

Toward a paradigm shift in Internet gambling research: From opinion and self-report to actual behavior

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(Received 11 December 2008; revised 20 January 2009; accepted 22 January 2009)

Abstract

Internet gambling is one of the fastest growing gambling-related industries (Christian Capital Advisers 2006). As the Internet gambling industry expands, many stakeholders have created, or are in the process of creating, gambling-related policy. Policy makers promulgating these regulations rely on professional opinions and/or conventional wisdoms related to Internet gambling to guide them because of the lack of sufficient scientific research. There is an ongoing need for quality empirical research to guide the development of public policies that surround Internet gambling. This article summarizes the current state of scientific research about Internet gambling by identifying, describing, and critiquing the available peer-reviewed literature. To identify the peer-reviewed literature related to Internet gambling published between January 1, 1967 and March 7, 2008, we used the search term “Internet [AND] gambling” in the PubMed and PsychINFO search engines. Of the 111 articles identified by our systematic search, only 30 included Internet gambling as a focus. The study methods presented in the abstracts of these 30 articles indicate that none included actual gambling behavior: 10 provided self-reports of gambling behavior using samples not representative of the general population, and 20 of the 30 articles were commentaries. In response to the clarion call to improve the state of psychological research (Baumeister et al. 2007), we have conducted research utilizing actual Internet gambling behavior. In contrast to prior self-report and case study research, our investigations using actual Internet gambling behavior suggest an overall pattern of moderate Internet gambling behavior (LaBrie et al. 2007).

Keywords: *Internet gambling, gambling, safe gaming, assessment, behavior, research methods, paradigm*

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ISSN 1606-6359 print/ISSN 1476-7392 online © 2010 Informa Healthcare Ltd.

DOI: 10.3109/1606635090277974

Introduction

Internet gambling is one of the fastest growing gambling-related industries (Christian Capital Advisers 2006). Although some contend its worldwide growth is less than land-based gambling (Miller 2006), the industry is thriving and expected to continue to grow (Christian Capital Advisers 2006). As the Internet gambling industry expands, many stakeholders have created, or are in the process of creating, gambling-related policy despite the absence of empirical evidence. Many of the policy development efforts rely on professional opinions and/or conventional wisdoms related to gambling, generally, and Internet gambling, specifically. For example, most recently, the United States (US) Congress passed the Unlawful Internet Gambling Act of 2006 (UIGA), which has prevented legitimate Internet gambling businesses from providing gambling opportunities to a vast segment of potential customers (i.e., US citizens). Some negative repercussions of this Act have started to emerge (e.g., hundreds of millions of Euros in capitalization lost (Ruiz 2006), fines on the US by the World Trade Organization to be paid to Aruba (James 2007)); however, both positive and negative consequences are possible. For instance, the UIGA might meet its goal of minimizing online gambling among US citizens and, in turn, minimize unsafe gambling-related activity among US citizens. Alternatively, US citizens might gamble online as much as they would have if it were legal, but use unscrupulous vendors to do so and lose the protections afforded by regulated, legitimate commerce. Because scientific research is not guiding the development of public policies that surround Internet gambling, there is an ongoing need for new empirical research about Internet gambling that can inform public policy. The findings from this research hold the potential to encourage the use of new technology to conduct research that can advance our understanding of Internet gambling, clarify the need for public policy efforts, and define best business practices for the Internet gambling industry.

A shifting horizon: Advancing the assessment of actual behavior

Reliance on self-reports about behavior, as opposed to actual observations of behavior, has become commonplace for researchers. It is likely that this reliance is due in part to the perception by scientists that measurement instruments have become more reliable and improved; in addition, investigators reduce study costs by substituting participant recall for repeated observations over time. Researchers, however, have started to criticize the measurement precision costs that derive from problems associated with self-report and recall methods. Baumeister and co-workers for example, recently noted that, “psychology calls itself the science of behavior... Yet some psychological subdisciplines have never directly studied behavior, and studies on behavior are dwindling rapidly in other subdisciplines” (Baumeister et al. 2007, p.396). The major concern related to the exclusive use of self-reports is that actual behavior and self-reports of behavior are often inconsistent (Baumeister et al. 2007). As with any other pattern of human behavior, it follows that an accurate epidemiology of Internet gambling behavior requires the examination of actual Internet gambling behavior. Studies of actual Internet gambling behaviors might reveal patterns that are inconsistent with self-reported patterns of Internet gambling; the inconsistencies can result from self-reports that underestimate or overestimate the actual behavior. The ability for scientists to shift from self-report to actual behavior represents a methodological paradigm change for the field of gambling studies.

Present study

Currently, there is very little published empirical research about Internet gambling. Consequently, it seems that, with some exceptions, theoretical propositions and opinion papers represent most of the scholarly discussion surrounding Internet gambling. However, a careful and systematic review of the extant literature is necessary to determine the actual pattern of these papers. Therefore, the goal of this study is to identify systematically the extant available scientific literature focusing on the play patterns associated with Internet gambling; in addition, we will illustrate differences between the conclusions generated by distinctive methods (i.e., self-report *vs.* actual behavior) that have assessed the nature of Internet gambling. By providing a systematic approach to the identification of this literature, we also offer a strategy that scientists can replicate in future studies to identify investigative trends associated with Internet gambling research.

Methods and procedures

Our approach to this study was simple, yet systematic. To identify the peer-reviewed literature related to Internet gambling, we used the search terms “Internet [AND] gambling” in the PubMed and PsychINFO search engines; we limited this search to peer reviewed studies published from January 1, 1967 to March 7, 2008. This search strategy reviewed these terms in the titles, abstracts, keywords, and text of published articles from a literature of over 28 million references in PsychINFO and over 17 million references in PubMed. We excluded our own existing Internet gambling publications from this sample for reasons that will be self-evident when we discuss the results of this strategy.

This search strategy identified 111 articles that met the search criteria. We excluded eight book reviews from this total. Our inspection of abstracts from the remaining 103 articles revealed that 56 did not address the conceptual junction of Internet and gambling; most of these discussed Internet addiction, addiction to nongambling game play or gambling problems not related to the Internet. This left 47 articles that addressed Internet gambling. A review of these 47 articles revealed that only 30 of them included Internet gambling as a focus; in the other 17 papers, it was only a tangential interest. We reviewed the study methods of these 30 articles and classified them according to the methodological approach. We classified studies that did not present any original quantitative empirical data about Internet gambling behavior as commentaries; these commentaries included studies that used so few case reports (i.e., < 5) that these publications were not representative of the population of cases from which these were drawn. We classified studies with original quantitative empirical data about Internet gambling behavior according to the study methods and procedures: Self-report surveys or studies of actual Internet gambling behavior.

Results

As Table I shows, we can classify two-thirds of the 30 articles identified by our systematic search as commentaries and the remaining third as self-report surveys. Of the 20 commentaries, 16 were comments or reviews without data, two were case reports that included less than five patients, and two were descriptions of Internet site characteristics. Of the 10 self-report surveys, none included representative samples from the general population. All of these self-report surveys employed convenience samples: four sampled

Table I. Studies identified by systematic search of internet gambling research (Excludes published and under review studies about actual Internet gambling behavior from the authors).

Study	Classification	Sample
(Griffiths 1996)	Commentary	Not applicable
(Griffiths 1999)	Commentary	Not applicable
(Griffiths 2003a)	Commentary	Not applicable
(Griffiths et al. 2006)	Commentary	Not applicable
(Griffiths and Wood 2000)	Commentary	Not applicable
(Griffiths and Parke 2002)	Commentary	Not applicable
(Hayer and Meyer 2003)	Commentary	Not applicable
(Kerber 2005)	Self-report	Convenience sample of college athletes at three sites (N = 636)
(King 1999)	Commentary	Not applicable
(King and Barak 1999)	Commentary	Not applicable
(Ladd and Petry 2002)	Self-report	Convenience sample of uninsured, underprivileged medical and dental patients (N = 369)
(Laffey 2005)	Commentary	Not applicable
(Larner 2006)	Commentary	Case study (N = 1)
(Messerlian et al. 2004)	Commentary	Not applicable
(Miller 2006)	Commentary	Not applicable
(Mitka 2001)	Commentary	Not applicable
(Nower 2003)	Commentary	Not applicable
(Petry 2006)	Self-report	Convenience sample of uninsured, underprivileged medical and dental patients (N = 1000)
(Petry and Mallya 2004)	Self-report	Convenience sample of university health center employees (N = 906)
(Petry and Weinstock 2007)	Self-report	Convenience sample of college students (N = 904)
(Sevigny et al. 2005)	Commentary	Description of Internet casino sites
(Shaffer 1996)	Commentary	Not applicable
(Smeaton and Griffiths 2004)	Commentary	Descriptions of UK Internet gambling sites
(Watson et al. 2004)	Commentary	Not applicable
(Wong et al. 2007)	Commentary	Case studies (N = 4)
(Wood et al. 2007a)	Self-report	Convenience sample of student Internet poker players (N = 422)
(Wood and Williams 2007)	Self-report	Convenience sample of Internet gamblers (N = 1920)
(Wood et al. 2007b)	Self-report	Convenience sample of Internet gamblers (N = 1920)
(Woodruff and Gregory 2005)	Self-report	Convenience sample of Detroit casino players (N = 200)
(Woolley 2003)	Self-report	Convenience samples of Australian consumers (N = 2948)

Internet gamblers, two sampled free care medical and dental patients, one sampled college students, one sampled college athletes, one sampled casino patrons, and one sampled employees of a university health center. None of the articles identified by our systematic search (other than our own) were studies of actual Internet gambling behavior. In the discussion that follows, the studies reporting actual Internet gambling behavior originate from our collaborative research program with *bwin* Interactive Entertainment, A.G.

Commentaries about Internet gambling behavior

Existing commentaries debate and speculate about the impact and influence that Internet gambling has on the public health. For example, in an attempt to clarify nomenclature,

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Shaffer (1996) and Shaffer et al. (2000) argue that the Internet, like other inanimate objects, does not have inherent addictive properties; the Internet is virtual space between computers. Addiction is the result of a relationship between people and objects or activities of interest. Computers, or the information that computers deliver, can represent these objects, but the Internet cannot. However, some commentaries speculate that Internet gambling is a public health hazard that, by its ability to increase access to consumers, has led to an increase in the prevalence of problem gamblers (Griffiths 1996, 1999, 2003a, 2003b; King 1999; King and Barak 1999; Griffiths and Parke 2002; Griffiths et al. 2006). In particular, commentaries speculate that Internet-based gambling's structural characteristics (e.g., rapid event frequency, high pay out ratio) encourage excessive betting. However, many of the cited Internet risk factors also exist among nonInternet-based gambling features (e.g., slot machines, video poker machines, Keno) and do not necessarily represent added risk. Commentaries also speculate that the potential social isolation of Internet gambling consumers limits the use of safeguards that might be able to reduce gambling-related problems; this difficulty, in turn, might lead to increased access by youth, unlimited access to cash flow, and gambling in inappropriate places (e.g., gambling in the workplace (Griffiths 1999; King 1999; King and Barak 1999; Griffiths and Wood 2000; Mitka 2001; Nower 2003; Messerlian et al. 2004; Griffiths et al. 2006)). Several commentaries recognize the need for empirical studies to substantiate these speculations (Griffiths and Parke 2002; Hayer and Meyer 2003). The two anecdotal case studies about Internet gambling among Parkinson's patients do not serve to increase the evidence base (Larner 2006; Wong et al. 2007): these anecdotal studies confound variables that provide alternative explanations for the apparent association between gambling-related problems and dopamine agonist pharmacotherapy. Two other commentaries suggest that few sites provide safeguards for Internet gambling consumers. Some sites even use unscrupulous practices (e.g., inflated payout rates during the demo period) to lure customers (Smeaton and Griffiths 2004; Sevigny et al. 2005). Numerous problems that result from unregulated Internet gambling suggest it is necessary to improve regulatory systems for Internet gambling websites (Watson et al. 2004; Laffey 2005; Miller 2006). However, empirical data is necessary to understand the existing patterns of Internet gambling behavior. In short, speculations and commentaries about Internet gambling behavior can stimulate the development of hypotheses and models, however, these publications are of limited utility to help develop and test parameters for safer Internet gambling.

Self-reported Internet gambling behavior

Self-report data provide potentially useful descriptive information about the attitudes of Internet gamblers. For example, one study indicates that land-based casino patrons who gamble on the Internet tend to be younger, more educated, and use the Internet more regularly for other nongambling purposes compared to land-based casino gamblers who do not use the Internet for gambling (Woodruff and Gregory 2005). In addition, Internet gamblers report preferring the convenience of Internet gambling to land-based casinos (e.g., Wood et al. 2007a, 2007b). One study found that wagering on racing and sports betting were the most commonly reported Internet gambling activities (Woolley 2003).

Self-report studies provide a very wide range of Internet gambling prevalence estimates across a variety of special population segments. For example, Petry and Mallya's (2004)

self-report survey of 906 university health center employees estimated a 1.2% prevalence rate of Internet gambling. Studies of patients seeking free or reduced cost medical or dental care surveyed show self-reported rates of ever having gambled using the Internet as 8.1% among 369 patients (Petry et al. 2004) and, in another study, 6.9% of 1000 patients (Petry 2006). Self-report studies of students provide higher prevalence rates of Internet gambling. For example, prevalence of Internet gambling lifetime rates were 23% among undergraduates in one study (Petry and Weinstock 2007), and 10% among college athletes in another study (Kerber 2005); one study found that among college students the prevalence of online poker playing at least twice a week was 33% (Wood et al. 2007a). It is possible that students' self reports suffer from recall bias because factors other than the internal processes associated with their actual behavior influence their perceptions of personal behavior (Nisbett and Wilson 1977; Baumeister et al. 2007).

Authors of several self-report studies (Kerber 2005; Petry and Weinstock 2007; Wood et al. 2007a; Wood and Williams 2007) claim that their study findings demonstrate higher rates of gambling-related problems among Internet gamblers than nonInternet gamblers. While Internet gambling might be associated with higher rates of gambling problems, to date, these studies do not demonstrate a causal relationship between Internet gambling and gambling-related problems. These cross-sectional surveys are point-in-time estimates that cannot reliably predict cause-effect relationships. And, as stated previously, reliance on participant self-report hinders the ability to assess Internet gambling behavior accurately.

In addition to the limitations of self-report, self-selected participation and low response rates (e.g., 54% for Kerber (2005) 33% for Petry and Mallaya (2004)) limit the representativeness of Internet gambling survey findings. Our systematic review failed to identify two prevalence studies (Welte et al. 2002; LaBrie et al. 2003) that included Internet gambling information. Our search failed to identify these studies because they did not have the key search terms required for inclusion in this research. Nonetheless, these studies used systematic sampling procedures rather than relying on convenience samples, increasing the likelihood that the sample under study is representative of the population from which it was drawn. One of these two studies (LaBrie et al. 2003), utilizing information from 10,765 students selected from the 119 scientifically identified schools comprising the 2001 Harvard School of Public Health College Alcohol Study, found that 1.9% of responding students participated in Internet gambling a few times a year and 0.3% participated in Internet gambling once or more a week. These prevalence estimates suggest that studies of college students using convenience samples (Kerber 2005; Petry and Weinstock 2007; Wood et al. 2007a) have overestimated Internet gambling among this population segment. In the only existing prevalence study of the US adult general population (Welte et al. 2002) that included data about Internet gambling, a telephone survey of 2340 nationally representative US adults yielded a 0.1% prevalence rate of Internet gambling during the past year. However, though these studies were more representative of the populations in question, they still suffer from the previously mentioned limitations that are associated with self-report studies.

The wide variation among all of the prevalence estimates suggests that the current rate of Internet gambling might not be reflecting the same target behavior, or that these estimates simply are unreliable as a result of measurement or recall bias. Consequently, future research will need to employ improved assessment and sampling procedures.

The assessment of actual Internet gambling behavior

To address the dearth of scientific information about Internet gambling, researchers need to employ investigative strategies that can improve the prevailing methods used to assess Internet gambling behavior. Internet gambling websites provide a unique research opportunity because of their ability to track site visitors as they are gambling. Research taking advantage of these comprehensive data resources, therefore, has the potential to provide an evidence-based foundation for the study of the nexus between the Internet and gambling. Data derived from Internet sources (1) can monitor precisely both individual-level and population-level characteristics of online gamblers and (2) has the capability of installing and testing empirically derived intervention efforts.

Recognizing the opportunity to use Internet gambling technology for research, *bwin* Interactive Entertainment AG (*bwin*), one of Europe's largest gambling sites, and the Division on Addictions (DOA) entered into a seminal research collaboration relying substantially on a database of *bwin* subscribers' gaming activity. By centering a research agenda on *bwin* data, the DOA could study the emergence of Internet-related addiction and take advantage of the potential for new technology to alleviate or prevent addiction. Despite these potential advantages, using industry associated data, and industry-academic collaborations can be associated with a variety of potential problems. These issues must be addressed from the outset of scientific collaboration. Before discussing the value of Internet-based data tracking for gambling studies, we will take a brief discursion to describe the nature of the *bwin*-Division on Addictions association.

bwin officials initiated the relationship with the Division on Addictions. The founder and co-director of the company approached the Division with the proposal that it might be possible to identify high risk gamblers early in their involvement with Internet gambling because all of their activities can be monitored and tracked. This idea was compelling and we recognized that this kind of monitoring opportunity had never before been available to gambling researchers. This led to the development of a contract between *bwin* and Harvard Medical School to conduct research focusing on Internet gambling. As is customary with all Harvard Medical School industry related projects, the contract had to satisfy university related policy for such collaborations. Harvard is unwavering in its requirements for academic freedom. Therefore, *bwin* had to agree to yield all control over publications, project review, and the scientific conduct of the research. Effectively, there was no negotiation between the industry and Harvard Medical School; *bwin* simply had to meet Harvard Medical School's demands. Once the research design satisfied institutional review board requirements to protect the confidentiality of the data and the data transfer and storage requirements, *bwin* provided the cohort of subscriber data without any strings attached. Practically, this meant that the Division was free to investigate as necessary and publish without industry review, regardless of the nature of the findings. As with all Division research, academic freedom is central and industry partners have no say about the conclusions drawn. We believe these working conditions are essential for a transparent and productive relationship between industry and science.

Before describing the findings of the studies from this collaboration that assess actual Internet gambling behavior in detail, it is important to underscore the unprecedented contribution that data tracking actual Internet gambling behavior brings to the state of Internet gambling research. *bwin* records every keystroke of every person that subscribes to the *bwin* website. At the beginning of this project, we defined and began tracking a longitudinal cohort of more than 40,000 subscribers from more than 80 countries. At this writing, we have created multiple datasets, and the original cohort has been followed for

more than 3 years. The published findings that derived from our analysis of the original longitudinal cohort generally are based on the first 2 years of data. During that time, 47,134 participants made 38 million bets on sporting propositions totaling €28.6 million; these bets did not include poker, casino-like game play and other regularly changing *bwin* propositions. The computer resources integral to the Internet permit a new research paradigm that can revolutionize data collecting: These resources allow us to collect the exact betting behavior of tens of thousands of subscribers from many locations around the world. This data includes details about the different types of sports bets, fixed odds bets (i.e., bets made on the outcomes of sporting events or games in which the amount paid for a winning bet is set by the betting service) and live-action bets (i.e., bets made on propositions about outcomes within a sporting event such as which side will have the next corner kick or whether the next tennis game in a match will be won at love by the server).

Research using data reflecting actual Internet gambling behavior has several methodological advantages compared to prior research about Internet gambling behavior. Research utilizing actual online behavior provides objective, detailed information about betting behavior, and the conditions under which gamblers place wagers. This strategy avoids the potential biases (e.g., memory-errors, self-presentation strategies, simple miscomprehension, and the phrasing of survey questions) that often emerge when research relies on participant self-report of past betting behavior (LaPlante et al. 2007). In addition, by utilizing a longitudinal study design, research from this collaborative is able to examine prospectively gambling behavior patterns that precede the development of excessive or maladaptive gambling behavior among *bwin* subscribers. This evidence-based approach permits us to identify effective prevention, diagnostic, and treatment strategies. Longitudinal studies often have provided landmark research findings that serve to improve public health interventions. For example, the Framingham Heart Study, a prospective, longitudinal study of more than 5000 healthy participants, helped to identify major cardiovascular disease risk factors and has led to vast improvements in public health strategies for cardiovascular disease prevention (Dawber and Stokes 1956). Similarly, analyses of this longitudinal cohort of *bwin* subscribers will allow researchers to gain a greater understanding of Internet gambling behavior and the factors that might influence the development and maintenance of gambling-related problems. The availability of this data source has provided new research opportunities to study the epidemiology of Internet gambling and responsible gambling practices with increased statistical confidence. Thus, this methodology represents a paradigm shift in the way scientists study Internet gambling.

Toward an accurate assessment of the epidemiology of Internet gambling behavior

Our research utilizing data about actual Internet gambling behavior has produced seven peer-reviewed publications (LaBrie et al. 2007, 2008; Broda et al. 2008; LaPlante et al. 2008, in press; Nelson et al. 2008; Peller et al. 2008), and other articles that are at various stages in the publication pipeline (e.g., Xuan and Shaffer, in press). We conducted seven empirical research studies about actual gambling behavior (LaBrie et al. 2007; Broda et al. 2008; LaBrie et al. 2008; LaPlante et al. 2008; Nelson et al. 2008; LaPlante et al. in press; Xuan and Shaffer in press) by assembling a prospective, longitudinal cohort of *bwin* subscribers' actual betting behavior in real time. The studies utilizing data about actual Internet gambling behavior provide a clear lens to examine Internet gambling behavior that is not clouded by the recall or sampling biases often evident in prior research.

Overall, findings from these studies of actual Internet gambling behavior (Broda et al. 2008; LaBrie et al. 2007, 2008; LaPlante et al. 2008, in press; Nelson et al. 2008; Xuan and Shaffer in press) contradict the speculation that most online gamblers exhibit excessive gambling behavior. The evidence shows instead that the vast majority of *bwin* subscribers engage in moderate sports betting behavior (e.g., for the median level players, 2.5 fixed odd sports bets of €4 each bet, every fourth day, or approximately US \$5.30). A comparison of betting behavior among the different types of games available on the *bwin* site shows varying patterns of wagering. For example, subscribers lost more money on sports gambling than casino gambling. The typical aggregate expense (losses) for casino players is higher than for sports bettors. This is not because casino has greater losses. In fact, the house odds for casino play are less than half the house cut on sports betting. The greater aggregate is because casino betting is more rapid cycling and people place more bets. This finding is consistent with previous literature showing that people involved in casino gambling exhibit riskier behaviors and more frequently present for treatment than sports bettors (Shaffer et al. 2004; LaPlante et al. 2006). Patterns of sports betting varied for fixed-odds (i.e., bets made on the outcomes of sporting events or games in which the amount paid for a winning bet is set by the betting service) and live-action bets (i.e., bets made on propositions about outcomes within a sporting event, such as which side will have the next corner kick or whether the next tennis game in a match will be won at love by the server). Advocates and policymakers have speculated that live-action betting leads to more excessive gambling behavior (Griffiths 1999; Kong et al. 2008). Although empirical evidence from this analysis shows that subscribers placed fewer bets and lost less money when placing live-action bets (i.e., median of 2.8 wagers of €4 every fourth day during the median duration of 6 weeks at a loss of 18% of the amount wagered) than when placing fixed-odds bets (i.e., 2.5 bets of €4 every fourth day during the median 4 months from first to last bet at a loss of 29% of the amount wagered). Although the *bwin* cohort of subscribers was predominantly male, we conducted some analyses to examine gender differences in betting behavior. On average, results show that women's betting behavior was very similar to men's, but that women bet on more days and over a shorter period of time (LaBrie et al. 2007). It is worth noting that because *bwin* markets itself primarily as a sports betting website, the *bwin* subscriber population might be more likely to engage in sports betting. Thus, findings from these studies might not be generalizable to all Internet gamblers.

LaPlante et al. (2008) and Xuan and Shaffer (in press) completed studies of *bwin* subscribers that also used longitudinal methods with actual betting behavior. LaPlante et al.'s (2008) study of 46,339 *bwin* sports bettors illustrates an overall healthy exposure and adaptation pattern of betting behavior for the entire sample during a period of 18 months (i.e., short term increases in activity followed by quickly developing declines in population participation, number of bets, and size of stakes). Separate analyses of the most involved bettors (i.e., top 1–5% of the sample) show that trends of more excessive gambling behavior are evident for a very small minority of subscribers (LaBrie et al. 2007, 2008). The most involved bettors had increasing stakes and bets for live-action betting over time (LaBrie et al. 2007).

Xuan and Shaffer's (in press) paper examines the multiple trajectories of gambling behavior among the cohort of *bwin* live-action bettors from February 1, 2005 to June 30, 2006 who reported closing their accounts because of gambling-related problems ($N=226$). These bettors who self identified as problem gamblers exhibited more signs of excessive gambling behavior (i.e., increasing monetary involvement and increasing loss) and more risk averse betting behavior than bettors who did not self identify as problem gamblers. The authors hypothesize that this behavior represents the self-identified problem gambler's

attempted by to regulate excessive gambling behavior. To gain a greater understanding of longitudinal trends for different types of Internet gambling behavior, we need more research examining the stability of these trends among different samples of bettors (e.g., groups with various risk and resilience gradients).

The assessment of actual Internet gambling using data from Internet websites provides new opportunities to improve this evidence base. In particular, studies evaluating the use of limit setting techniques (i.e., Nelson et al. 2008; Broda et al. 2008) provide researchers the opportunity to evaluate the efficacy of various harm reduction techniques.

Discussion

Although the field of Internet gambling is still in its infancy, we now have the technological ability to study real time gambling and all of its attendant details. This new technology represents a paradigm shift for both (1) the conceptual frameworks that organize how we think about information and each other (Kipnis 1991) and (2) research methods. This new technology provides researchers with the opportunity to conceptualize new and different research from the studies that have been available. This new research can focus on actual human behavior in addition to self-report, offering the opportunity to implement rigorous behavioral methodologies. Taken together, this technology and the opportunity to study actual behavior instead of only self-reported behavior represents a fundamental methodological shift in gambling studies that was not available in laboratory or land-based gambling settings. This scientific revolution already has yielded findings about Internet gambling that are distinct from earlier speculations or self-report based-research. For example, our findings derived from actual Internet gambling raise important questions about the utility and validity of self-report-based gambling research. Furthermore, this new body of research advances our understanding about the constructs and nomenclature now associated with excessive Internet gambling behavior. To illustrate, the current clinical definition of pathological gambling (American Psychiatric Association 1994), with respect to “persistent and recurrent” behavior, derives from the self-report of self-identified problem gamblers. The emerging body of literature using actual Internet gambling behavior suggests that these patterns might be different from those reported by treatment seekers, encouraging us to test these constructs empirically. In addition, studies of actual Internet gambling behavior assist with clinical case identification by providing behavioral evidence that will help clinical investigators minimize classification errors. Ultimately, it will be necessary to integrate evidence from studies of actual gambling behavior with self-report data that reflects the experience of gambling (e.g., perceptions and symptoms) to allow us to develop a more complete picture of Internet gambling behavior. Increased ability to understand the complexity and trajectory of gambling patterns also has important practical implications for developing strategies to regulate Internet gambling. For example, research identifying specific mediators and moderators of excessive Internet gambling provides policymakers and public health practitioners with an improved body of literature on which to base decision-making. This improved evidence base will guide the development of policies and public health interventions that will promote safer Internet gambling. Thus, continued research about Internet gambling utilizing the study of actual behavior has broad public health implications.

Limitations

This assessment of the peer-reviewed literature that focuses on Internet gambling has some important limitations. Although we conducted a systematic review of the literature, use of different keywords or search engines might have resulted in a different selection of articles. We present a critical discussion of study methodology (e.g., assessment techniques, sampling procedures) that we considered pertinent to the state of Internet gambling research; however, other researchers might have interpreted these studies differently.

The studies discussed in our systematic review evidenced important limitations. Commentaries do not provide any empirical evidence about Internet gambling. The self-report studies contain empirical data about Internet gambling behavior; however, the validity of these self-reported behaviors is potentially biased (e.g., recall bias). Researchers used convenience samples for many of these self-report surveys, and this strategy compromises the reliability of prevalence estimates and our ability to generalize the findings. Studies that utilize actual gambling behavior also have limitations. For example, these data still rely on subscriber self-reported demographic characteristics. Several people might use an account or a single user might be making bets for others. Subscribers might be engaging in Internet gambling on multiple sites, including *bwin*. Therefore, the research based on actual gambling might not capture fully all of the features associated with subscriber betting behavior. Although *bwin* subscriber betting behavior is likely representative of betting behavior, these studies do not describe the players' clinical characteristics, perceptions, or the social consequences associated with their betting behavior. There are several other potentially important limitations associated with Internet-based gambling research. First, as we have noted elsewhere (LaBrie et al. 2007; Xuan and Shaffer in press), we currently have no means test, that is, no data about subscriber income. Consequently, it is difficult to know which subscribers might be betting beyond their means. Second, due to the absence of a means test and other psychosocial information about the meaning and consequences of gambling (e.g., debt, family/social problems, legal problems, etc.), we have little information to base any clinical judgments about the impact of Internet gambling on the lives of individual subscribers. Finally, it is reasonable to expect that Internet gamblers might also gamble both online and at casinos or other gambling venues. Therefore, we cannot estimate the potential synergistic effects of Internet and nonInternet gambling. Consequently, estimates of how much Internet subscribers gamble might not be accurate.

Next steps: Research to increase understanding of Internet gambling behavior

Despite advances in the methodology used to assess Internet gambling behavior (e.g., use of actual gambling behavior, longitudinal studies), current gaps in knowledge about Internet gambling behavior demand further empirical research. By introducing the Internet Gambling Study Act of 2007, US policymakers have acknowledged the need for empirical research to guide policymaking decisions. There are several areas related to Internet gambling that require further inquiry. For example, research examining the psychological characteristics of subscribers in more detail (e.g., functionality measures, mood) is an important next step towards understanding how to create parameters for safer Internet gambling. Further research also can improve the efficacy of product safety parameters for Internet gambling, by studying the factors that mediate and moderate safe play. For example, because research has not addressed comprehensively all of the components of the Epidemiologic Triangle, it is important to develop more research to address the social

settings with which people gamble (Peller et al. 2008). In addition, Internet gambling research will need to pinpoint factors that moderate exposure and adaptation effects across time and space to gain a better understanding of ways to create environment parameters for safer gambling behavior (LaPlante et al. 2007; Peller et al. 2008). Use of standardized assessment tools (e.g., Regional Impact of Gambling Exposure (Shaffer et al. 2004)) can facilitate quantified measurement of gambling exposure effects. Furthermore, the development of research that recognizes the dynamic relationship between host, agent, and environment holds the potential to generate new approaches for product safety. For example, research shows that time spent gambling on the Internet can be as debilitating to subscribers' daily functioning as the amount of money they spend gambling (Nelson et al. 2008). Therefore, interventions designed to limit Internet gambling involvement might help some people with gambling-related problems. However, future research will need to integrate observations of behaviors with self-reports of symptoms to optimally target interventions.

Advances in research about Internet gambling behavior will require collaborative partnerships between researchers, operators, and policymakers (Peller et al. 2008). For example, allowing researchers full access to data about subscribers' actual betting behavior and characteristics requires Internet gambling operators to participate in responsible gambling collaboratives that bring key stakeholders together. This empirical data can, in turn, help policymakers to enforce regulations that promote safer gambling behavior for all Internet gambling subscribers.

Acknowledgements and Disclosures

bwin Interactive Entertainment, AG provided primary support for this article. The Division also receives funding from the National Center for Responsible Gaming, National Institute of Mental Health (NIMH), National Institute of Alcohol Abuse and Alcoholism (NIAAA), National Institute on Drug Abuse (NIDA), the Massachusetts Council on Compulsive Gambling, the State of Nevada Department of Public Health, the Las Vegas Sands Corporation, the Massachusetts Family Institute, and others. The authors of this article take the responsibility for its content and do not personally benefit from their work with gaming-related companies (e.g., stocks, etc.).

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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