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Managerial and Decision Economics, Vol. 22, No. 1/3, Management and Information Issues for Industries with Externalities: The Case of Casino Gambling. (Jan. - May, 2001), pp. 77-96.

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Assessing Self-Reported Expenditures on Gambling

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Estimates of the proportion of gambling revenues derived from problem gamblers represent an important element in the rational calculus of public gambling policy. However, a critical concern in calculating such estimates is the accuracy of self-reported expenditure data. In this paper, we review an emerging literature on estimating the proportion of expenditures from problem gamblers for different types of gambling, with a focus on the relationship between self-reported estimates and known spending. We then examine recent national survey data pertaining to this matter. After detailing several of the challenges in the effort to assess self-reported expenditures on different types of gambling, we recommend some methodological improvements that can be made in response to these problems. Copyright © 2001 John Wiley & Sons, Ltd.

INTRODUCTION

Longstanding ambivalence characterizes the history of gambling in the United States, as successive waves of leniency alternate with severe repression (Rose, 1986). Since the beginning of the latest wave of gambling legalization in the United States in the 1970s, annual consumer spending on commercial gambling in the United States has grown from \$3 billion to \$54 billion (Kallick *et al.*, 1976; Christiansen, 1999a). Americans now spend more on legal gambling than they spend altogether on movie tickets, spectator sports, cruise ships, recorded music and theme parks on an annual basis. Gambling businesses, including lotteries, casinos and racetracks, paid about \$18.5 billion in privilege taxes in 1997 in addition to income, real estate and other business taxes (Christiansen, 1999a,b). Compared with the revenues from legalized gambling, less than \$22

million (0.12% or twelve-tenths of 1%) was spent in 1997–1998 by state governments, the gambling industries, and other concerned organizations to address the externalities associated with these activities (National Council on Problem Gambling, 1999).

Estimates of the proportion of gambling revenue (and, by extension, tax revenue) derived from expenditures by problem gamblers represent one important factor in the rational calculus of public gambling policy. This information is needed to ascertain the consumer surplus of different types of gambling for problem gamblers. This information is also useful as evidence on which to base ameliorative efforts by gaming operators and state governments. As with tobacco, alcohol and guns, the measurement of distinctive externalities due to gambling has led to growing concern with balancing the benefits gained by consumers against the costs. However, in the case of an addictive good like alcohol or gambling, it is often difficult to calculate the consumer surplus since the decisions made by individuals with

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alcohol- or gambling-related problems may not always be based on rational grounds. While the consumer surplus generated by the gambling industries is large, there is no assurance that the assumptions of rational choice will yield appropriate conclusions about the balance of benefits and costs.

In recent years, several different approaches have been developed for estimating the proportion of gambling revenues derived from problem gamblers. One missing element, common to all but a few of these studies, is an assessment of the accuracy of self-reported expenditure data from surveys compared with alternative sources of information, such as financial records of gaming operators. The importance of such comparisons cannot be over-stated. Survey research is costly and, in our view, unless such comparisons are made, the effort to elucidate the question of the proportion of gambling revenues derived from problem gamblers is incomplete.

The goal of this paper is to detail several factors that affect assessments of the proportion of gambling expenditures coming from problem gamblers for different types of gambling and present data from the recent United States national survey that underscore the need for alternative methods for obtaining data on gambling expenditures. In the following section we outline some of the challenges to estimating the proportion of revenues derived from problem gamblers. In the third section we review the burgeoning literature on estimating expenditures from problem gamblers. In the fourth section we present data from several state surveys of gambling and problem gambling to demonstrate the variability in such estimates. In the fifth section we compare the estimates from these surveys with known revenues for different types of gambling in these states to highlight the questionable accuracy of survey-based estimates of gambling expenditures. In the sixth section we present several likely explanations for the poor fit between survey estimates of expenditures and known revenues for different types of gambling. In the seventh section we present data from the recent United States national survey that throws additional light on the reasons for the poor fit between survey estimates and known revenues. Finally, in the eighth section we conclude with recommendations for ways to conduct gambling research in the future to obtain improved estimates of expenditures on different types of gambling.

UNDERSTANDING THE CHALLENGES

There are several sources of uncertainty that affect our ability to pursue the central goal of this paper: namely, improving our understanding of available information on the proportion of gambling revenues derived from problem gamblers. These include:

1. the methods used to classify individuals as 'problem gamblers',
2. the accuracy of information about expenditures on different types of gambling elicited in surveys,
3. the impact of the sampling frame on estimates of expenditures, and
4. characteristics of different gambling activities that may affect both reporting of expenditures and sampling of players.

In the present context, the classification issue is perhaps the least contentious. While several different approaches have been developed in recent years to estimate the proportion of gambling revenues derived from problem gamblers, most have relied on the medical/psychiatric approach to identify problem gamblers in their study samples. This approach rests on a definition of problem gambling as 'gambling behavior that compromises, disrupts or damages personal, family or vocational pursuits' (Cox *et al.*, 1997). Used in this way, the term includes individuals with less severe difficulties as well as pathological gamblers whose difficulties place them at the most severe end of a continuum of problematic gambling. Pathological gambling is presently defined as a progressive disorder characterized by a continuous or periodic loss of control over gambling, a preoccupation with gambling and with obtaining money with which to gamble, irrational thinking, and a continuation of the behavior despite adverse consequences. To be diagnosed as a pathological gambler, an individual must meet at least five of ten diagnostic criteria established by the American Psychiatric Association (1994).

Several tools have been developed to identify problem and pathological gamblers in clinical settings and in population research. The most widely used tool is the original South Oaks Gambling Screen and its subsequent modifications (Lesieur and Blume, 1987; Abbott and Volberg, 1996). Since revised psychiatric criteria for pathological gambling were published in 1994, several screens

based on these new criteria have been developed (Abbott and Volberg, 1999; National Research Council, 1999).

The few studies on problem gambling expenditures conducted by economists have not relied on the psychological definition of problem gambling. Instead, problem gambling has been equated with heavy expenditures on gambling, an approach that rests on the notion that heavy consumption is equivalent to abuse or pathology (Grinols and Omorov, 1996; Grun and McKeigue, 2000).¹ However, this approach does not take into account one important difference between gambling and other addictive goods: limits to the consumption of gambling are financial rather than physical. Furthermore, there is a small but significant proportion of the population that gambles heavily but without problems (e.g. professionals who exploit inefficiencies in games of subjective probability, such as sports betting or horse racing, individuals able to take advantage of opportunities available to skilled players of games of mixed chance and skill, such as poker or blackjack, and high net worth individuals, who are unlikely to ever experience financial limits in their gambling).

ESTIMATING EXPENDITURES FROM PROBLEM GAMBLERS

Grinols and Omorov (1996) published one of the earliest attempts to estimate the proportion of gambling expenditures derived from problem gamblers. In contrast to later efforts based on original research, Grinols and Omorov developed their widely cited estimate that 52% of casino revenues come from problem and pathological gamblers on generalizations from limited, publicly available data on gambling involvement, gambling expenditures and problem gambling prevalence rates. A detailed examination of their approach reveals the numerous assumptions built into this estimate. For example, Grinols and Omorov use a distribution model from the lottery industry, rather than empirical data about casino gambling to argue that the total of all 'heavy bettors', a group that includes all problem and pathological gamblers, make up 10% of all casino gamblers and account for 65% of casino gambling revenues. Their estimate of the national prevalence of problem and pathological gambling is based on an average derived from the results of

six early state-wide prevalence surveys conducted between 1986 and 1990. In estimating the expenditures of problem and pathological gamblers, Grinols and Omorov depend on information provided by callers to a problem gambling helpline, although they cite as supporting evidence a similar figure derived from several population surveys.

Another effort to estimate the proportion of revenues derived from problem gamblers comes from Australia. Dickerson *et al.* (1996) estimated that 26% of total spending on gambling in Australia comes from problem gamblers. In contrast to the approach taken by Grinols and Omorov (1996), the Australian researchers used survey data to identify the number of problem gamblers in the general population and to estimate their average expenditures. While reliance on survey data is an improvement, problems remain with the approach taken by the Australian researchers. For example, they did not use a nationally representative sample but instead relied on a sample from the four largest cities, which excludes the 16% of the Australian population that lives in rural areas, as well as most of the marginalized Aboriginal population. Another concern is that many of the potential respondents, particularly weekly gamblers who would be expected to exhibit high rates of problem gambling, refused to complete the entire interview. A third problem is that the South Oaks Gambling Screen was only administered to weekly gamblers, and a fourth problem is that the cut-off scores for classifying respondents as problem and pathological gamblers were much higher than the conventional scores on this screen. A final problem is that the Australian researchers made no effort to examine the relationship between the estimates of gambling expenditures provided by individuals in the survey and the known revenues of the gambling industries in Australia.

In a more recent article, Lesieur (1998) presented another approach to estimating the proportion of expenditures derived from problem gamblers for different types of gambling. Lesieur examined reports on surveys of gambling and problem gambling in seven North American jurisdictions carried out between 1992 and 1996.² All of these surveys used a modified South Oaks Gambling Screen to assess lifetime and current (past year) problem gambling. To elicit information about expenditures on different types of gambling in all of these surveys, respondents were

asked how much they spent on each type of gambling 'in a typical month' for those types of gambling in which they had participated in the past year.

Lesieur's approach entailed multiplying the mean reported expenditure for non-problem gamblers and problem gamblers for each type of gambling by the total number of individuals in each of these two groups. He then added these two figures and calculated the proportion of the total amount that came from problem gamblers for each type of gambling. Across these jurisdictions, Lesieur found that between 20% and 40% of total reported expenditures came from problem gamblers. Lesieur argued that several types of gambling, including casino table games, electronic gaming machines (EGMs), off-track pari-mutuel wagering and bingo, were 'problem-gambling skewed', by which he meant that one-third or more of total reported expenditures on these types of gambling came from problem gamblers in each jurisdiction.

RECENT STATE SURVEYS

Volberg *et al.* (1998) took a similar approach to Lesieur in calculating the proportion of expenditures derived from problem gamblers for different types of gambling. While these researchers used survey data derived in the same way as the surveys reviewed by Lesieur, there were some important differences in their approach, explained partly by access to the original data rather than to published reports. For example, Volberg *et al.* focused on past-year players and past-year problem gamblers in calculating the proportion of expenditures on different types of gambling accounted for by problem gamblers rather than comparing all lifetime problem gamblers to all non-problem gamblers. Another difference was that Volberg *et al.* calculated the statistical confidence intervals around the proportions of expenditures accounted for by problem gamblers, providing a sense of the reliability of these ratios. A third difference is that Volberg *et al.* were careful to compare estimated expenditures (derived from the survey respondents) with the known revenues from different types of gambling, based on data from state gambling regulatory agencies, providing further information about the reliability of data on estimated expenditures.

In addition to published results from two states (Iowa and Mississippi) (Volberg *et al.*, 1998), this analysis has been completed for four additional states, including Louisiana, Montana, New York and Washington State. While there are publicly available reports detailing the results of all of these surveys (Volberg, 1995, 1996a,b; Polzin *et al.*, 1998; Volberg and Moore, 1999a, in Ryan and Speyrer, 1999 and Volberg and Moore, 1999b), the results presented here are based on new analyses of the original data from each state.

As with the surveys examined by Lesieur, all of these state-level surveys included the modified South Oaks Gambling Screen assessing lifetime and current (past year) problem gambling and elicited information about gambling expenditures by asking respondents to estimate how much they spent on different types of gambling 'in a typical month'. In all of these surveys, samples of respondents were contacted and interviewed by telephone. The number of interviews completed in each jurisdiction was determined by balancing available resources, confidence intervals and the size of the population. One of several methods for randomizing respondents within households was used and only one respondent per household was interviewed. Table 1 presents information about the characteristics of the surveys used in the present analysis, including the sample size, the response rate, and the period of data collection.

Table 2 presents information about the proportion of estimated expenditures derived from problem gamblers for several different types of gambling in the six state surveys. Information is presented for all of the past year participants in each activity as well as for the top 1%, 10% and 20% of spenders. The table presents information on the size of each group, the number of problem gamblers in each group, the range of expenditures reported by the group, total expenditures for the entire group and total expenditures by problem gamblers in each group. Table 2 also presents the share of total expenditures accounted for by each group and the share of expenditures accounted for by problem gamblers in each group. Owing to the small size of some of these groups in individual states, the data are grouped by gambling activity and are not broken out by jurisdiction. In spite of this aggregation, these findings should be considered exploratory rather than definitive, owing to the very small numbers of individuals in the highest spending groups (see columns A and B),

Table 1. Characteristics of State-Level Gambling Surveys

Jurisdiction	Sample size	Response rate (%) [†]	Data collection period
Iowa	1500	57	February–March 1995
Mississippi	1014	70	September–October 1996
New York	1829	55	April 1996
Louisiana	1800	59	November–December 1998
Montana	1227	83	January–February 1998
Washington State	1501	59	October–November 1998
Total/average	8871	64	

[†] Response rates for the Iowa, Mississippi, and Washington State surveys = completes/completes + refusals + partial interviews + language and hearing impaired + non-contacted but known eligible. Response rate for the New York and Louisiana surveys = completes/(completes + (completes/(completes + ineligible)) × (not contacted + refused)). Response rate for the Montana survey = completes/completes + refusals + partial interviews + non-contacted but known eligible.

Sources: Volberg (1995, 1996a,b), Polzin *et al.* (1998), Ryan and Speyrer (1999), and Volberg and Moore (1999a,b).

the lack of information on margins of error associated with these estimates, and the number of extreme outliers.

Table 2 shows that the proportion of estimated expenditures accounted for by problem gamblers varies substantially for different gambling activities. Column G shows that, for all past year players, this proportion ranges from a low of 14% for lotteries to a high of 27% for casino table games. Among the top 1% of players, the proportion of estimated expenditures accounted for by problem gamblers is even more variable, ranging from 18% among past year pari-mutuel bettors to 48% among past year casino table game players. Another observation, based on column E, is that all five gambling activities conform quite closely to both the 80:20 rule outlined by Vilfredo Pareto and the 65:10 ratio identified by Clotfelter and Cook (1989). As Pareto's rule suggests, about 80% of estimated expenditures on each type of gambling is accounted for by the top 20% of those who have spent money on that activity in the past year. As Clotfelter and Cook (1989) noted for lotteries, about 65% of estimated expenditures are accounted for by the top 10% of players. A third observation, based on a comparison of columns D and F, is that the ratio of total expenditures from the top 1% of players compared with all past year players differs across these gambling types, with the top 1% of casino table game players accounting for \$1 out of every \$5 spent by the entire group of past year players compared to \$1 out of every \$3 for the top 1% of past year pari-mutuel gamblers. A final observation, based on column

C, is that the range of estimated expenditures is far greater for pari-mutuel wagering and casino table games than for lottery, gaming machines, or bingo.

The Australian Productivity Commission (1999) used the approach developed by Volberg *et al.* with data from the Australian national gambling survey. The Australian national survey differs from gambling surveys conducted in North America in several key respects, most notably the format of the expenditure questions and the much higher bar set for respondents to score as problem gamblers. In spite of these differences, the Australian researchers found, like Lesieur and Volberg, that the proportion of expenditures derived from problem gamblers varies considerably for different modes of gambling. In Australia, the proportion of estimated expenditures from problem gamblers was highest for pari-mutuel wagering on horse races (48%) and gaming machines (39%) and lowest for non-instant lottery games (7%).

COMPARING ESTIMATED EXPENDITURES AND REPORTED REVENUES

For gambling activities regulated, operated or taxed by the state, comparisons can be made between the levels of spending calculated from respondents' reports of their own behavior and data on gambling receipts available from state regulatory agencies. Such receipts are audited thoroughly, and we would expect them to be

Table 2. Estimated Expenditures Derived from Problem Gamblers

	Group size	PGs in group**	Range	Total expenditure by group	Total expenditure by PGs	Share of total expenditure by group	Share of (E) from PGs
	A	B	C	D	F	E	G
Lottery*							
Top 1%	45	13	60–2500	17 740	4430	27.1	25.0
Top 10%	458	74	20	38 158	7528	58.4	19.7
Top 20%	897	119	10	47 183	8455	72.2	17.9
All	4473	242	0	65 348	9224	100.0	14.1
Pari-mutuel*							
Top 1%	8	2	300–8000	14 222	2544	35.6	17.9
Top 10%	51	9	50	27 931	5914	69.4	21.3
Top 20%	99	17	30	32 294	6636	80.7	20.6
All	518	54	0	39 962	7457	100.0	18.7
Casino table**							
Top 1%	8	5	500–4000	16 882	8052	20.5	47.7
Top 10%	69	24	100	50 030	18 492	60.8	37.0
Top 20%	137	34	50	62 475	20 687	75.9	33.1
All	674	71	0	82 299	22 206	100.0	27.0
Gaming machines***							
Top 1%	24	11	250–2500	27 105	12 294	24.9	45.4
Top 10%	233	77	42	66 423	24 173	61.1	36.4
Top 20%	470	114	20	81 084	26 427	74.6	32.6
All	2276	197	0	108 743	27 991	100.0	25.7
Bingo							
Top 1%	12	4	200–1800	7593	3184	30.4	41.9
Top 10%	101	25	30	16 306	5421	65.2	33.2
Top 20%	202	38	8	19 519	5816	78.1	29.8
All	1035	91	0	25 006	6270	100.0	25.1

* Respondents in Mississippi must travel out-of-state to play the lottery and wager on horse or dog races. Respondents in New York generally traveled to New Jersey to gamble on casino table games and slot machines in 1996.

† In Washington State, casino table games include only those located at Native American casinos. In Montana, casino table games include only those played outside the state.

‡ In Montana, gaming machine expenditures includes only in-state video poker machines. In Louisiana, expenditures on slot machines at riverboat casinos and those located outside casinos were calculated separately. One New York respondent, who claimed to spend \$10 000 on slot machines in a typical month, was dropped from the analysis.

Sources: Data from surveys in Iowa, Louisiana, Mississippi, Montana, New York and Washington State combined and analyzed for past year participants in specific gambling activities. Surveys reported in full in Volberg (1995, 1996a,b), Polzin *et al.* (1998), and Volberg and Moore (1999a,b).

** Problem gamblers are those respondents who scored three or more points on the past year South Oaks Gambling Screen.

highly reliable. The major source of error in these data involves flows of gamblers and their expenditures across state lines. For several types of gambling, including state lotteries, bingo, and charitable gambling, it is likely that interstate flows are generally negligible, although there are meaningful exceptions³. For other types of gambling, such as casino gambling and horse and dog racing, estimates can be developed of the geographic origin of actual receipts based on data from surveys conducted among the patrons of each type of facility.

Table 3 shows the ratio of estimated expenditures to known consumer spending on different types of gambling in the six jurisdictions that we

have just examined for the proportion of expenditures from problem gamblers. These ratios are obtained by dividing the total estimated expenditure by the sample size to obtain a per capita monthly estimate, multiplying the monthly per capita estimate by 12 to obtain an annual per capita estimate, dividing the known annual revenues by the state's adult population to obtain annual per capita revenues, and, finally, dividing the annual per capita estimate by the annual per capita revenues to obtain a ratio between estimated expenditures and known revenues. Table 3 also presents information about the size of the groups in each state that had participated in different gambling activities in the past year and

Table 3. Ratio of Estimated Expenditures to Known Consumer Spending

Type of gambling	Group size	Share of estimated expenditures from PGs**	Ratio of estimated to known expenditures
Lottery			
Iowa	814	19.3	1.77
Mississippi*	182	15.1	6.09
New York	1209	14.1	1.56
Louisiana [‡]	841	19.7	0.27
Montana	570	12.9	2.01
Washington State	857	6.9	2.88
Pari-mutuel			
Iowa	82	43.1	2.49
Mississippi*	24	8.0	6.56
New York	173	35.2	1.81
Louisiana [‡]	98	8.1	9.48
Washington State	82	12.2	1.96
Casino table			
Iowa	219	33.3	2.47
Mississippi	74	13.1	2.14
New York*	147	27.4	6.57
Louisiana [‡]	60	47.3	5.27
Gaming machines			
Iowa	481	15.3	0.78
Mississippi	254	18.5	0.88
New York*	264	37.2	3.67
Louisiana Casino Slots [‡]	304	30.6	0.42
Louisiana EGMs [‡]	343	27.1	0.26
Montana VGMs	474	36.2	0.37
Bingo and charitable[†]			
Iowa	153	20.2	4.10
Mississippi	40	73.8	1.65
New York	164	39.1	5.08
Louisiana [‡]	429	11.7	0.92
Washington State	166	6.9	3.94

* Respondents in Mississippi must travel out-of-state to purchase lottery tickets and to wager on horse or dog races. In 1996, respondents in New York generally traveled to New Jersey to gamble on casino table games and slot machines.

[†] Estimated expenditures from the surveys are for bingo only; consumer spending includes bingo and charitable gambling revenues.

[‡] Based on Ryan and Speyrer (1999, p. 7, table 1-1). Estimates of consumer spending were adjusted to reflect the proportion of total revenues derived from Louisiana residents. In the original report, casino revenues were not split between table games and slot machines. Consumer spending on these activities was calculated by multiplying total casino revenues from Louisiana residents by 65.5% for slot machines and 12.9% for table games. These are the proportions of past-year casino players in the Louisiana sample who indicated that they usually played these games when they visited a Louisiana riverboat casino.

Sources: Volberg (1995, 1996a,b), Polzin *et al.* (1998), Ryan and Speyrer (1999) and Volberg and Moore (1999a,b).

** Problem gamblers are those respondents who scored three or more points on the past year South Oaks Gambling Screen.

the proportion of estimated expenditures among these past year players derived from problem gamblers.

As in Table 2, the data in Table 3 demonstrate that there is substantial variability in the proportion of estimated expenditures accounted for by problem gamblers involved in different gambling activities. For example, estimated expenditures by problem gamblers among past year lottery players range from 7% to 20% and estimated expenditures by problem gamblers among past year gaming

machine players range from 15% to 37%. Ranges are even wider for bingo, pari-mutuel wagering and casino table games—activities that involve much smaller numbers of participants.

Table 3 also demonstrates that respondents' estimates of gambling expenditures in surveys differ strikingly from reported spending derived from state administrative records. With some exceptions,⁴ survey respondents tend to over-state their expenditures on lottery games, bingo and charitable games, casino table games, and

pari-mutuel wagering. Generally, survey respondents tend to under-state their expenditures on gaming machines.

For example, respondents from Iowa, Montana, New York, and Washington State report lottery expenditures that are about double what would be expected based on state administrative records. Respondents from the four states where casinos operate report expenditures on casino table games that are even further out of line with known consumer spending on these activities. Similarly, estimated expenditures on pari-mutuel wagering and on bingo and charitable wagering are several times higher than known consumer spending in these states. In contrast, respondents from Louisiana and Montana report only 26% and 37%, respectively, of their actual expenditures on gaming machines located outside casinos. Respondents from Iowa, Louisiana and Mississippi, where riverboat, dockside, and Native American casinos feature slot machines, report 78%, 42% and 88%, respectively, of known consumer spending on casino slot machines.

The Australian Productivity Commission researchers also examined the relationship between estimated expenditures from survey respondents and gross revenues of gambling operators. In spite of additional questions in the Australian national survey designed to elicit only net expenditures on gambling, estimated gambling expenditures represented only 73% of the known gross revenues. As in the United States, estimated lottery expenditures among the Australian respondents were 42% higher than known consumer spending, while estimated expenditures on gaming machines represented only 58% of gaming machine revenues reported to the Australian government (Productivity Commission, 1999).

EXPLAINING THE DIFFERENCES

There are several possible explanations for differences between estimated expenditures derived from surveys and actual expenditures as reported to government agencies. These fall into three general areas that we identified at the beginning of this paper: (1) the characteristics of different gambling activities that may affect both reporting of expenditures and sampling of players, (2) the accuracy of information about expenditures on different types of gambling elicited in surveys, and

(3) the impact of the sampling frame on estimates of expenditures.

Differences Among Gambling Activities

In considering the characteristics of different gambling activities, it is important to emphasize that evolving social attitudes towards gambling and tacit beliefs of survey respondents about the social desirability of different gambling activities may affect their responses. Gambling is a broad concept that includes diverse activities, undertaken in a wide variety of settings, and individual and community definitions of gambling can vary widely. For example, a recent Gallup poll found that 52% of respondents defined stock market investment as a form of gambling, while 22% did not consider buying state-sponsored lottery tickets to be gambling (Gallup, 1999). Similarly, many people do not regard playing bingo, purchasing raffle tickets, and attending 'Las Vegas-style' fund-raising events as gambling.

Furthermore, there is still stigma associated with gambling by some groups in society, most notably women and the elderly (Lesieur and Blume, 1991; Gerstein *et al.*, 1999). While women's participation in *legal* gambling activities is no longer very different from the gambling done by men, women are still significantly less likely than men to participate in *illegal* types of gambling (Hraba and Lee, 1996). Among different ethnic groups, Hispanics are most likely to gamble in order to socialize, while Blacks are most likely to gamble in order to win money. There are also substantial ethnic differences in the reasons that non-gamblers have for *not* gambling. White non-gamblers are most likely to say that they refrain from gambling for moral reasons, while Black non-gamblers are most likely to say that they refrain from gambling for financial reasons (Volberg *et al.*, 1999).

Another likely explanation lies in the difficulty that many respondents have in estimating expenditures on gambling activities in which they do not participate regularly. In some instances, respondents may rely on recollection of events that are distant in time. For other activities, 'heuristics', or cognitive habits of problem solving, may be used to make a preliminary estimate which is then adjusted to fit specific circumstances (Tversky and Kahneman, 1974; Groves, 1989). Other challenges to making accurate estimates c

gambling expenditures may be the rapid cycle of play associated with some games and the effects of alcohol consumption on memory (Griffiths, 1998; Baron and Dickerson, 1999).

The Accuracy of Expenditure Estimates

Apart from the characteristics of different gambling activities, there is more generally a differential tendency for human beings to remember emotionally positive events, such as winning, and to forget negative ones, such as losing (Wagenaar, 1986; Thompson *et al.*, 1996). Painful memories, such as the exact amount of large losses, may be forgotten more readily than happy memories, such as the exact amount of a big win. Alternatively, it is possible that an extremely unpleasant event, like a very large loss, may be more memorable than a large number of smaller losses (Tourangeau *et al.*, 2000). In considering the accuracy of information about gambling expenditures elicited in surveys, it is important to consider how respondents' personal experiences with different gambling activities may affect their ability to recall their gambling expenditures with accuracy.

Another important factor that likely underlies gaps between 'reported' and 'actual' spending involves respondents' interpretations of the term 'spending'. Blaszczynski *et al.* (1997) found substantial variation in the responses of college students presented with a series of *vignettes* and asked to respond to the question: 'How much did you spend gambling?' in relation to each one. While two-thirds of the students interpreted the question to mean net expenditure (i.e. the difference between the initial amount available at the beginning of a gambling session and the amount remaining at its conclusion), the remaining one-third of these students offered estimates based on several alternative methods, depending on the characteristics of the *vignette* under consideration.

All of the data on estimated expenditures analyzed by Lesieur and Volberg were derived from responses to the question 'How much do you spend on [type of gambling] in a typical month?' While many of the respondents in these surveys probably interpreted this question to mean net expenditure, a substantial proportion of these respondents are likely to have used other methods on which to base their estimates. However, the results of the Australian national survey show

that even careful phrasing of expenditure questions may still result in expenditure estimates that are substantially different from reported revenues (Productivity Commission, 1999).

A final facet to the issue of the accuracy of estimates of gambling expenditures relates to the question of whether problem gamblers estimate their gambling expenditures in the same way as non-problem gamblers. While there is no scientific evidence at present to support the notion that problem gamblers' reporting errors are different from non-problem gamblers' reporting errors, there is evidence that all gamblers engage in a range of cognitive biases, including illusions of control, superstitions, erroneous beliefs, biased evaluation of outcomes, and distorted assumptions about randomness (Ladouceur and Walker, 1996). There is also evidence that the presence in memory of numerous, similar events can reduce respondents' ability to answer questions about them accurately (Tourangeau *et al.*, 2000). This suggests that frequent gamblers (which includes most, but not all, problem gamblers) will report their gambling expenditures with less accuracy than those who gamble less frequently. If problem gamblers' reporting errors are different from those of non-problem gamblers, or if frequent gamblers' reporting errors are different than those of infrequent gamblers, then survey estimates of the proportion of expenditures for a particular game derived from problem gamblers or frequent players will be affected by these errors. However, further research is needed to examine this issue in detail.

Impact of the Sampling Frame and Non-Response Bias

A third likely explanation of differences between estimated expenditures and reported revenues lies in the ability of researchers to include in their samples individuals who are extreme users or to appropriately weight their samples to reflect these individuals. While part of the challenge lies in our ability to find such individuals in the general population, another part of the challenge lies in our ability to successfully interview them.

A variety of studies suggest that the most likely explanation for under-reporting of some behaviors, such as extreme sexual behavior or heavy alcohol consumption, is related to the under-sampling of the small proportion of individuals in

the population who are extreme participants in these activities, particularly when standard household sampling methods are used. For example, studies based on household sampling are likely to under-represent very heavy drinkers, as these individuals are more likely to be institutionalized or incarcerated, less likely to live in households, and may also be less able or willing to participate in surveys. Although such people do not constitute a substantial portion of the population, their effect on mean consumption estimates is believed to be considerable (Polich and Orvis, 1979).

Similarly, in gambling surveys, it is likely that a small but heavily involved proportion of the population spends inordinately large amounts of money on their chosen activity. We have noted that not all of these individuals are problem gamblers; indeed, some are able to generate substantial incomes on the basis of their poker play or pari-mutuel wagering (Hayano, 1982; Greenhouse, 1998). The results of gambling surveys that do not represent such individuals at the appropriate weights would show substantially lower expenditures than if such individuals were appropriately represented in the sample.

Difficulties in obtaining a representative sample of the entire gambling population are compounded by the distinct challenges of successfully interviewing such individuals. Willingness to participate in surveys and difficulties in completing interviews with eligible respondents who are difficult to contact are problems of non-response, rather than of the sampling frame itself. Both professional and problem gamblers may be difficult to represent in gambling surveys because their numbers relative to the general population are so low. However, problem gamblers may also be difficult to represent in gambling surveys for reasons more like those of heavy alcohol users than professional gamblers. Lesieur (1994) notes that telephone survey methods are likely to under-represent problem gamblers (and, hence, their estimated expenditures) for a variety of reasons. While problem gamblers' lack of telephone service is related to the sampling frame, their absence from home because they are gambling and their reluctance to participate in a gambling-specific survey are related to biases of non-response. As with heavy drinkers, however, if professional gamblers and problem gamblers are under-represented in gambling surveys, the effect on estimates of gambling expenditures is likely to be significant.

These explanations combine in different ways to affect estimates of gambling expenditures among survey respondents in different jurisdictions. For example, while social desirability is probably the major reason for over-estimates of charitable expenditures, the cognitive heuristic of 'telescoping', which occurs when a respondent remembers engaging in a specific behavior, but adjusts the estimate to fit the question in the interview (Sudman *et al.*, 1996), is a more likely explanation of over-estimates of lottery expenditures. In contrast, the stigma that continues to be attached to women playing slot machines outside of traditional gaming venues probably contributes to under-estimates of expenditures on gaming machines. In addition, the rapid cycle of gaming machine play and its usual association with alcohol consumption may contribute further to under-estimates of gaming machine expenditures. Cognitive biases, such as differential recall of wins, probably contribute to over-estimates of expenditures on lottery tickets as well as casino table games and pari-mutuel wagering. As with gaming machines, estimates of expenditures on casino table games are probably affected by alcohol consumption. However, estimates of expenditures on casino table games and pari-mutuel wagering are also likely affected by the difficulties in identifying heavy players using telephone survey sampling methods. The difficulty of identifying heavy players is illustrated in Tables 1 and 2. While the data included in the analysis is drawn from interviews with nearly 9000 adults, only 8% of these individuals had played casino table games in the past year and only 6% had wagered on pari-mutuel events. The top 1% of players in each of these two groups corresponds to less than one-tenth of 1% of the total sample.

All of these observations lead us to expect estimated expenditures in gambling surveys to vary substantially from actual expenditures as recorded in official accounts. We have noted that in general, estimated expenditures tend to be higher than actual expenditures for lottery games, casino table games and pari-mutuel wagering. In contrast, estimated expenditures tend to be lower than actual expenditures on casino slot machines and EGMs. The results of a recent national survey of gambling and problem gambling in the United States, where expenditure questions were asked in an entirely different way than in earlier studies, sheds some further light on this issue.

THE UNITED STATES NATIONAL SURVEY EXPENDITURE DATA

Sample Characteristics of the National Survey

The national Gambling Impact and Behavior Study (GIBS) was a research program initiated on behalf of the National Gambling Impact Study Commission. The full program of survey research, carried out by three of the present authors with other colleagues between April 1998 and March 1999, included five separate initiatives: a nationally representative telephone survey of 2417 adults, a national telephone survey of 534 youths aged 16 and 17, intercept interviews with 530 adult patrons of gaming facilities, a longitudinal data base (1980–1997) of social and economic indicators and estimated gambling revenues in a random national sample of 100 communities, and case studies in ten communities regarding the effects of large-scale casinos opening in close proximity (Gerstein *et al.*, 1999). Discussion here focuses on the approach taken in the adult and patron surveys to estimating expenditures on different types of gambling.

The telephone survey of adults (18 and older) was based on a random sample of ten-digit telephone numbers purchased from Survey Sampling, Inc. The list from which the numbers were drawn included only actual US area codes and 1000-number telephone banks that had been determined to contain a threshold number of active residential numbers. Each number in the sample of 9200 numbers was called (in some cases as many as 50 times) to determine whether it was a working residential number (WRN) in contrast to a non-working number, a commercial/business line, a cell phone, data or fax line, or a non-primary household telephone. There were 4358 WRNs, and interviewers successfully screened 3281 WRNs to establish the number of adults of each sex residing there and select one household adult for interview using systematic randomized sampling rules (Kish tables). Usable interviews were subsequently completed with 2417 adults, including 44 in Spanish and 14 in self-administered versions of the questionnaire mailed to respondents at their preference. The screening completion rate was 75.3%, and the post-screener completion rate was 73.7%, for a final cooperation rate of 55.5%.

Respondents to the telephone survey were weighted by age group, sex, ethnic/racial group,

number of adults in the household, and state (in a few cases, contiguous smaller states were treated as a block). The weighted numbers and proportions were approximately equal to those in the general population, according the March 1998 Current Population Survey, and the weights summed to the overall number of adult residents of the United States, approximately 200 million (more precisely, 197.35 million) persons. On average, each respondent in the 1998 survey represented about 81650 adults.

It was expected (and the results below confirm) that the adult random-digit-dial (RDD) survey would yield a relatively small number of problem and pathological gamblers. In anticipation of this limitation, the national research team was charged with conducting a second survey to generate additional problem and pathological gamblers. An intercept survey of patrons of gaming facilities was selected as the most promising approach—in other words, to go where gamblers are, and especially where more frequent gamblers would be found in concentrated numbers. The research design called for a minimum of 500 patron interviews to be collected from five major facility types in approximate proportion to their estimated share in overall gaming revenues. The patron-intercept survey comprised 530 completed interviews in 21 facilities in seven states, including 150 in Nevada and New Jersey casinos, 64 in riverboat casinos, 67 in tribal casinos, 193 with patrons of lottery outlets, and 56 at pari-mutuel race tracks.

After studying the composition of the patron intercept sample, we derived a statistical approach to combining the samples and re-weighting the resulting file to accurately reflect the 'dual-frame' origin of the respondents. All adults were viewed as having two opportunities to be represented in the sample—household contact via telephone or interception while visiting a gaming facility. The merged sample included all of the more frequent past-year lottery or casino players from both surveys (intercept patrons not interviewed in casino or lottery sites were included here if they met either the lottery or casino participation criteria in their questionnaire responses). This 'players' sample contained about 1226 individuals (450 from the patron intercept survey and the remainder from the telephone survey) representing about 64 million players.

We then sorted the players from both surveys into 23 groups or 'adjustment cells' (described in detail in Gerstein *et al.*, 1999, Appendix B); each cell included respondents who reported similar frequencies of casino and lottery play and were similar in age. We then took the population estimated to have the characteristics of each of these cells according to the telephone data alone and divided that population number by the number of patron *and* telephone cases in the cell. We then assigned this average weight to each of the patron cases, and finally readjusted all weights to aggregate to the cell's population. In other words, we had the intercepted patrons *share* the sample weights assigned initially to the telephone cases whom they most resembled in terms of age and past-year gambling behavior. Finally, we re-combined these re-weighted cases with all of the telephone cases who were not in the 'players' file; none of these other case weights (adding up to 133 million persons) were changed.

Table 4 shows key characteristics of the weighted RDD file, the original unweighted patron file, and the combined, re-weighted patron + RDD file. The patron group was, on the whole, somewhat more likely than the RDD sample to be male, African-American, older than 50, less than college educated, divorced, not employed, not an active parent, and living close to a major casino, and in a lottery state. Some of these characteristics are also likely to be associated to some extent with under-representation in a telephone sample. More to the point of carrying out the patron survey, the patrons were three to four times more likely to play the lottery at least once a week, gamble in other venues at least once a month, and (albeit only a small fraction) consider themselves to be 'professional' gamblers.

Questionnaire Design

The guidelines put forth by the National Gambling Impact Study Commission specified that the most recent psychiatric criteria be used to identify problem and pathological gamblers in the general population. This meant that none of the existing versions of the South Oaks Gambling Screen could be used, as this instrument is based on the original criteria for the diagnosis of pathological gambling (American Psychiatric

Association, 1980). In constructing the questionnaire for the adult and patron surveys, the research team elected to develop a new problem gambling screen based, as required, on the most recent psychiatric criteria (American Psychiatric Association, 1994). The NORC Diagnostic Screen for Gambling Problems (NODS) was tested for its performance in a clinical sample prior to adopting it in the national surveys and demonstrated strong internal consistency, high sensitivity, good specificity, and good retest reliability (Gerstein *et al.*, 1999).

Questions about gambling expenditures in the national GIBS also differed significantly from questions about expenditures asked in earlier surveys. Rather than asking respondents to estimate their spending in a typical month, respondents in the adult and patron surveys were asked a series of far more specific questions for each type of gambling they had done in the past year. For several activities, respondents were asked whether they budgeted beforehand a certain amount that was the most they were willing to lose. For all of the activities, except lottery and private wagering, respondents were asked how much money they had taken with them to gamble on the last day they participated in that activity, whether they acquired more money to gamble with after they started, whether they came out ahead or behind on the money they wagered, and how much they came out ahead or behind. For every type of gambling they had done in the past year, respondents were asked to estimate whether they had come out ahead or behind on that activity for the entire year, and how much ahead or behind they were.

Questions about lottery expenditures were phrased somewhat differently than questions about other types of gambling. Respondents were asked how much they had spent on different kinds of lottery tickets (instant, daily, large jackpot, multi-state games) in the past 7 days and past 30 days. Respondents were also asked how much of that spending was done using a credit card and whether they had bought lottery tickets with other people in a ticket-buying pool. As with other types of gambling, past year lottery players were asked whether they had come out ahead or behind on their lottery tickets and how much ahead or behind they were over the entire year.

Table 4. Key Characteristics of Adults in the Telephone, In-Person, and Combined Survey Samples of the National GIBS

Demographic characteristic	Random-digit-dial (RDD) telephone sample (<i>n</i> = 2417)	In-person patron-intercept sample (<i>n</i> = 530)	Combined patron + RDD sample (<i>n</i> = 2867)
Sex	%	%	%
Female	51.9	43.2	51.5
Male	48.1	56.8	48.5
Race/ethnicity			
White	71.5	71.1	71.4
Black	11.1	20.0	12.2
Hispanic	10.2	4.2	9.3
Other	7.3	4.8	7.1
Age			
18–29	22.5	11.6	22.3
30–39	24.0	16.5	24.0
40–49	20.2	19.8	20.3
50–64	17.1	31.6	17.3
65+	16.2	20.5	16.1
Education			
Less than high school	11.8	15.6	12.3
High school graduate	27.5	34.6	27.9
Some college	31.2	28.5	30.7
College graduate	29.5	21.3	29.1
Income			
Less than \$24 000	34.4	28.5	32.8
\$24 000–49 999	31.2	31.9	31.0
\$50 000–99 999	27.1	28.7	26.7
\$100 000+	9.4	10.8	9.5
Marital/parental status			
Married	58.0	54.8	57.8
Divorced/separated	10.0	17.3	10.6
Never married	24.7	21.7	25.0
Other marital status	7.4	6.3	6.6
Lives with (minor) children	38.3	27.8	38.3
Employment			
Current full-time employment	59.1	51.1	58.0
Part-time employment	11.4	10.6	11.9
Not employed	29.5	39.2	30.1
Distance to major casino			
0–50 miles	21.2	60.8	24.4
51–250 miles	64.1	37.5	61.7
251+ miles	14.7	1.7	13.9
Lottery state	83.7	100.0	84.0
'Professional gambler'	1.0	4.0	1.4
Frequency of play			
At least weekly lottery	12.3	41.4	12.5
At least monthly other gambling	12.6	49.8	12.0

Source: Gerstein *et al.* (1999, p. 24, table 5).

Demographic and Behavioral Characteristics of Problem and Pathological Gamblers

Based on the NODS scores from the combined sample, we estimated that 2.7% of American adults can be classified (using the lifetime items as a measure, in accordance with the DSM-IV criteria) as problem or pathological gamblers. These

clinically significant types were about twice as prevalent among men versus women, blacks versus whites, persons less than 65 years versus 65 or older, never-married or divorced versus married persons, and among individuals living within 50 miles of the nearest large-scale casino. There was a tendency as well for higher prevalence rates among persons in households with less than

\$50000 annual income versus higher-income households.

The lifetime problem and pathological gamblers were twice as likely as other gamblers (31% versus about 15%, with the older group of non-gamblers falling in between) to describe their general health over the past 12 months as fair or poor. Lifetime problem and pathological gamblers were also twice as likely as all other groups (13% versus 6–7%) to have sought professional help for emotional or mental health problems in the past year. Lifetime problem and pathological gamblers were more likely than others to acknowledge being somewhat or very troubled by their emotions, nerves or mental health: 42% versus 27%, 16%, and 11%, respectively, for groups who were classified as 'at-risk', 'low-risk' (in terms of sub-clinical signs of gambling pathology) and non-gamblers.

Gambling Expenditures by Problem and Pathological Gamblers

One expectation in this effort was that the researchers would be able to estimate the proportion of gambling revenues associated with problem and pathological gamblers, which was expected to exceed their prevalence in the general population. However, only the information on lottery expenditures turned out to be useful in this way. When respondents were questioned explicitly about expenditures on lottery play, the researchers were able to reconcile these data quite well with officially counted sales receipts. The estimated total spent by the combined adult and patron samples on lottery tickets was \$31.5 billion, or about 92% of the \$34.3 billion in lottery sales recorded by states and municipalities (Christiansen, 1999a). Lottery expenditures by problem and pathological gamblers in the combined adult and patron surveys accounted for 14% of total estimated expenditures. This proportion is exactly the same as the proportion of lottery expenditures derived from problem gamblers in earlier state surveys (see Table 2).

There were two principal obstacles to our efforts to account for the proportion of gambling revenues associated with problem and pathological gamblers in the national survey. First, as we noted above, a certain fraction of gambling revenues, particularly from table games in destination-style casinos but also in some high-stakes lotteries and in some pari-mutuel betting pools, have historically been derived from a relatively small number

of high-end players, many of whom are not United States residents. Estimates based on a survey that does not sample from this special stratum must restrict their scope of generalization to exclude reference to these very wealthy international players. Owing to the amount of money that these individuals put into play at casinos (and to a lesser extent in other games), any denomination of gambling in monetary units will likely be missing this component. There are also, of course, some expenditures by United States players outside of the country, a number for which no estimates are available, but experienced observers consider to be relatively small. In general, the international attraction of Las Vegas results in the United States importing far more in gambling expenditures than it exports.

The second problem is the weakness in individuals' reports of gambling winnings and losses. Virtually none of the data from the national survey on amounts 'ahead' or 'behind' (won or lost) appears to be accurate at face value. Further, there is a distinct lack of realism in the overall estimates of monetary wins and losses reported by respondents in the adult and patron surveys. Most revealing of the rosiness of the collective view of gambling is private gaming, largely at cards, in which there is no 'house' or commercial intermediary to remove money from players' wins and losses. In private bets, all of the wins and losses should balance. However, in the combined adult and patron sample, there were 594 respondents who considered themselves ahead compared with 246 respondents who considered themselves behind on the last occasion when they gambled privately, a ratio of three self-reported winners for each loser. Similarly, when respondents considered private gaming in the past year, there were 482 self-reported winners compared with 293 self-reported losers, a ratio of five self-reported winners for every three losers. While these ratios are not inherently impossible, as they might imply that each loser's money was spread out across a larger number of (smaller) winners, the individual amounts reported as won and lost by each group actually further exaggerate, rather than reduce, this disparity in numbers of winners and losers.

Despite the lack of realism in the overall estimates, there is some intriguing information in the extent to which problem and pathological gamblers account for amounts in both the win and loss columns. Table 5 presents information about the

Table 5. Percentage of Total Dollars Won or Lost in the Last Day and in the Past Year that are Accounted for by Problem and Pathological Gamblers, among Adults in the National GIBS

Type of gambling	Based on the most recent day of gambling		Based on past year of gambling	
	Ahead	Behind	Ahead	Behind
Casino	6.6	15.6	14.8	16.7
Track	3.1	1.0	3.4	13.5
Bingo	12.5	20.1	11.0	8.5
Charitable	1.6	0.2	7.3	2.6
Cardroom	21.2	11.7	15.6	19.1
Private	1.2	34.3	29.6	3.2
Unlicensed	–	–	18.4	8.3
Lottery	–	–	1.2	6.1

Source: Analysis based on GIBS public use file. Data available through the Inter-University Consortium for Political and Social Research at the University of Michigan.

proportion of amounts ahead and behind for the last day and for the past year that are accounted for by problem and pathological gamblers for different activities.

Table 5 shows that in lottery play, problem and pathological gamblers account for 1% of the amount ahead and 6% of the amount behind for the past year. In casino play, problem and pathological gamblers account for about 17% of past-year losses, 16% of last-day-based losses, 15% of past-year winnings, and nearly 7% of last-day-based gains. In pari-mutuel betting, problem and pathological gamblers account for 13% of past-year losses, 3% of past-year winnings, 1% of the last-day-based losses, and 3% of last-day-based winnings. More generally, Table 5 shows that problem and pathological gamblers account for a much larger share of last-day losses than last-day wins for casino games, bingo and private gambling activities. When we consider amounts ahead and

behind in the past year, problem and pathological gamblers account for a much larger share of losses than wins for pari-mutuel wagering. In contrast, problem and pathological gamblers account for a much larger proportion of the amounts that respondents claimed to be ahead for the year for private and unlicensed gambling activities.

Another interesting comparison is between the amounts respondents indicated that they had budgeted to lose before their last gambling experience and the amount that they took to gamble with that day. Table 6 shows this comparison for the combined adult and patron samples and broken out by non-problem and problem categories.

The ratios in Table 6 suggest that few gamblers stick to a budgeted amount once they start gambling. For example, respondents took nearly two dollars for every dollar they had budgeted to lose on the last day they gambled at a casino. Respondents took three dollars for every dollar they had

Table 6. Ratio of Amount Taken to Gamble to Amount Budgeted to Gamble on the Last Day of Gambling, among Adults in the National GIBS

Type of gambling	Total adults in combined sample (<i>n</i> = 2867)	Non-problem and at risk gamblers (<i>n</i> = 2412)	Problem and pathological gamblers (<i>n</i> = 113)
Casino	1.78	1.62	2.24
Track	9.22	6.83	30.89
Bingo	1.51	1.24	2.51
Charitable	2.25	2.22	8.00
Cardroom	3.07	1.88	5.99

Source: Analysis based on GIBS public use file. Data available through the Inter-University Consortium for Political and Social Research at the University of Michigan.

budgeted to lose on the last day they gambled at a cardroom and they took nine dollars for every dollar they had budgeted to lose on the last day they gambled at a racetrack, *jai alai fronton* or off-track betting facility. Table 6 also shows that the ratio of dollars budgeted to dollars taken to gamble is far higher for problem and pathological gamblers (respondents who scored three or more points on the lifetime NODS) than for low-risk or at-risk gamblers (respondents who scored zero, one or two points on the lifetime NODS). Problem and pathological gamblers took nearly \$6 for every \$1 they budgeted to lose at cardrooms and over \$30 for every \$1 they budgeted to lose at racetracks, *jai alai* or at off-track betting facilities.

Finally, it is interesting to compare the ratio of amounts ahead to amounts behind for different types of gambling and for problem and pathological gamblers compared with low-risk and at-risk gamblers. These data are presented in Table 7.

Table 7 shows that respondents were most likely to believe that they came out ahead in their last session playing bingo or in their last private gaming session. Respondents were also far more likely to believe that they had come out ahead for the year in their private gambling, in games at unlicensed establishments and at bingo. Charitable games and lottery play were the only gambling activities in which respondents were more likely to believe they had come out behind than ahead for the year. Curiously, respondents were more likely to believe that they were ahead on the last day they participated in charitable gambling than they were to believe that they came out ahead on charitable gambling for the entire year.

Table 7 also presents information about differences in the recollections of non-problem and problem gamblers in relation to different types of gambling. For example, problem gamblers are more likely than non-problem gamblers to recall being behind on the last day that they gambled at a casino. However, problem and non-problem gamblers are equally likely to believe that they are ahead in their casino gambling over the entire year. In contrast, problem gamblers are substantially more likely than non-problem gamblers to recall being ahead in their last session wagering on charitable games, on pari-mutuel events and at cardrooms. Although problem gamblers tend to believe they were ahead in their last session of pari-mutuel betting, they seem well aware that they are behind in their pari-mutuel betting over the past year. The same pattern, but even more pronounced, is true for charitable gambling by problem gamblers. Non-problem gamblers are substantially more likely than problem gamblers to believe that they were ahead in their last session of private wagering. Over the past year, however, problem gamblers are far more likely than non-problem gamblers to believe that they came out ahead in their wagering on private games.

Instead of a careful, computer-like accounting for gambling dollars, the data on estimated expenditures in the national survey illustrate the tendency for individuals to under-state their net losses and exaggerate their net wins, particularly when accounting for expenditures in private settings. A more general finding from these data is that gamblers, whether or not they are classifiable

Table 7. Ratio of Aggregate Amount Ahead to Aggregate Amount Behind at the End of the Last Day Gambled and in the Past Year of Gambling, among Adults in the National GIBS

Type of gambling	Total adults in combined sample (<i>n</i> = 2867)		Non-problem and at risk gamblers (<i>n</i> = 2412)		Problem and pathological gamblers (<i>n</i> = 113)	
	Last day	Past year	Last day	Past year	Last day	Past year
Casino	1.65	1.57	1.82	1.60	0.70	1.40
Track	2.33	2.57	2.28	2.87	7.27	0.64
Bingo	11.68	3.25	12.79	3.16	7.24	4.24
Charitable	2.25	0.25	2.21	0.24	19.50	0.70
Cardroom	2.25	2.25	2.00	2.35	4.09	1.83
Private	9.89	9.79	14.89	7.15	0.33	90.25
Unlicensed	–	4.38	–	3.89	–	9.66
Lottery	–	0.24	–	0.25	–	0.05

Source: Analysis based on GIBS public use file. Data available through the Inter-University Consortium for Political and Social Research at the University of Michigan.

as problem or pathological, seem accustomed to a fairly high level of wishful thinking about the economics of the games they play.

CONCLUSION

Our review of the literature on the proportion of consumer spending on commercial games derived from problem gamblers shows that estimates of gambling expenditures based on household surveys of the population can range widely, and are not very accurate, although they generally confirm that individuals identified on behavioral and psychometric measures as problem and pathological gamblers account for an appreciably larger share of such expenditures than their proportion in the population. While it might be possible to design a national survey that would result in more accurate information, the costs of such an effort are likely to be appreciable. In the face of stringent constraints on the resources that have been available to conduct gambling research, what can be done to improve the validity of expenditure data?

There are three critical problems associated with obtaining accurate data on gambling expenditures. These are tied to the major sources of uncertainty that we identified at the beginning of this paper and discussed in greater detail above. The difficulties in recruiting heavy players into surveys reflect the impact of survey sampling frames and non-response bias on estimates of gambling expenditures. The challenge of obtaining valid and accurate information about gambling expenditures from survey respondents is related to the importance of careful construction of expenditure questions. Finally, there is the question of how characteristics of different gambling activities, and particularly the distribution of wins and losses, affect both the ability to obtain accurate reports of gambling expenditures and to sample representative groups of players. While there is no perfect way in survey designs to guard against any of these problems, it is possible to improve our methods to take these particular challenges into account.

Recruiting Heavy Players

A key difficulty in conducting accurate gambling surveys is the small number of people who wager

large amounts or who gamble professionally. Small groups like these are difficult to find and interview in surveys of the population. The approach taken in Australia has been to screen for regular, weekly players. However, high refusal rates among heavy gamblers may compromise the generalizability of the survey results. The national GIBS addressed this issue in relation to identifying adequate numbers of problem and pathological gamblers by 'going where the gamblers are' and interviewing patrons at gambling venues. The results of the patron survey confirmed the promise of this approach as substantial numbers of problem and pathological gamblers were included in the final sample. On the whole, the patron group was far more likely than the adult RDD sample to play the lottery at least once a week, to gamble in casinos or at the track at least once a month and to consider themselves to be 'professional' gamblers (Gerstein *et al.*, 1999). In our opinion, supplementing household surveys with surveys at gambling establishments would improve the likelihood that heavy gamblers (including professional and problem gamblers) would be included in the final results.

Getting Valid Expenditure Information

In some types of gambling (e.g. sports betting, poker games and wagering on horse races), there is probably a 'macho' mindset that leads participants to selectively recall wins and losses. It is also possible that people are better able to recall enjoyable events (such as winning) than unenjoyable events (such as losing). Alternatively, it is possible that people are more likely to remember a single, extremely large loss than a lengthy series of much smaller losses. Certainly, more research is needed on the psychological satisfactions of different gambling activities, as well as the likely different heuristics associated with different games that lead to inaccurate estimates of expenditures. Approaches, such as asking heavy gamblers to keep diaries of their gambling expenditures, as well as wins and losses, would help us understand the selectivity of accounts of expenditures in household surveys. With adequate sample sizes, such approaches might also indicate whether problem and pathological gamblers rely on similar or different cognitive mechanisms in accounting for gambling expenditures than non-problem gamblers.

Distribution of Wins and Losses

In conducting gambling research, little notice has been paid to characteristic features of different gambling activities and their likely impact on reports elicited from samples of respondents in the population.

Games differ in their proportion of winners and losers. Games also differ in that the amounts won and the amounts lost (spent) can be of different types: losses can be highly stereotyped and mechanized, as in the cost of lottery tickets, or losses and wins can vary freely. These variations have quite different implications for both the chances of accurately reflecting the distribution of winners and losers in a survey and for the accurate recall or calculation of wins and losses by survey respondents. In general, stereotyped, repetitive bets are easier to recall accurately, particularly for long stretches of time such as a year. In contrast, irregular, large amounts will be more easily recalled than irregular, small amounts over the same period of time. As we found at the state and national level, lotteries are the most accurate form of betting to be self-reported, owing to the high degree of commercial standardization and the concentration of wealth transfers from many losers to a few winners. As games depart from this formula, with transfers occurring among smaller groups and in more particularistic and irregular ways, the tendency for large wins to be salient (and thus average winnings to be over-estimated) and large losses to be neglected or minimized (and thus average losses under-estimated) becomes greater and the fit between estimated expenditures and known consumer spending poorer.

It may, therefore, be necessary to vary the type of questions used to elicit information about expenditures on different games. In the case of the most difficult games, it may be necessary to probe for information only within tighter timeframes and to ask for specification regarding the degrees of certainty that attach to dollar amounts. It will also be important to assess respondents' attitudes toward different gambling activities and relate these attitudes to their reports of expenditures on different types of gambling.

In spite of growing demands for such information, research on gambling expenditures remains a relatively unexplored topic. In considering the implications of our analysis of gambling expenditure reporting errors, we echo the call made by

several Australian researchers for further investigation (Blaszczynski *et al.*, 1997). Research is badly needed on the social desirability of different types of gambling and the relationship between gambling attitudes and estimates of expenditures. Cognitive research is needed to examine the ways in which respondents interpret questions about expenditures on different types of gambling, as well as the process respondents use to determine their gambling expenditures. Research is also needed to determine whether problem gamblers think about and report their gambling expenditures differently than non-problem gamblers. These avenues of research are particularly relevant to policy makers, since different games raise different amounts of tax revenue.

Our review indicates that not all forms of commercial gambling are alike in the extent of the negative externalities associated with their operation and, further, that substantial challenges lie ahead for researchers trying to improve the validity of estimates of gambling expenditures derived from non-problem and problem gamblers.

Acknowledgements

The research reported here was carried out under contracts with the Iowa Department of Public Health, the Louisiana Gaming Control Board and the University of New Orleans, the Mississippi Council on Problem and Compulsive Gambling, the Montana Gambling Study Commission and the University of Montana Bureau of Business and Economic Research, the New York Council on Problem Gambling, the Washington State Lottery, and the National Gambling Impact Study Commission.

NOTES

1. The equation of problem gambling with heavy gambling is made tacitly rather than explicitly by Grinols and Omorov, through their inclusion of all problem gamblers and pathological gamblers in the proportion of the population they term 'heavy bettors' (see Table 1, Grinols and Omorov, 1996).
2. Six of the seven studies reviewed by Lesieur were directed by the senior author of the present article.
3. For example, the flow of expenditures from states without legal lotteries or casinos but with major population centers located within driving distance of contiguous states that permit such operations is likely to be considerable. Such situations are probably best dealt with by redefining market areas to include contiguous states involved in these markets.
4. Depending on the jurisdiction, these exceptions are most likely due to small group sizes, irregular participation in out-of-state gambling activities, or reporting conventions for gambling revenues in different states.

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