino games (such as roulette, poker, blackjack) played in a casino or online (prevalence rates of playing casino games online in the last year was 3% overall).

Amount of money usually spent in a month

This question was asked separately for each of the 15 forms of gambling. In each case, the question was only asked of those respondents who had indicated that they had engaged in that form of gambling at least once a month in the last year. The question about betting on dog races, for example, was as follows: 'In a month, how much money do you usually spend betting on dog races? Include: money spent online with a betting exchange or with a bookmaker.' For 10

Table 3. Best estimates of percentage of days gambling and of gambling spend attributable to problem gamblers, by type of gambling.

Type of gambling	% days play attributable to PGs (average of 2 estimates)	% spend attributable to PGs (average of 4 estimates)
National Lottery (N = 4636)	1.73	1.51
Another lottery (N = 1987)	2.77	1.59
Scratch cards (N = 1882)	6.78	6.58
Football pools (N = 315)	7.81	5.41
Bingo[a] (N = 697)	4.87	4.15
Slot machines (N = 943)	13.99	11.97
FOBTs (N = 290)	25.66	22.92
Horse races[b] (N = 1234)	11.80	7.04
Dog races[b] (N = 318)	22.20	27.22
Sports betting[b] (N = 594)	14.79	10.20
Betting on non-sporting events[b] (N = 309)	14.06	11.47
Casino games[c] (N = 366)	31.21	11.03
Poker (N = 136)	18.03	11.14
Online slot machine style games (N = 198)	17.06	11.42
Private betting (N = 816)	12.55	5.06

Ns are unweighted numbers
(a) Includes bingo played at a club or online (the prevalence of playing bingo online was less than 1%).
(b) Includes bets made online, by telephone, or in person, with a bookmaker or a betting exchange.
(c) Includes casino games (such as roulette, poker, blackjack) played in a casino or online (prevalence rates of playing casino games online in the last year was 3% overall).

of the 15 forms of gambling, the following seven response options were provided: £1–£10; £11–£30; £31–£50; £51–£100; £101–£200; £201–£500; £501 or more. The exceptions were fixed odds betting terminals (FOBTs), horse races, sports betting, casino games, and poker, for which the following eight options were provided: Less than £10; £10–£50; £51–£100; £101–£200; £201–£300; £301–£500; £501–£1,000; £1001 or more.

DSM-IV-based problem gambling scale

The 10-item scale used in BGPS10 and the two previous BGPSs (Sproston et al, 2000; Wardle et al, 2007). Items asked about 'the last 12 months'. Each item represents one of the 10 DSM-IV diagnostic criteria. Meeting three or more of the criteria was required for categorization of a respondent as a problem gambler.

PGSI problem gambling scale

The nine-item Problem Gambling Severity Index (Ferris & Wynne, 2001) used in BGPS10 and in the earlier 2006/07 BGPS (Wardle et al., 2007). Items ask about 'the past 12 months'. Response options are: Almost always; Most of the time; Some of the time; Never (scored 3, 2, 1, 0 respectively). Scores are summed across all items and scores of 8 or more are required for categorization of a respondent as a problem gambler. Scores of 3 to 7 result in categorization as a 'moderate risk' gambler, a group thought to be at elevated risk of experiencing adverse consequences from their gambling (Ferris & Wynne, 2001; Wardle et al., 2011).

The psychometric properties of both problem gambling scales, as used in the 2006/07 BGPS, have been reported previously (see Orford, Wardle, Griffiths, Sproston, & Erens, 2010).

Table 4. Prevalence of PGSI problem & moderate risk gambling (PG & MR) and percentage of days gambling and gambling spend attributable to PGSI PGs & MRs, by type of gambling.

Type of gambling	% prevalence of PGSI PG& MR	% days play attributable to PGSI PGs & MRs	% spend attributable to PGSI PGs & MRs Estimate A % prevalence adjusted for greater spend by PGSI PGs & MRs	% spend attributable to PGSI PGs & MRs Estimate B % days adjusted for spread of spend over days play
National Lottery (N = 4636)	3.30	12.88	5.35	11.92
Another lottery (N = 1987)	3.86	6.36	6.37	4.50
Scratch cards (N = 1882)	5.86	14.53	15.76	9.51
Football pools (N = 315)	12.79	15.96	18.29	14.78
Bingo[a] (N = 697)	6.05	10.66	9.80	8.53
Slot machines (N = 943)	10.08	27.17	34.07	17.31
FOBTs (N = 290)	23.12	38.80	43.00	34.79
Horse races[b] (N = 1234)	6.28	22.46	17.52	12.88
Dog races[b] (N = 318)	14.78	38.99	55.72	25.23
Sports betting[b] (N = 594)	12.76	26.55	25.78	20.34
Betting on non-sporting events[b] (N = 309)	17.03	23.48	34.91	20.06
Casino games[c] (N = 366)	15.98	42.29	24.29	21.42
Poker (N = 136)	20.00	30.33	11.00	25.62
Online slot machine style games (N = 198)	21.00	29.82	30.45	23.31
Private betting (N = 816)	9.01	19.80	13.06	12.06

Ns are unweighted numbers
(a) Includes bingo played at a club or online (the prevalence of playing bingo online was less than 1%).
(b) Includes bets made online, by telephone, or in person, with a bookmaker or a betting exchange.
(c) Includes casino games (such as roulette, poker, blackjack) played in a casino or online (prevalence rates of playing casino games online in the last year was 3% overall).

Analysis

The aim of the analysis was to arrive at an estimate, for each form of gambling separately, of the contribution problem gamblers (and moderate risk gamblers) make to: (1) the total number of attendances or occasions of play by all players (or, to be more exact, the total number of days play); and (2) the total amount spent by all players. Three sets of estimates were calculated: days and spend attributable to DSM-IV scale problem gamblers; those attributable

to PGSI problem gamblers; and those attributable to PGSI problem gamblers plus moderate risk gamblers. In each case, a single estimate of the attributable percentage of days play, and two separate estimates of the attributable percentage of spend, were calculated, as follows:

1. Estimate of the percentage of all days play attributable to problem (and moderate risk) gamblers

This involved first converting the eight responses to the frequency question to approximate numbers of days play in 12 months by applying the multipliers 312, 234, 130, 52, 30, 12, 8.5 and 3 and then calculating the total days play by problem gamblers as a percentage of days play by all players. The calculation is straightforward. For example, in the case of sports betting, 16 respondents indicated that they bet every day or almost every day, with four respondents defined as problem gamblers on the DSM scale. Using the multiplier 312, this equated to 1248 days of play per year for DSM problem gamblers out of a total 4,992 days. Seventy-seven sports bettors reported betting about once a month, with three respondents defined as problem gamblers on the DSM scale, which, using the multiplier 12, equated to 36 out of 924 days attributable to problem gamblers. Summing across all eight frequency response categories resulted in a total of 3,997 days per year for DSM problem gamblers out of a total of 25,838, producing an estimated percentage of days attributable to DSM problem gamblers of 15.5%.

2A. Estimate of the percentage of all spend attributable to problem (and moderate risk) gamblers, by adjusting the prevalence of problem (and moderate risk) gambling for the differential spend of problem (and moderate risk) gamblers and others (estimate A)

Figures for the problem (and moderate risk) gambling prevalence for each form of gambling separately have been reported previously (Wardle et al., 2011). For example, 4.4% of all respondents who reported betting on sports events in the 12 months prior to the survey scored above the threshold for problem gambling on the DSM scale. These prevalence figures were used as the basis for arriving at the first estimate of spend attributable to problem gamblers. To arrive at those estimates, the prevalence figures were adjusted (mostly upwards) to allow for the fact that those scoring as problem gamblers reported a different average monthly spend (mostly more) than others. These calculations were relatively straightforward. For example, in the case of sports betting, the eight spend response options were assigned the values £5, £30, £75, £150, £250, £400, £750, and £1,000, and the average monthly spend of problem gamblers and non-problem gamblers was calculated. The average monthly spend on sports betting of 30 DSM scale problem gamblers was found to be just under £93 and that of non-problem gamblers £36. The ratio of these two figures, 2.58, was therefore used as the multiplier to convert the DSM sports betting problem gambling prevalence of 4.4% into an estimated attributable spend of 11.3%.

2B. Estimate of the percentage of all spend attributable to problem (and moderate risk) gamblers, by adjusting (downwards) the figures for attributable percentage days play, to allow for the possibility that those who play most frequently spend on average less per day (estimate B)

This calculation was less straightforward. The data showed that, in the case of all forms of gambling, those who indicated gambling most frequently, which usually included a disproportionately large number of problem gamblers, made estimates of monthly spend

suggesting that they spread their spend over a larger number of occasions than did those who gambled less frequently. For example, in the case of sports betting, the 16 respondents who reported betting everyday/almost every day, reported spending an average of just over £43 per month, which, divided by 26 (the six frequency response options of once a month or more were equated to 26, 19, 11, 4, 2.5 and 1 days per month), suggested an average spend per person, per day of £1.66. The 77 sports betters who indicated betting about once a month, reported an average monthly spend of £20.39, equating to £20.39 per day, or more than 12 times the estimated daily spend of the most frequent betters. Similar gradients existed for all forms of gambling although for sports betting it was one of the steepest. The next step in arriving at these estimates was to weight the figures for percentage of all days attributable to problems gamblers in each frequency category by the average daily spend for that frequency category. For example, in the case of sports bettors who reported betting everyday/almost every day, the proportion of days attributable to DSM scale problem gamblers (1248/4992 – see above) was therefore multiplied by £1.66 to estimate the contribution of the most frequent DSM problem gamblers to total spend. Similarly, for those reporting betting about once a month, the attributable proportion of days (36/924 – see above) was multiplied by £20.39. (A complication was that there was no estimate of spend for those gambling less than once a month. The assumption was therefore made that the same gradient would continue, such that the least frequent gamblers (less than once a month) would spend on average the most per day of gambling. For example, in the case of sports betting, figures of £25 and £30 per betting day were assigned, respectively, to those reporting sports betting 6–11 times a year and 1–5 times a year). Summing these products across the eight frequency categories produced the figures £19,343/£209,180, equivalent to an estimate of attributable spend of 9.3%.

Results

Estimates of the percentage of all days play on different gambling activities attributable to problem gamblers

The second column of figures in Table 1 displays these estimates using the DSM-based scale as the measure of problem gambling, and the equivalent figures in Table 2 show the estimates using the PGSI. Those two sets of estimates have been averaged to produce a set of best estimates of percentage of days play attributable to problem gamblers, shown in the first column of figures in Table 3. These estimates fall roughly into four groups. First, there are three forms of gambling where the estimate of days play attributable to problem gambling exceeds 20%: casino games (31%), FOBTs (26%) and dog races (22%). There then follows a group comprised of seven forms of gambling for which these estimates lie between 12% and 18%: poker, online slot machine style games, sports betting, betting on non-sporting events, slot machines, private betting, and horse races. The third group, that includes football pools, scratchcards, and bingo, is associated with estimates between 5% and 8%. Finally, estimates for other lotteries and the National Lottery are 2% to 3%.

These estimates are dependent on two factors. The first is the relative concentration of problem gamblers amongst participants in a particular form of gambling (the prevalence of problem gambling for that form of gambling). It can be seen by comparing these estimates with the problem gambling prevalence figures (previously reported by Wardle et al., 2011 and reproduced here in the first columns of figures in Tables 1 and 2), that the rank order of the different forms of gambling is quite similar. For example, the National Lottery has the lowest rank for both prevalence of problem gambling and for percentage of all days play attributable to problem gamblers, while FOBTs have one of the highest ranks for both.

The rank order correlation is not perfect however (0.78 for DSM data, 0.88 for PGSI data). This is a reflection of the operation of the second factor on which estimates of attributable days are dependent: the differential frequency of engagement in a form of gambling by problem and non-problem gamblers. Frequency of engagement was greater for problem than non-problem gamblers in the case of each of the 15 separate forms of gambling. Hence the figures for attributable percentage of days play are greater in all cases than the equivalent percentage prevalence figures. For example, Table 2 shows that, whereas the prevalence of PGSI problem gambling amongst sport betters is 4.8%, the percentage of daily attendances for sports betting attributable to DSM problem gamblers is 14.1%, a multiplier of nearly three. The multipliers for most forms of gambling are in the region of 2–4. However, some multipliers are smaller than 2 and others greater than 4, which accounts for the lack of a perfect rank order correlation between prevalence and attributable percentage days play.

Football pools are one of the clearest examples of a low multiplier. For example, Table 1 shows that the prevalence of DSM scale problem gambling amongst football pools betters is 7.5% and the attributable percentage of days play is not much higher at 9.8%, due to the fact that the majority of football pools bettors, both problem and non-problem gamblers, bet once a week. The clearest example of a relatively large multiplier is that of casino games. Table 2 shows the prevalence of PGSI problem gambling amongst casino games players to be 5.6% (only the sixth highest prevalence amongst the 15 forms of gambling), whereas the estimate of attributable percentage of days is as much as 29.5%. That is due to the fact that just over 50% of problem gamblers who played casino games reported doing so more than once a week whereas the majority of non-problem gambling casino games players reported gambling less than six times a year.

Estimates of the percentage of all spend on different gambling activities attributable to problem gamblers

Four separate estimates of the percentage of all spend attributable to problem gamblers were calculated: two using the DSM scale for assessing problem gambling (shown in the last two columns of Table 1) and two using the PGSI (last two columns of Table 2). The four estimates have been averaged to produce the best estimates shown in the final column of figures in Table 3. Two forms of gambling, betting on dog races and FOBTs, stand out amongst those best estimates, with estimated percentages of spend attributable to problem gamblers which are considerably greater than the estimates for all other forms of gambling (dog races 27%; FOBTs 23%). There then follows a group of six forms of gambling for which the best estimate is between 10% and 12% (slot machines, betting on non-sporting events, online slot machine style games, poker, casino games, and sports betting). Lying between 4% and 7% are estimates for a further five forms of gambling: betting on horse races, scratchcards, football pools, private betting, and bingo. Finally, estimates for the National Lottery and other lotteries are both between 1% and 2%.

As was the case for estimates of the percentage of days play attributable to problem gamblers, the rank order of forms of gambling in terms of estimates of percent of spend attributable to problem gamblers is similar to, but not identical with, the ordering according to the prevalence of problem gambling associated with each activity (rank order correlation with DSM prevalence = 0.73; with PGSI prevalence = 0.85). The most notable discrepancies are betting on dog races which achieves the highest value for estimated attributable percentage spend but only the sixth and fourth ranks for prevalence according to the DSM-based scale and PGSI respectively; and slot machine playing which

achieves the third rank for percentage of attributable spend but only the ninth rank for prevalence (both DSM and PGSI). Further inspection of the figures in Tables 1 and 2 shows that this effect is due to relatively high estimates of attributable percentage of spend based on weighting the prevalence figures according to the differential reported spend of problem gamblers and non-problem gamblers (the first estimates [estimates A], shown in the penultimate columns of Tables 1 and 2). For each of those two forms of gambling, problem gamblers reported spending four or five times as much per month as non-problem gamblers (slot machines) or six times as much (betting on dog races). In the other direction, estimates of attributable percentage spend are relatively low for football pools compared to prevalence. Although problem gamblers are relatively more likely to engage in football pools gambling than they are to engage in, for example, horse race betting, they report spending no more in a month on the football pools (in fact slightly less) than do non-problem gamblers.

Estimates of the percentage of all days play and all spend attributable to PGSI problem and moderate risk gamblers combined

Estimates using the PGSI and a score on that scale of 3 and above in order to include both problem gamblers (scores of 8 and above) and moderate risk gamblers (scores of 3 to 7) are shown in Table 4. Again rank orders of forms of gambling in terms of percent of days play and percent of spend attributable to problem and moderate risk gamblers are similar to one another and similar to the order in terms of prevalence of problem gambling and moderate risk gambling combined (attributable percentage days play = 0.82; attributable percentage spend = 0.83). The sizes of these estimates are of course higher than those shown in Tables 1–3 because those in Table 4 are based on a much larger group of gamblers (both problem and moderate risk gamblers as opposed to problem gamblers alone). Estimates of percentage attributable days play vary from around 6% (other lotteries) to 40% (casino games, dog races, and FOBTs). Playing casino games again stands out as being the form of gambling with the highest estimated percentage attributable days play (42%) but a lower figure (average of estimates A & B, 23%) and a much lower rank order (seventh) for percentage attributable spend. This is because, unlike some other forms of gambling such as betting on non-sporting events that shows the opposite pattern, problem and moderate risk gamblers reported attending casinos relatively frequently but spending only moderately more highly compared to other gamblers (an average of £120 per month versus just under £80), thus producing a relatively lower estimate A for attributable spend; and high frequency casino attendees (more than once a week) reported spending a similar amount per month as low frequency attendees (about once a month), thus producing a relatively low estimate B.

Discussion

This is the first time, to the authors' knowledge, that an attempt has been made, using British data, to estimate the proportion of gambling that involves gamblers who have gambling problems. Although the data and the analysis for this paper have a number of limitations (see below), the present analysis has a number of clearly evident strengths. More specifically, two separate definitions of the proportion of gambling associated with problem gambling were employed: the proportion of gambling days attributable to problem gamblers; and the proportion of spend attributable to problem gamblers. Two alternative ways of calculating the attributable proportion according to the second of those definitions were employed and the results have been shown separately and

combined. All analyses were carried out twice, once using the DSM-IV-based scale to categorize gamblers as problem or non-problem gamblers, and once using the alternative PGSI method. In addition, the PGSI enabled a further set of analyses to be carried out which included 'moderate risk' gamblers. Finally, all analyses were carried out separately for 15 different forms of gambling. In a number of these respects the present analysis represents an advance on the most comprehensive previous attempt to estimate what proportion of a nation's gambling might be problem gambling, carried out in Australia by the Australian Productivity Commission (APC, 2010).

As expected, estimates of the proportion of gambling attributable to problem gamblers varied greatly by type of gambling, from a low of 1–2% for the National Lottery and other lotteries to 20–30% for FOBTs and dog races. Estimates of attributable spend were consistently somewhat lower than estimates of attributable days play (although dog races was an exception). The lower figures for spend appear to be due to frequency of play being a stronger differentiator of problem and non-problem gamblers than was reported monthly spend (which affects the first estimate of attributable spend) and the consistent trend in the data for the most frequent players to spread their spending over a larger number of days than was the case for less frequent players, hence spending less per gambling day (which affected the second estimate of spend). The most notable discrepancy between estimates of days and spend attributable to problem gamblers was for casino games. Although problem gamblers who played casino games were much more likely than others to play them very frequently, neither they nor frequent casino games players as a whole reported spending a great deal more than others. This might be because occasional casino games players are those who spend most when they do play and/or because frequent players experience a less unfavourable balance of losses over wins when they play.

When estimates are made of the days and spend attributable to problem and moderate risk gambling combined, using the PGSI scale (which theoretically assumes that gambling and problem gambling lie on a continuum), then estimates are necessarily greater, varying from a low of 5–6% for other lotteries to around 40% for dog races and FOBTs. Again casino games stands out as a form of gambling with an estimate of attributable days of the same order as dog races and FOBTs but with a substantially lower level of attributable spend. Poker showed a similar pattern but to a lesser degree.

Although our estimates are lower than those reported by the APC (2010) for the kinds of gambling machines to be found in most Australian states, some of the present figures are very substantial. They suggest that, with the exception of the National Lottery, other lotteries, scratchcards, football pools, bingo and possibly private betting, problem gamblers account for at least 10–15% of all other types of gambling, with estimates rising to between 20–30% for certain forms of gambling. If moderate risk gamblers are included in the calculations, those figures are increased to 15–30%, rising to around 40% for some forms of gambling. These figures provide a different perspective on the question posed in this paper. Simple prevalence figures such as those reported in the BGPS10 (Wardle et al., 2011) under-estimate the contribution that problem gambling makes to the gambling environment and to gambling takings. Whereas the proportion of the whole adult population categorized as problem gamblers in BGPS10 was 0.7% or 0.9% (according to the PGSI and DSM-based scales respectively), or 1.0% or 1.3% as a proportion of all those who gambled in the last year, the present results suggest that problem gambling is a much more prominent influence in the day-to-day conduct of most forms of British gambling. On any given day, the analysis presented here suggests substantial proportions of those engaged in gambling have gambling problems and substantial proportions of takings are likely to come from problem gamblers. For example, using gambling industry statistics

available from the Gambling Commission (2008/09), gross profits from gambling machines in arcades approach half a billion pounds annually, so if, as our figures suggest, the percent of spend on machines which is attributable to problem gamblers is in excess of 10%, then problem gamblers are contributing in the region of £50 m a year to profits from that one form of gambling alone.

Some forms of gambling are more popular than others and some more costly than others. To obtain a complete picture of the contribution that different forms of gambling in Britain make to all takings from problem gamblers, it would therefore be necessary to take into account two further parameters: the relative popularity of different forms of gambling in the population; and the average amounts spent by the public on different forms. A rough calculation can be made if it can be assumed that BGPS10 reports of monthly spend by those gambling at least once a month provide a reasonably good indication of the relative amounts of money spent by all gamblers. Weighting the best estimates of percentage spend attributable to problem gamblers, shown in Table 3, by frequency of engagement and by average monthly spend produces a division of the 15 forms of gambling into two groups. Six forms of gambling are each likely to be contributing between 10% and 20% of the total spend on British gambling which represents losses made by problem gamblers: betting on horse races (a popular, high spend form of gambling), playing table games in a casino (less popular but high losses), FOBTs (high losses, especially by problem gamblers), betting on sports events (quite popular, quite high losses), betting on dog races (losses especially high for problem gamblers), and slot machines (quite popular, moderately high losses by problem gamblers). The remaining nine forms of gambling each appear to contribute between 1% (other lotteries) and 4% (football pools) to the total of all problem gamblers' losses.

There are, of course, a number of limitations of the present data and analysis. First, all the estimates made must be considered gross approximations due to the nature of the data collected. They rely on self-report responses given to questions about frequency of engagement, and amount spent per month, on different forms of gambling. Questions about spend are particularly problematic, requiring as they do an assumption that the respondent has understood that by 'spend' is meant stakes minus winnings, and then the making of a rough calculation of net spend (Blaszczynski et al., 1997; Wardle et al., 2007). There is evidence that many people, asked to calculate how much a fictitious player has 'spent' gambling, use a turnover rather than a net expenditure strategy, with the result that the estimate of spend is higher (Blaszczynski et al., 2006). The same is true when people report on their own gambling spend, but this factor which acts to inflate estimates of spend may be offset to some extent, when, as in the present study, people are asked to summarize spending over a period of a month, in which case there is a tendency to under-report spend compared to that reported in a daily diary (Blaszczynski et al., 2008). In addition to these uncertainties about answers to questions about spend, estimates are likely to be very sensitive to the answers about frequency and spend provided by relatively small numbers of problem gamblers. The absence of spend data for those engaging in a form of gambling less than once a month was a further limitation. Here, average spend figures for less frequent gamblers had to be imputed on the basis of the pattern of spend data for the more regular gamblers. An additional limitation was the need to rely, for a measure of the commitment of time to gambling, on estimates of 'days play' rather than a possibly more sensitive measure of actual time spent (e.g. hours of play).

Despite these limitations, the authors believe the present results are important as a first ever estimate of gambling occasions and losses attributable to problem gamblers in Britain. In the BGPS10, summary questions about gambling frequency and spend over a year or a

month were assumed to produce answers which had validity in sorting respondents roughly into those with lesser or greater time and financial involvement in gambling. It was not expected that such questions would produce highly accurate estimates (Wardle et al., 2011). Although there must therefore be uncertainty about the accuracy of the precise estimates produced, it is probable that the general picture of the results is valid in two important respects: firstly, the demonstration that percentage days and spend attributable to problem gambling far exceed the basic prevalence figures previously reported, and secondly, the relatively much higher percentages for certain forms of gambling compared to others. The variation in estimates of attributable days and spend produced by the different methods used here (DSM scale versus PGSI; estimates A versus B of attributable spend) serve as some indication of the sensitivity of the results to different methods of calculation.

Particularly in the case of percentage attributable spend, we have been cautious in our estimates which for a number of reasons are likely to be underestimates. It is likely that most people underestimate their gambling losses (Griffiths, 1994) and it is possible that this bias may particularly be the case for problem gamblers. It was surprising to discover, for all forms of gambling, a negative gradient for spend per day by days gambling per month which seems to indicate a relatively strong trend (stronger for some forms of gambling than others), for those who gambled more often to gamble less per gambling day. Although there may be good reasons for this, we are inclined to believe that this is partly an artefact due to a greater underestimate of losses on the part of the most frequent gamblers. If that assumption is correct, then the second estimates of attributable spend (estimates B) are likely to be underestimates for that reason.

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