

Review of problem gambling and comorbid disorders and behaviours: Final Report

Nigel E. Turner, Ph.D.
Peter Ferentzy, Ph.D.

Address for correspondence:
Nigel Turner, Ph.D.
Social, Prevention and Health Policy Research Department
The Centre for Addiction and Mental Health
33 Russell St.
Toronto, Ontario, Canada M5S 2S1
Tel: (416) 535-8501 ext 6063; Fax:(416) 595-6899
E-mail: nigel_turner@camh.net

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Abstract

This paper was initiated in response to an RFA identifying a need to summarize the literature regarding the comorbidities of problem gambling. Currently a lot of information exists on the topic of comorbidities, but it had not been summarized in a convenient manner that would facilitate further exploration in this area. The objective of the proposed study was to provide a review and synthesis of available knowledge on the association between problem gambling and workplace absenteeism, suicide, mental health disorders, and addictions (in particular smoking).

In this paper we report on the number of papers that have examined evidence regarding the link between problem gambling and four major areas of comorbidities: (1) smoking, (2) substance abuse, (3) psychiatric comorbidities, and (4) suicide. We were unable to find very much information of work absenteeism.

In addition, the project also involved contacting various treatment centres in order to determine the extent to which assessment and/or treatment of problem gambling takes into account comorbid disorders and behaviours.

Key words: problem gambling; comorbidity; concurrent disorders; literature review.

Executive Summary

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In this study, we report on the number of papers that have examined evidence regarding the link between problem gambling and four major areas of comorbidity: (1) smoking, (2) substance abuse, (3) psychiatric comorbidities, and (4) suicide. We were unable to find very much information on work absenteeism.

In addition, the project involved contacting various treatment centres in order to determine the extent to which assessment and/or treatment of problem gambling takes into account comorbid disorders and behaviours (N = 40).

SUD findings.

- We examined 137 articles on substance abuse.
- 67 of these studies examined treatment samples.
- 41 were studies of the general population (e.g., telephone surveys).
- 17 included other types of samples.
- High correlations between PG and SUD are well established.
- The relationship has been shown in PG samples, SUD samples, as well as studies of other clinical populations.
- PGs with SUD are often more severe cases.
- Alcohol appears to be the most common SUD amongst gamblers.
- The percentage of alcoholic comorbidity is particularly strong in the US where alcohol is served for free to problem gamblers.

Psychiatric Comorbidities

- We examined a total 116 papers that addressed the relationship between problem gambling and various comorbid psychiatric disorders.
- 55 were studies of clinical populations.
- 41 were studies of the general population.
- 20 were other types of samples.
- The most frequently studied comorbidity was depression, which was found in 64 of the papers.
- Nearly all studies that examined depression found a positive relationship with PG.
- 43 studies examined impulsivity in one form or another; of these 6 examined ADHD.
- Evidence for bipolar or manic disorder was examined in 14 papers.
- Anxiety was examined in 34 studies. In nearly all cases the relationship was positive.
- OCD was examined in 15 studies, but the results were mixed with some studies finding no link.
- Personality disorders were examined in 19 studies. The most frequently cited personality disorder correlated with problem gambling was antisocial personality disorder.

- Evidence for comorbidities in general are very strong, but the strength of the findings depends on how many studies examined a particular issue; the link with depression and anxiety for example are well documented, but the evidence is weaker for some other disorders (e.g., ADHD, psychosis).

Smoking findings

- We examined a total of 54 studies examining smoking and PG.
- 18 studies of clinical samples
- 26 studies of the general population
- 9 studies of other types of samples (e.g., recruited through advertisements, prison studies, casino employees)
- A great deal of our information came from comorbidity studies that did not target smoking directly.
- Smoking amongst problem gamblers is more common than in the general population.
- Smoking is also more common among persons with SUD and other comorbid conditions associated with PG, so it would be premature to identify a strict relation between smoking and PG.

Suicide

- In total 51 papers discussed the relationship between gambling problems and suicide. These papers were divided into four general types.
- We found 8 papers on actual cases of suicides.
- We found 29 studies that examined suicidal thoughts or suicide attempts with clinical and helpline samples.
- We found 11 studies of suicidal thoughts in the general population.
- We found 3 studies of statistics on suicide rates in a given area that examined if suicide rates were higher in areas with casinos. The results depend on whether or not one includes visitors in the population.
- In most clinical and general population papers a link between suicide and gambling was found. However, a small number of papers reported no link.
- In the papers reviewed in this study, the average number of problem gamblers reporting suicidal thoughts ranged from 2% to 81% with an average of 39.7% (SD = 22.0%). Suicide attempts ranged from 3% to 40% with an average of 19.4% (SD = 12.9%).
- Clinical studies reported higher levels of suicidal thoughts and suicide attempts than general population studies.

Survey results

- The results of the counsellor survey found that counsellors take a variety of approaches in dealing with problem gambling.
- Nearly all of the counsellors reported scanning¹ for suicidal thoughts, depression, drug abuse and alcohol abuse.
- Very few reported scanning for ADHD.

¹ Counselors do not necessarily use a formal screen, but will scan for signs of disorders during their assessment or treatment procedures.

- Most have specific plans for dealing with comorbidity and they take an individual approach to dealing with the problem. The most common approach was to refer the client to a specialist or other agency.
- All of the respondents endorsed teaching coping skills, relapse prevention, motivational interviewing, and solution focused problem solving.
- Twelve step and spiritual approaches were endorsed least often..

Summary

- The results indicate that problem gambling is related to a number of psychiatric comorbidities.
- Genetic and longitudinal twin research suggests that some of this comorbidity is linked to genetic vulnerability.
- The most common comorbidities appear to be alcoholism, nicotine dependence, and depression.
- It is likely that the cause and effect relationship for these various disorders is complex with some coming before problem gambling, and others resulting from the consequences of problem gambling.
- Comorbidities represent a very vulnerable population for developing problem gambling as well as a variety of other disorders.
- More research is needed to determine cause and effect relationships

Introduction

Purpose

The purpose of this study was to organize and summarize information on comorbidities of problem gambling. Prior to our efforts, a lot of information existed on the topic, but it had not been summarized in a convenient manner that would facilitate further exploration in this area.

The objective of this study was to provide a review and synthesis of available knowledge on the association between problem gambling and workplace absenteeism, suicide, mental health disorders, and substance addictions (in particular smoking). In addition, the project involved contacting various treatment centres in order to determine the extent to which assessment and/or treatment of problem gambling takes into account comorbid disorders and behaviours in Ontario and other jurisdictions (national and international). All objectives have been fulfilled, save for one: information on PG and workplace absenteeism was scant, leaving us with practically nothing with which to work.

Significance

Many people who have a gambling problem also suffer from one or more concurrent disorders. However, clients often fail to disclose other addictions and psychiatric problems (Freimuth, 2005; Schneider et al, 2005). This is particularly troubling for criminal offenders who may feel that disclosure of any additional problems may hinder their release from prison or add to their conditions for probation (Turner & Preston, 2011). Although many studies have examined the topic, the literature had to be reviewed and summarized in order to facilitate an incremental accumulation of an understanding of the topic. For example, many gamblers also suffer from depression, but how common is this problem? Are figures available that estimate the magnitude of the association? What about psychotic behaviours? Similarly, research has shown that addictions are more common amongst problem gamblers. Smoking for example is well known to be more common amongst problem gamblers than in the general population. In order to move forward we need a comprehensive review of the relationship between psychiatric disorders and PG. The information provided in this study should facilitate treatment planning by alerting clinicians to possible additional issues they may need to deal with.

This research should make an important contribution to the problem gambling field by summarizing relevant information. Before any new studies are carried out, we need to first consolidate what is already known. Summarizing existing information will facilitate the accumulation of knowledge, help to avoid duplication and, above all, permit us to move from a state of knowledge to the application of that knowledge. From a practical point of view, a better understanding of co-occurring disorders will facilitate improved delivery of services, and help therapists be more selective and more focused during assessment.

Overview of PG and assorted comorbidities

Pathological gambling is an addiction-like mental disorder marked by a preoccupation with gambling, chasing losses, loss of control, and even an increasing tolerance for higher wagers. Often stemming from a desire to escape stress, its ramifications can include but are not limited to: jeopardising relationships, financial hardship, and criminal activity both to support one's gambling and to pay gambling related debts (American Psychiatric Association, 2000). Problem gambling is a term that is often used to refer to both pathological (severe problem) and moderate sub-clinical levels of problems. Roughly 1% of the population reports having a gambling pathology in the past year and another 2.8% report having a subclinical level of problems (Shaffer, Hall, & Vander Bilt, 1999).

Problem gambling frequently co-occurs with a number of other psychiatric disorders such as depression (Bagby, et al., 2008), anti-social personality disorder (Cunningham-Williams, et al., 2000), and post-traumatic stress disorder (Specker, et al., 1996). Turner, Jain, Spence, and Zangeneh (2008)

found that 30% of the variation in the severity of problem gambling symptoms could be attributed to mood and anxiety related problems. Turner, Ialomiteanu, Paglia-Boak, and Adlaf (2011) found that student problem gamblers scored particularly high on social dysfunction, and also had elevated scores on depression, delinquency, and alcohol abuse. Slightly more than a third of the heavy gamblers in their study had Audit scores of 8 or more, indicating hazardous drinking. In addition, heavy gamblers had particularly low scores on self-esteem compared to the other clusters of youth in their study. Cook et al., (2010) found that youth problem gamblers were significantly more likely to report substance-related problems, mental health problems, psychological distress, and delinquency after controlling for age and sex. Delinquent behaviours were also common among problem gamblers, including theft and selling drugs.

Gambling severity is positively correlated with suicidal ideation and suicidal attempts (Battersby, Tolchard, Scurrah, & Thomas, 2006; Newman & Thompson, 2007). Alarming, among those who commit suicide, individuals who have a gambling problem are less likely to have utilized mental health services than those who do not have a gambling problem (Seguin et al., 2010). Cook et al., (2010) found that problem gamblers were 4 times more likely than non-problem gamblers to have seriously considered committing suicide, and nearly 18 times more likely to report a suicide attempt. Hodgins, Mansley, and Thygesen (2006) studied a community sample of 101 individuals with gambling problems and found that 38.6% reported having thoughts of suicide, and 32.7% reported a suicide attempt.

Turner et al., (2009) and Turner and Preston (2011) examined problem gambling and mental health problems in incarcerated offenders. They found that problem gambling was much more common in the offender population than in the general population. Turner and Preston (2011) also included psychometric measures that were administered to all offenders (N = 436) and the results did reach significance for depression ($\rho = .23$, $p < .01$), social anxiety ($\rho = .18$, $p < .01$), general anxiety ($\rho = .12$, $p < .05$), childhood attention deficit symptoms ($\rho = .14$, $p < .01$), current attention deficit symptoms ($\rho = .24$, $p < .001$), drug abuse ($\rho = .30$, $p < .001$), and alcohol abuse ($\rho = .23$, $p < .01$). These results suggest that even compared to the general offender population, pathological gamblers have more psychiatric problems.

The rates for substance use disorders among treatment-seeking pathological gamblers are also significantly higher than general population rates (Maccallum & Blaszczynski, 2002). The lifetime rate of substance use disorders among pathological gamblers ranges from 25%-63% (Crockford & el-Guebaly, 1998). Cigarette smokers are three times as likely to become problem gamblers as non-smokers (Griffiths, et al., 2010). Also, gamblers who smoke daily are more likely to have a history of substance use disorder, spend more money on gambling, and report less control over their gambling than gamblers who do not smoke daily (Petry & Oncken, 2002).

There is also some preliminary evidence that certain types of gambling may be associated with higher rates of workplace absenteeism. Research suggests that video poker poses more of a risk of work absenteeism for gambling in comparison to Bingo gambling or Horse racing clubs (Oliveira & Silva, 2001).

Although the association between problem gambling and other disorders and behaviours is well documented, far less is known about the nature or causal direction of the associations. The high degree of comorbidity has led some researchers to propose that mental health services be encouraged to integrate with screening, assessment, and treatment of problem gambling (Seguin et al., 2010).

However, the bulk of the research that has been conducted has been of a correlational nature that measures concurrent problems, rather than causes. In this study, the establishment of causal relations between assorted behaviours and conditions presented a serious challenge. Not much is known about the clinical issues and co-occurring psychiatric disorders among smoking and non-smoking pathological gamblers, though one study did find smoking among treatment seeking PGs to be associated with many clinical issues, most notably more severe gambling problems (Grant, Kim,

Odlaug & Potenza, 2008). One study suggests that persons with PG use smoking as a cognitive enhancer (Mooney, Odlaug, Kim, & Grant, 2011), and there is a published case study addressing how these two addictions “intertwine ... uncontrolled gambling fuels the nicotine addiction” (Grant, Black, Stein, & Potenza, 2009). Yet the available information is scant, and the ways in which the conditions under study interact will require a conceptual framework that in some ways transcends PG, smoking and other specified areas of inquiry. In fact, some of the most extensive work on such matters has been done in relation to behaviours not targeted in this study (e.g., criminal behaviour was examined in Turner, et al., 2009; Abbott, McKenna, & Giles, 2005). Nonetheless, many of the concerns translate in useful ways.

A study of PG and co-morbidity requires a good grasp of the ways in which addictions, compulsions and other mental health issues can interact. When dealing with a range of compulsions, substitution has to be a major consideration. In a paper on sexually compulsive behaviour and PG, Grant and Steinberg (2005) start by pointing to strong epidemiological links between the two afflictions: a client presenting with one will be, at least statistically, at high risk for the other. These authors also remind the reader of something the research community has indeed established with authority: the diagnostic characteristics of PG and substance abuse are very similar. When we speak of all these addictions we are, despite their unique characteristics, dealing with kindred afflictions. Assorted behaviours can indeed show similar traits. A key difficulty in the identification of behavioural addictions is well exemplified by the following: When persons engage excessively in behaviours such as online gambling, online sex or online shopping, it is not clear whether they are addicted to the targeted activity (gambling, sex, shopping) or specifically to the Internet (Widyanto & Griffiths, 2006; see also: Griffiths, 2004). Griffiths (2000) identifies an assortment of online sexual behaviours, ranging from purchasing sexual material to the seeking out of sex therapists, all of which may or may not represent an addiction for the person in question. Young (1999) has identified five sets of online behaviours which may involve issues with impulse control. Of note is that even online gambling is treated as a subset of a broader category – Net Compulsions – which also includes shopping.

Freimuth (2005) has observed that patients often present with a seemingly primary affliction while others go unreported, or that others may surface after the first behaviour has ceased (p.92). Furthermore, there is still some confusion about the very nature of “addiction”, leaving us with unanswered questions about whether the designation is the best one even for PG (Petry, 2006; Potenza, 2006; Shaffer, 1999). This is related to another difficulty: the status of addiction as a primary disorder. Even if we grant that it can be, we can note for example a question raised by Allegre et al (2006) about if, and when, exercise dependence qualifies as primary or should be treated as a subset of an eating disorder.

Method

This study summarized the available literature on the relationship between PG and mental disorders, addiction, smoking, and suicide. It included both published and (a few) unpublished reports where available. The method involved a box score type literature review (see Johansson, et al., 2009) in which the evidence is summarized based the number of significant results for a particular type of effect. It was hypothesized that strong evidence would be found connecting PG with depression (including suicide), anxiety, post traumatic stress, and substance abuse.

Literature Search Strategies.

The search method involved (1) use of formal academic search engines such as OVID and Psychlit that cover formal peer reviewed publications as well as academic books, (2) use of less formal Google scholar that included both peer reviewed and non-peer reviewed sources, (3) contact with scholars in the field for their unpublished reports on the topic, (4) access to web sites for funding

agencies or other organizations for unpublished reports (e.g., Ontario Problem Gambling Research Centre, Alberta Gambling Research Institution, Canadian Centre for Substance Abuse). Search terms included: gambling and comorbidity, problem gambling and comorbidity, pathological gambling and comorbidity (this was accompanied by targeted searches, e.g., PG and depression). Different terms associated with gambling were then coupled with: addiction, substance use, substance abuse, substance used disorder, SUD, alcoholism, and other items as well. Given the complex nature of the subject matter, an opportunistic approach had to be taken to the selection of search terms. For example, the many terms associated with gambling were not simply coupled with suicide, but also with “self-harm”. The reason for such a prudent approach is that none of our research targets qualified as “fields” in themselves, and that this fact, coupled with a range of terminological inconsistencies, prompted us to caution before assuming that we had reached “exhaustion”. Given that the goal of the study was to catalogue the papers in this field, no studies were excluded. However papers that did not include any actual data (e.g., opinion papers) were not included in the report.

Inclusion and Exclusion Criteria for the selection of research articles. Given that the RFA specifically requested published and grey literature, no exclusion criteria were used. Furthermore, the sampling frame for the studies was restricted to those that have been conducted within the past 21 years (since 1990). This cut off date was selected first, because this time period marks the beginning of the ascendancy of legalized gaming venues such as casinos and slot venues around North America and Australia and these venues have seriously altered the landscape compared to the period prior to 1990 and, second, because time and labour constraints would inhibit a farther reaching effort.

Analysis

Literature Review Analysis. Ideally the best method for compiling information on comorbidity would be a meta-analysis in which the mathematical properties of each finding is consolidated and then a weighted average effect size is computed. Meta-analysis is, essentially, a statistical method used to integrate findings from a number of studies and compute a reliable and accurate evaluation of the available evidence (Egger, Phillips, & Smith, 1997). Meta-analysis may also help clarify the differences and similarities between assorted studies (Egger et al., 1997). Shaffer, et al., (1999) for example published a meta-analytical summary of prevalence estimates of problem gambling in the United States and Canada.

Unfortunately, researchers rarely use a common format that would facilitate a proper meta-analysis. The latter would require consistency in methods and instruments, and a clear description of methods and sampling techniques in order to combine the results of the study. In most cases, the studies that we know about were conducted using a variety of different methods and were conducted using different sampling frames. As such a meta-analysis is not feasible. A different approach is to catalogue the studies in terms of the sample, instruments, variables, main result(s) statistical outcomes, and level of significance. Johansson, et al., (2009) recently published a critical review of risk factors associated with problem gambling that used this method. In their table 1 they listed several different risk factors. Some studies had evidence related to several different risk factors. Then in Table 2, they summarized the results in terms of the number of studies that examined the issue and a judgement about the overall quality of the information for each risk factor. They defined a well established effect as one with at least 3 studies supporting it and a probable risk factor as one that had 1 or 2 well designed studies supporting it. They also listed effects that were not well documented as possible risk factors for PG. Johansson et al., (2009) do not mention dealing with non-significant results in their table. A more comprehensive approach was used by Miller et al., (1995) in which the authors summarized evidence regarding treatment methods for alcoholism. Miller et al., (1995) catalogued both positive (significant) and negative (non-significant) results and weighted them in terms of the quality of the study (e.g., controlled studies were weighted more strongly), and a cumulative evidence score was computed. This approach is often called a box-score type of meta-analysis. This method is not a true meta-analysis because it does not take into account the effect size. One main limitation of

this method is that it focuses on the significance of the findings, rather than the magnitude of the findings. As such it may underestimate the importance of an effect drawn from a number of underpowered studies (small samples), and may overestimate the importance of an effect based on a few large overpowered studies (e.g., with $N = 1000$, a trivial effect may be significant). However, this method is generally more feasible than a meta-analysis when dealing with a heterogeneous collection of studies as was the case in the current study. In the current study we catalogued the literature as a first step towards conducting a more systematic box score literature review. The information was then summarized in terms of the portion of studies that have examined an issue that found evidence for that issue, and in some of the cases, in terms of the strength of those findings (where possible). The data was organized in terms of psychiatric disorder or problem (e.g., depression, anxiety, suicidal ideation) and in terms of type of data (e.g., clinical data, general population data, and youth data).

Each paper or report that was uncovered was read by both authors. Important pieces of information such as sample size, effects, significance levels, and gender break down for each paper was (where possible) was extracted and the paper was added to a data base that includes the different pieces of information about the paper. Many papers cover more than one disorder and as such were entered into several sections of the data base. We have currently only conducted preliminary analysis of the data and will continue to consolidate this information by assessing statistical estimates, significance levels, and effect sizes where possible. In the current analysis we categorize the papers into broad general categories and summarize the major findings of the papers according to the four main topics examined in this review (e.g., smoking, SUD, psychiatric disorders and suicide). The results are then summarized in 4 separate tables that are provided in the appendices.

Results

In total, 252 papers were reviewed, though many of these appear in more than one section. Here we offer a topical breakdown of the results stemming from the literature study. This is followed by a brief summary.

Part 1: Substance abuse

In total, we scrutinized 136 articles for data pertaining to substance abuse. Of these, 68 were studies of treatment samples, 40 were studies of the general population (e.g., telephone surveys), 17 included other types of samples including studies of offenders or samples recruited by advertisement, and a surprisingly large number (10) were review papers. Of the clinical studies 27 were samples of substance abusers, 30 were samples of problem gamblers or compared problem gamblers to other samples, and 8 were samples of other disorders. Of the general population studies, 13 were studies of youth or university students, 22 were studies of the adult population, and 5 were longitudinal studies. Note that for the purpose of this summary, youth included undergraduate students. In addition, for this study “clinical” was broadly defined as any group of participants who were engaged in or was seeking some form of help including formal treatment, gamblers anonymous or a helpline.

A strong relationship between PG and SUD is by now well established (Petry, Stinson, & Grant, 2005; Alegria et al., 2009; Martins, Ghandour, & Storr, 2011; Lorains, Cowlshaw, & Thomas, 2011; Johansson, Grant, Kim, Odlaug, & Götestam, 2009). Steinberg, Kosten, and Rounsaville (1992) found a 15% PG rate among cocaine abusers under study. In a review of the literature on PG and psychiatric comorbidity Crockford and El Guebaly (1998) concluded that in community and clinical samples between 25% and 63% of PGs met criteria for a substance use disorder. In another literature study, Spunt, Dupont, Lesieur, Liberty, and Hunt (1998) estimated that problem gambling rates among those who abuse substances (alcohol and other drugs) are four to ten times that of the general population. In an SUD treatment sample (n=74) de Carvalho, Collakis, de Oliveira, and da Silveira (2005) found high PG rates (10.8% problem and 18.9% pathological). In a community sample, El-Guebaly, Patten, Currie, Williams, Maxwell et al (2006) determined that persons with SUD have a PG rate 2.9 times that of persons with no identified disorder. Langenbucher, Bavly, Labouvie, Sanjuan, and Martin (2001) found that 13% of persons in an SUD treatment sample met PG criteria. Out of 462 New York City methadone patients, Spunt (2002) identified 21% as probable PGs and another 9% as problem gamblers.

As mentioned, a surprising 10 reviews of the literature were found. One meta-analysis of available prevalence studies of gambling (Shaffer, Hall, & Vander, 1999 -- CANADA-USA) found that the estimated prevalence for problem and pathological gambling amongst substance abusers was higher than in the general population. In a synthesis of available information, Lorains, Cowlshaw and Thomas (2011) estimate that 57.5% of PGs have struggled with some form of SUD. Sussman, Lisha and Griffiths (2011) surveyed 83 studies, and estimated the SUD rate among PGs at 26%. In a methadone treatment sample Feigelman, Kleinman, Lesieur, Millman and Lesser (1995 – USA) found that 10% qualified as PG. In another SUD treatment sample, Spunt (2002 – USA) estimated the probable PG rate at 21%.

Still, causal associations and inherent links are difficult to draw. Cunningham-Williams, Cottler, Compton, Spitznagel and Be-Addalah (2000 – USA) found that alcohol use and cannabis use most often preceded PG, whereas use of other drugs typically came after. Similarly, while PG and SUD share many traits, it would be imprudent to insist on firm conclusions regarding a common disorder underlying each behaviour. Crockford and el-Guebaly (1998) suggest that since gambling and substance use often take place at the same locations, co-morbidity may in some cases stem from availability and social setting rather than internal links between the disorders. This may be particularly true in jurisdictions (e.g., the United States) where free alcohol is given to people who are gambling.

Cultural issues related to deprivation generate different numbers than general population surveys. Westermeyer, Canive, Garrard, Thuras and Thompson (2005 – USA) found a 7.6% PG rate among Hispanic and Native veterans, with an SUD relationship of $\chi^2=22.782$ ($p < 0.001$). Gender also figures, with Potenza, Steinberg, McLaughlin, Wu et al (2001 – USA) finding that male and female callers to a gambling hotline reported significantly different patterns of drug and alcohol problems ($\chi^2=9.11$; $p0.01$).

Of note, not all studies found a strong link between substance abuse and problem gambling. For example LaPlante, Nelson, Odegaard et al (2008) examined psychiatric disorders amongst repeat driving under the influence offenders and found that only 1.2% of men and 0.7% of women were identified as current PG. These figures are not different from prevalence estimates in the general population.

Part 2: Comorbid psychiatric disorders.

In total we examined 116 papers that addressed the issue of the relationship between problem gambling and various comorbid psychiatric disorders. Appendix 4 provides a table with a listing of the authors, dates, sample sizes, a summary of each study, and a list of the psychiatric disorders investigated in each paper. Of these papers 55 were studies of clinical populations, 41 were studies of the general population, and 20 were targeted samples most often recruited through advertisements. Of the general population studies 21 studied adults, 10 studied youth, and 10 were longitudinal studies. Note that for the purpose of this summary, youth included undergraduate students. In addition, for this study clinical was broadly defined as any group of participants who were engaged in or seeking some form of help including formal treatment, Gamblers Anonymous or a helpline. Of the clinical studies, 18 catalogued the frequencies of disorders within the problem gambling population, 6 examined subgroups within the sample of gamblers (e.g., male vs. female or impulsive vs. non-impulsive), 4 contrasted gamblers with non-gamblers, and 6 studies contrasted problem gamblers with some other disorder (e.g., OCD). In addition, 5 of the studies targeted substance abuse populations and 16 were studies of some other population of patients.

The targeted population studies are an assortment of studies that do not fit neatly into the first two categories. They include studies using experimental designs that contrasted gamblers and other groups, as well as studies of correctional populations.

Of the studies examined, 62 included depression, 43 examined impulsivity, 34 examined some form of anxiety, 19 examined personality disorders, 15 examined obsessive compulsive disorders (OCD), 14 examined bipolar or manic disorder, 9 dealt with post traumatic disorder, 6 examined conduct disorder, hostility or violence, and 3 examined psychosis. In addition, 21 examined some other disorder and 26 examined comorbidity in general. A number of studies just recorded general symptoms rather than specific disorders. Table 1 provides a summary of the disorders cross-tabulated by type of study.

Table 1: Type of disorder by type of study.

	Treatment / help seeking	General population	Targeted sample	Total
Aggression / conduct	2	3	1	6
Anxiety / phobias (excluding OCD)	15	11	8	34
Bipolar	9	5	0	14
Depression	27	19	16	62
Impulse control	21	14	8	43
Obsessive-compulsive disorder	11	3	2	16
Personality disorder	8	8	3	19
Psychosis / schizophrenia	1	2	0	3
Post traumatic stress disorder	6	1	2	9
General comorbidity	15	6	5	26
Other	12	7	2	21
Total	127	79	47	253

Note: the number of papers exceeds the number of studies because most papers examined more than one disorder.

Most of these studies examined psychiatric disorders as well as substance abuse problems. For example, Alvarez-Moya, Jimenez-Murcia, Aymami et al (2010) measured several disorders including obsessive compulsive disorder (OCD), depression, anxiety, hostility, phobic anxiety, paranoid ideation,

psychoticism, alcohol abuse, substance abuse, smoking and a general symptoms index. Many papers dealt with more than one comorbid disorder. In this section we only summarize the results related to psychiatric disorders. Substance abuse was dealt with in an earlier section. In addition, we address several personality disorders that have been associated with pathological gambling.

Depression

Depression or related mood disorders (including PTSD and Dysthymia) were identified in 62 of these studies (e.g., Black, Moyer & Schlosser, 2003; Blaszczynski & Farrel, 1998). Momper, Delva, Grogan-Kaylor et al (2010) found that about 33% of problem gamblers had experienced at least one depressive symptom. Also, depressed people had significantly higher scores at the scales for pathological gambling (Brooker, Clara & Cox, 2009). Westermeyer, Canive, Garrard, Thuras and Thompson (2005) found that PGs were more likely to have a mood disorder. Studies by Turner et al., (2006, 2008; Preston et al in press) all showed a strong link of problem gambling with depression and anxiety.

In nearly every study we looked at, PG was positively associated with depression. However, not all studies have found a link. For example, Biddle, Hawthorne, Forbes and Coman (2005) found no significant relationship between problem gambling, posttraumatic stress disorder (PTSD), anxiety, or depression amongst their PTSD patients. However, the high level of PG in this group (28%) suggests a strong link between PTSD and PG. The lack of an effect for depression was likely due to range restrictions because all of the clients were suffering from PTSD. Another exception was Cunningham-Williams, et al., (2000) which found that depression was not higher for PGs with SUD than other SUDs. Again, range restriction might explain the lack of an effect. In addition, Wohl, Matheson, Young and Anisman (2008) found that depression scores were elevated for pathological gamblers, but not for subclinical problem gamblers. Overall, depression is the most common comorbidity of PG we have identified.

Anxiety

Anxiety (excluding OCD) was identified in 34 of these studies including Black and Moyer, (1998), Alvarez-Moya, Jimenez-Murcia, Aymami et al (2010)), and Bienvenu, Samuels, Riddle, Hoehn-Saric et al., (2000). Westermeyer, Canive, Garrard, Thuras and Thompson (2005) found that PGs were more likely to have an anxiety disorder. Turner et al., (2008) showed a strong link between anxiety and problem gambling, as did Westermeyer, Canive, Garrard, Thuras and Thompson (2005). Cunningham-Williams, Cottler, Compton and Spitznagel (1998) found 7.7% of PGs to demonstrate anxiety.

Alvarez-Moya, Jimenez-Murcia, Aymami et al (2010) found different subtypes of problem gamblers to have different levels of comorbidities (including anxiety) and some problem gamblers to have no comorbidities. Black and Moyer (1998) found 40% of PGs (n = 30) to demonstrate a lifetime anxiety disorder. Turner, et al., (2008) reported that general anxiety was the strongest single predictor of problem gambling severity.

A difficulty with studies of anxiety is that there is more than one kind. While Desai and Potenza (2008) and Dannon, Lowengrub, Shalgi, Sasson et al (2004) refer to generalized anxiety, Turner, Jain, Spence and Zangeneh (2008) also include social anxiety, as do Bernardi and Pallanti (2009). The difficulty is obviously compounded by the many subtypes for PG, which themselves have not been standardized and hence vary from one study to the next.

Of interest: anxiety and depression are conditions that could result from PG or lead to PG, rendering the identification of PG aetiology problematic.

OCD

We examined 15 articles dealing with the relation between PG and OCD. Evidence for links between OCD and PG were inconsistent. Bienvenu, Samuels, Riddle, Hoehn-Saric et al (2000) found that out of a sample of 80 participants with OCD, none were PG. On the other hand, in a PG treatment sample, Blaszczynski and Steel (1998) estimated OCD cases at 26 – 31.7%. Cunningham-Williams, Cottler, Compton and Spitznagel (1998) found that 0.9% of PGs under study demonstrated OCD. Dannon, Lowengrub, Sasson, Shalgi, Tuson et al (2004) found 5% of PGs under study to have comorbid OCD.

Once more, we suggest caution regarding designations. PG is currently classified as an impulse control disorder (ICD) and will soon be reclassified as an addiction. These three afflictions – OCD, ICD, and addiction – share many traits, and the lines between are not always clear.

Impulsivity

Forty-three of the studies we examined addressed some form of impulsivity including disinhibition and attention deficit disorder. However, most often these studies did not assess if the impulsivity was of a clinical diagnosis; most often impulsivity was simply measured psychometrically. Given that PG is currently listed as an ICD, and that even if we call it an “addiction” impulse control would be an issue (all addictions are obviously disorders of impulse control), findings on this topic could – depending on one’s point of view – be seen either as comorbidity or as a superfluous adjunct. Again, terminology is an issue. For example Vitaro, Wanner, Ladouceur, Brendgen et al (2004) speak of “disinhibition” and acknowledge that this can also mean “impulsivity”. Consider as well the statement by Wohl, Matheson, Young and Anisman (2008): “Impulsivity was categorized as falling into three types, namely behavioral impulsivity, cognitive impulsivity, and non-planning impulsivity, along with general or overall impulsivity” (p. 84). While these authors found that “General impulsivity varied as a function of the subtype of gambler” (p. 84), Blanco, Potenza, Kim, Ibanez, Zaninelli (2009) suggest a direct link between PG and impulsivity, with the latter as a good marker for gambling severity. Turner, et al. (2008) found that impulsivity explained a relatively small portion (5.1%) of the variance of problem gambling severity and was much less important than negative affect and experiences of wins. On the other hand Grant and Kim (2003) found that 22.9% of 96 PGs under study exhibited a concurrent ICD, and that these reported significantly greater intensity of urges to gamble. In all, impulsivity is a good predictor of PG, though issues pertaining to categorization render unclear how best to make use of this information.

Included in the studies of impulsivity, six studies specifically examined PG and ADHD. Breyer, Botzet, Winters et al. (2009) found that approximately 24% of ADHD persisters who gambled met PPG criteria, compared to 7% of the desisters and controls. Turner et al. (2008) found that ADHD symptoms were correlated with PG. This finding was replicated in Preston et al., (in press) with a sample of offenders. Overall, however, knowledge on the rapport between PG and ADHD is scant.

Bipolar disorder

We examined 14 articles addressing bipolar disorder (BD) or mania. Dannon, Lowengrub, Sasson, Shalgi, Tuson et al (2004) estimated the rates of BD among a sample of 44 PGs at 2-3%. Fuentes, Tavares, Artes and Gorenstein (2006) identified a rate of 4.7%. Kessler, Hwang, Labrie, et al (2008) found lifetime PG and BD connections to be 17%. McIntire, McElroy, Konarski, Soczynska et al (2007) found a high PG rate (6.3%) among persons with BD. di Nicola, Tedeschi, Mazza, Martinoti et al. (2010) found that with bipolar patients, 33% presented at least one behavioral addiction compared to the 13% of controls. However, in other studies BD was not related to PG. In most of these studies BP does not appear to be strongly associated with problem gambling.

Personality Disorders

In all, we surveyed 19 studies that dealt with assorted personality disorders. Several other studies examined personality, but not personality disorders per se; these were not included in this list. Blaszczynski and Steel (1998) found high rates of several personality disorders in a treatment sample of problem gamblers with the most frequent being Borderline 57 -- 69.5%. Histrionic 54 -- 65.9% Narcissistic 47 -- 57.3%, and Dependent 40 -- 31.7%. Sacco, Cunningham-Williams, Ostmann and Spitznagel (2008) found that twenty percent of a PG sample was diagnosed with a DSM-IV personality disorder (n = 29). Conversely, Saez-Abad and Bertolin-Guillen (2008) found no personality disorders among 33 pathological gambling patients. The potential list of possible personality disorders is long (borderline, avoidant, narcissistic, anti-social, etc.). In total, we identified six studies that specifically focused on Antisocial Personality Disorder (ASPD), though this is a difficult category in itself. Pelletier, Ladouceur and Rheaume (2008) found that the most frequent comorbid personality disorder among PGs was antisocial personality disorder (29.0%). Cunningham-Williams, Cottler, Compton and Spitznagel (1998) also found high levels of ASPD amongst problem gamblers. As with criminality, it is quite likely that many cases of comorbid PG and ASPD are subsequent to issues related to gambling, though of course such matters would be case-specific. Sacco, Cunningham-Williams, Ostmann and Spitznagel (2008) found that the relationship between ASPD was not significant.

Other disorders.

Several other disorders were also examined. Fire setting was identified in one study (Blanco, Alegria, Petry, Grant, et al., 2010) as correlated with PG. Nine papers dealt with post traumatic stress disorder. Three studies under consideration addressed schizophrenia or psychotocism. Cunningham-Williams, Cottler, Compton and Spitznagel (1998) found 4.2% of PGs under study to struggle with this disorder, whereas Edens and Rosenheck (2012) identified 11.6% as schizophrenic.

In summary, several psychiatric disorders have been found to be associated with problem gambling and the most frequently studied disorders are anxiety, depression, impulsivity, assorted personality disorders, bipolar disorder, and obsessive compulsive disorders. For personality disorders, antisocial personality disorder may demonstrate the strongest evidence. There is currently no consensus on the cause and effect relationship between problem gambling and these comorbid disorders.

Part 3: Smoking

In total, we scrutinized 54 studies addressing the relationship between smoking and PG. These studies included 18 studies of clinical samples, 26 studies of the general population, 9 studies of targeted populations, and 1 literature review. For the current study, under clinical studies, we included anyone seeking help including mutual aid groups, or helpline callers. Both clinical and general population figures are highly variable due in part to the regional differences in smoking prevalence. Of the general population studies, 9 were studies of gambling and smoking amongst youth or student populations, 14 were studies of the adult general population, and 3 were longitudinal studies. Of the clinical studies 9 were samples of problem gamblers, 2 were substance abusers, 2 were other clinical populations, and 3 were studies comparing problem gamblers and some other population. Targeted population studies were a mix different methods including studies of smokers or gamblers recruited through advertisements, studies of casino employees, or studies of correctional populations.

Though strong correlations are undeniable, it is hard to sift out other issues (e.g., marijuana) in order to determine specific links to PG and smoking. For example, Barnes Welte, Hoffman and Tidwell (2009) offer a conflated relation among youth between gambling, alcohol use, tobacco use and marijuana use. Furthermore, people with all kinds of issues – such as depression and ASPD – are more likely to smoke than the general population.

Momper, Delva, Grogan-Kaylor et al (2010 –USA) found that individuals with problem gambling were more likely to use tobacco (OR = 5.40) several times per week. This association, however, became non-significant when demographic controls were entered in the model.

Goldstein, Walton, Cunningham et al (2009 -- USA) found that 31.1% of PGs were smokers. Yet the numbers are nowhere near consistent. For example Fuentes, Tavares, Artes, and Gorenstein (2006 -- Brazil) found that 68.7% of PGs under study were nicotine dependent. Arguably, geography might help to explain this discrepancy. Grant, Chamberlain, Odlaug, Potenza, and Kim (2010 – USA) found that 41.4% of PG subjects met criteria for current nicotine dependence. Delfabbro, Winefield, Dollard, Metzer et al (2006 – Australia) found a significant association between gambling and alcohol use. These authors studied marijuana, hard drug use and negative moods as well – cigarette smoking was significantly associated with all other activities ($p < .001$).

Gender seems to have little bearing on this one issue. Desai and Potenza (2008 – USA) found little difference in smoking rates between men and women with PG (Male: 43.96%; female: 42.5%). Chaumeton, Ramowski, and Nystrom (2011 – USA) also found smoking rates among male and female gamblers to be nearly identical.

Most studies found evidence for a positive relationship between smoking and problem gambling. Perhaps unsurprisingly, Cunningham-Williams, Cottler, Compton, Spitznagel and Be-Addallah (2000 – USA) found smoking to precede PG in 56% of cases. Lee, LaBrie, Rhee, and Shaffer (2008 – Korea) found that casino employees with gambling problems had higher smoking rates ($\chi^2 = 57.3$; $p = 0.01$). Conversely, Peles, Schreiber and Adelson (2009 – USA) found no correlation between nicotine smoking and PG. As well, Levens, Dyer, Zubritsky et al. (2005) found in a study of elderly patients, that at-risk gambling behavior was not significantly associated with gender, current or past depressive symptoms, or cigarette smoking.

Not much is known about the clinical issues and co-occurring psychiatric disorders among smoking and non-smoking pathological gamblers, though one study did find smoking among treatment seeking PGs to be associated with many clinical issues, most notably more severe gambling problems (Grant, Kim, Odlaug & Potenza, 2008). One study suggests that persons with PGs use smoking as a cognitive enhancer (Mooney, Odlaug, Kim, & Grant, 2011), and there is a published case study addressing how these two addictions “intertwine ... uncontrolled gambling fuels the nicotine addiction” (Grant, Black, Stein, & Potenza, 2009). Yet the available information is scant, and the ways in which the conditions under study interact will require a conceptual framework that in some ways

transcends PG, smoking and other specified areas of inquiry. In fact, some of the most extensive work on such matters has been done in relation to behaviours not targeted in this study (e.g., criminal behaviour Turner, et al., 2009; Abbott, McKenna, & Giles, 2005).

Perhaps a decent summary statement can be drawn from Rodda, Brown & Phillips (2004 – Australia) who found negative affect to contribute both to gambling problems and tobacco dependence.

Out of the 54 studies 41 found elevated levels of smoking amongst problem gamblers, 7 examined some other comparisons (e.g., male vs. female rates of smoking), and 4 papers found no relationship between smoking and problem gambling.

In addition, 27 studies reported the proportion of problem gamblers who smoke (see Table 2). The percentages ranged from 13% to 78% with an average of 49.6% (SD = 19.7%). According to Health Canada (2012), the results of the most recent Canadian Tobacco Use Monitoring Survey (CTUMS) indicate that 17% of the Canadian population aged 15 years and older were current smokers. In the United States, Schiller et al., (2010) estimated that 21% of adults were current smokers, and 21% were former smokers. The results of the studies examined suggest that smoking is substantially more common amongst problem gamblers than in the general population. These findings, however, need to be taken with some caution; many of the papers examined did not publish a specific prevalence figure for smoking amongst problem gamblers. In addition, we did not weight the estimates based on sample size so the estimate given above is a crude first pass through the data.

Table 2: Means and standard deviations for percentage of problem gamblers who are smokers.

Type of sample	N	Mean	SD	Minimum	Maximum
General Population Adult	8	54.1%	16.7%	31.1%	77.0%
General Population Longitudinal	2	62.7%	16.5%	51.0%	74.4%
General Population Youth / Student	2	14.8%	1.7%	13.6%	16.0%
Targeted Sample	4	37.6%	12.8%	19.0%	48.0%
Treatment / Help Seeking	11	55.0%	18.6%	13.2%	78.0%
Total	27	49.8%	19.6%	13.2%	78.0%

Part 4: Suicide

In total 51 papers discussed the relationship between gambling problems and suicide. The data are often based on more male than female subjects.

There were several different types of papers on suicide, including (1) papers on actual cases of suicides, (2) studies of suicidal thoughts from clinical and helpline samples, (3) studies of suicidal thoughts in the general population, and (4) studies of statistics on suicide rates in a given area. Note that for the purpose of this summary, “clinical” includes helpline callers.

Cases studies

In total 8 papers examined actual suicide cases (e.g., Kola, Mansukhani, Barraza & Bostwick, 2010²; Penfold, Hatcher, Sullivan & Collins, 2006; Seguin, Boyer, Lesage, McGirr et al., 2010) and reported on evidence for gambling in these groups. The scope of these studies varies. For example, Kola, et al., (2010) report on a single case study of a problem gambler who is suicidal. On the other hand Chan, Chiu, Chen, Chan, et al., (2009) describe 150 cases and also include an additional 150 controls in their study.

Blaszczynski and Farrel (1998) reported that almost a third (31.8%) of suicide cases had previously attempted suicide. While there is no way to determine in any case whether suicide was gambling related, each subject had a PG history and one of suicidal ideation.

A study in New Zealand by Penfold, Hatcher, Sullivan and Collins (a) (2006) found that 17.1% of patients admitted to hospital following a suicide attempt tested positive for problem gambling.

Yip, Yang, Ip, Law and Watson (2007) found a strong relationship between gambling and debt-related suicide – OR for gambling = 9.17 (CI = 4.76–17.86). Gambling was among the main causes of debt accumulation and contributed to about 34% of the total. The main cause of financial debt among suicide deaths was the individual’s overspending and gambling involvement, rather than any direct impact caused by adverse personal economic situations such as unemployment.

Chan, Chiu, Chen, Chan, et al (2009, Hong Kong) studied suicide decedents and included 32 cases (21%) with addiction-related disorders (alcohol or substance use disorders or pathological gambling). In another study Wong, Chan, Conwell, Conner and Yip (2010) found that among the 150 suicides and 150 controls examined, 17 suicides (11.3%) and one control case (0.6%) met criteria for the diagnosis of pathological gambling at the time of death or interview. Data was collected from a territory-wide case-controlled psychological autopsy study of suicides between 15 and 59 years of age in Hong Kong. Suicides with pathological gambling included 11 (64.7%) men and 6 (35.3%) women. There was no significant difference in the mean age between the male and female suicide cases (42.3 years vs. 44.8 years; $t=0.49$, $P=0.63$). All 17-suicide cases with pathological gambling had unmanageable debt at the time of death. Fourteen cases (82.4%) had other associated psychiatric disorders, most often major depressive disorders ($n=10$, 58.9%) and substance-use disorders ($n=3$, 17.6%).

Clinical population studies

The largest number was the 29 studies that collected information on people seeking treatment, calling a helpline or related activity (e.g., GA or self help) or from some other treatment-related venue, and recorded the percentage that reported current or past suicide ideation or attempts. Several papers found a high level of suicide ideation and suicide attempts. Beaudoin and Cox (1999) found that 51% of PGs under study reported past year suicidal ideation, 16% reported past attempts, and 5.3% reported attempts in the past year. Battersby, Tolchard, Scurrah and Thomas (2006) found that 81.4% showed some suicidal ideation and that 30.2% reported one or more suicide attempt in the preceding 12 months. Suicide ideation was associated with debt, SOGS scores, and depression. In a community

² In the case described in Kola et al., (2010) the case was an attempted suicide.

sample of 101 individuals in Canada with gambling problems who had made a recent quit attempt, Hodgins, Mansley and Thygesen (2006)³ found that 28.7% reported no history of suicide ideation or attempts, 38.6% reported having only thoughts of suicide, and 32.7% reported a suicide attempt. Only 7% of those who attempted suicide did so because of gambling related issues. Nearly all (97%) of those who'd attempted suicide were depressed at the time.

Carrie, Kennedy, Cook, et al (2005) found that 20% (n=7) reported suicidal ideation. Of these, 3 individuals reported suicide attempts related to gambling problems. In a sample of 960, Potenza, Steinberg and Wu (2005) found that suicidality caused by gambling was 22.67%. Suicide attempts caused by gambling were 3.93%.

In Germany, Schwarz and Lindner (1992) reported that of 58 male pathological gamblers, eighteen patients (36.7%) had attempted suicide because of their pathological gambling. Another 17 (34.7 %) talked about very specific thoughts and plans for suicide which were the consequence of their pathological gambling.

In a Singapore PG treatment sample of 150 (87.3% male), Teo, Mythily and Anatha (2007) found that sixteen (10.7%) subjects had histories of suicide attempts.

Frank, Lester and Wexler (1991) surveyed 162 GA members (94% male). Of those responding to questions about suicide (132), 34 (21%) said they had never considered suicide, 77 (48%) had thought about suicide and 21 (13 %) had attempted suicide. Gamblers who had been suicidal in the past began gambling at earlier ages, and sought help at earlier ages. Gamblers who had been suicidal in the past were also more likely to have stolen money or merchandise because of gambling. Kaminer, Burleson and Jadamec (2002) report that early age of gambling onset was associated with suicide attempts (64 males and 33 females).

Kausch (2003a) found that a combination of risk factors likely contributes to suicidality among PGs. Overall, 39.5% reported having attempted suicide. In another study Kausch (2003b) found that in a sample of 113 PGs in treatment, 39.8% had made suicide attempts at some point in their lives.

Kausch, Rugele and Rowland (2006) reported that 38.7% of problem gamblers (91% male) had made a suicide attempt at some point in the past. Of these, 46.5% had made one prior attempt, and 53.5% had made more than one attempt. They also reported that a large percentage (64%) of problem gamblers reported some history of abuse.

In a PG treatment sample of 125, Ledgerwood and Petry (2004) reported that 48% had a history of gambling-related suicidal ideation, and that an additional 12% had made at least one gambling-related suicide attempt.

MacCallum and Blaszczyński (2003 -- n = 85) found high rates of suicidal ideation, suicidal plans, and attempts. 36% of participants reported a history of suicidal ideation associated with their gambling. However, no clear relationship was observed between suicidality and indices of gambling behaviour. Depression was the strongest indicator of suicidality.

Mathias, Vargens, Kessler and Cruz (2009) found that pathological gambler's were more likely to report suicide attempts (OR 1.26).

Ibanez, Blanco, Moreyra and Saiz-Ruiz (2003) studied gender differences in problem gamblers. Ibanez et al (2003) found several differences between males and females including an earlier age of onset for males, greater impulsivity and more anti-social behaviours. In terms of suicide, they found that 27.7% of the males and 22.7% of the females reported suicidal ideation. A total suicidal thoughts measure was not significantly different between males and females.

³ Note technically this was not a clinical sample because the population had recovered most often without help. It has been included here with the clinical studies because it involves a self-identified population of problem gamblers, rather than a sample drawn from the general population.

General population studies

Another 11 studies recorded the number relationships between suicidal ideation and problem gambling in either the adult general population or amongst youths in school. Brooker, Clara and Cox (2009 – Canada) found that compared to the rest of the sample (n = 36, 984), the 742 moderate to high risk gamblers were more likely to report suicide attempts – OR 1.25 (1.12-1.38), <.05 – and more likely to report suicide ideation: OR 1.17 (1.10-1.25), p <.05.

Feigelman, Gorman, and Lessieur (2006) compared 298 at-risk gamblers and 13,000 controls. Only female gamblers showed higher rates of suicide attempts, and suicidal thoughts.

Park, Cho, Jeon, Lee, Bae, et al (2010) worked with a Korean sample of 5,132 controls, 158 problem gamblers and 43 pathological gamblers. Suicidal ideation was more common amongst problem (24.7%) and pathological gamblers (30.2%) than amongst controls. Suicide plans followed a similar pattern: controls: 3.2%; problem gamblers: 5.1%; pathological: 11.6%. Suicide attempts were as follows: controls: 3%; problem gamblers: 6.3%; pathological: 7%.

Cunningham-Williams, Gruzca, Cottler, Womack, Books, et al (2005) found that 29% of the problem gamblers under study had thoughts of death/harm. This was significantly higher than the rest of the population, but the relationship with actual suicide attempts did not reach significance.

In a study of secondary school children (N=15,245), Garfinski and de Wilde (1998) found that 6.9% of boys who gambled in the past year had attempted suicide, and that 13.5% of girls who gambled in the past year had attempted suicide. Yet this study found some stunning numbers on other measures, for example “In boys, 27% of those who reported sedatives and cigarettes also reported a suicide attempt” (p.135).

McGrath, Stewart, Klein and Barret (2010) found a trend for increased suicide thoughts/attempts among people who gamble to cope (COP) with distress when compared to both gamblers with social motives SOC (p 1/4 0.068) and enhancement motives ENH (p 1/4 0.102).

In Canada, Newman and Thompson (2007, N = 36,984) found that the odds ratio for PG and attempted suicide was 3.43 (95% confidence interval, 1.37 to 8.60).

Newman and Thompson (2003, N = 7,214) found the odds ratio for pathological gambling and suicidal thoughts to be statistically significant (odds ratio = 4.91; 95% confidence interval = 1.41,17.1) when major depression was the only comorbid mental disorder. However, as additional mental disorders were included in the analysis; pathological gambling ceased to be statistically significant. This finding may suggest that the association of gambling and suicide is due to a common mental illness factor.

A study by Nower, Gupta, Blaszczyk and Derevenski (2004 -- Canada) found higher rates of suicidality among problem and pathological gamblers as compared to non-gamblers and social gamblers.

Not all general population studies of suicide have found a positive relationship. Cunningham-Williams, Cottler, Compton and Spitznagel (1998) studied “problem gamblers” (gamblers who reported at least 1 gambling-related problem – N= 161, which includes 29 gamblers who met DIS/DSM-III criteria for pathological gambling). The odds ratio was 1.6 (0.4, 6.0), which means that the gamblers are no more likely to have suicidal thoughts than the rest of the population.

Regional studies with statistical analysis

In addition, three studies examined statistics on the number of suicides in various jurisdictions (e.g., Philips, Welty, & Smith, 1997).

Philips, Welty and Smith (1997) found suicide rates to be higher – both with locals and visitors – in regions with legal gambling. They report that cities with established casinos have 2-fold (Atlantic City) or 4-fold (Las Vegas) the expected rates of completed suicide for cities of similar demographic composition. Available data were consistent with an increase from the expected rates following the introduction of casinos (data only available for Atlantic City).

However, according to Potenza, Flelin, Heninger, Rounsaville and Mazure (2002) the interpretation of the data has been challenged, particularly given the complexities involved in making population-based estimates in cities with high rates of noninhabitant visitation.

McCleary, Chew, Merrill and Napolitano (2002) studied a cross-section of 148 U.S. metropolitan areas before and after the advent of legalized casinos. They found that suicide showed a modest net positive correlation with casino presence.

Using county-level data from eight communities that adopted casinos, Nichols, Stitt and Giacomassi (2004) found no statistically significant difference between casino and control counties, suggesting that casino gambling has little significant impact, positive or negative, on suicide.

Correlates

Some of these studies note that there are variables that moderate the relationship between suicide and gambling, and found that some populations were more vulnerable than others. For example, Barry, Steinberg, Wu and Potenza (2009) found that Asian gamblers were 9.4 times more likely to report suicide attempts than Caucasian gamblers.

According to one study, age seems to mitigate the relationship. Kausch (2004) found that 42.9% of younger PGs and 22.2% of older PGs had attempted suicide. Sex differences in suicidal thoughts were reported by Martins, Tavares, Lobo, Galetti, and Gentil (2004 – N=156). These authors found that female problem gamblers attempted suicide more often (22%) than males (6%). Substance abuse may be a risk factor for more suicidal thoughts. Ladd and Petry (2003) also found that PGs (39.9% female) with substance abuse treatment histories had more suicidal thoughts and more suicide attempts. Similarly, Kausch (2003a) found that those clients with histories of SUD were more likely to have attempted suicide. Penfold, Hatcher, Sullivan and Collins (2006b) found that of 12 PGs who had attempted suicide, 8 scored positive for alcohol abuse.

One finding of interest (Nower & Blaszczynski, 2008) was age-related: older gamblers were more likely to identify suicide prevention as a reason for self-exclusion. In another study, the same authors (2005) also found female PGs to be more likely to identify suicide prevention as a reason for self-exclusion.

Type of treatment setting may also be related to different rates of suicidal thoughts. A study by Ladouceur, Sylvain, Sevigny, Poirer et al (2006) comparing the characteristics of pathological gamblers seeking inpatient (134) and outpatient (99) treatment found that thoughts about committing suicide over the past 12 months were more common amongst inpatients (67.3%) than outpatients (38.6%) and that a greater number of inpatients (22.8%) had attempted suicide compared to outpatients (3.9%). Similarly Ledgerwood, Steinberg and Potenza (2005 – n = 986) found that problem gamblers who reported gambling-related suicidality (n = 252; 25.6%) were more likely than those who did not (n = 734; 74.4%) to acknowledge family, financial, legal, and mental and substance-related problems. This study found that depression was strongly related to suicidality. In addition, those reporting gambling-related suicide attempts (n = 53; 21.5%) were more likely than those who thought about it but did not attempt suicide (n = 193; 78.5%) to report gambling-related illegal behaviours, as well as mental health and substance abuse treatment. Langhinrichsen-Rohling, Rohde and Rohling (2004) measured suicide proneness and found that it was related to severity of problem gambling. In addition, this study also highlights the importance of the link between suicide and depression. Overall, these studies suggest that the severity of gambling problems is related to suicidality

In the USA, with a treatment sample of 342, Petry and Kiluk (2002) found that differences in suicidality emerged according to severity of psychiatric, social/family, and gambling problems. Desai and Potenza (2009) report that although 19% of their schizophrenia or schizoaffective disorder patients were past year problem gamblers, they were not more likely to have suicide thoughts than other patients.

In Canada, a different type of study was conducted by Seguin, Boyer, Lesage, McGirr et al., (2010 – n = 122) which found that psychopathology was prevalent in both gambling related and non-gambling related suicide groups. Data on a sample of 49 PG suicides and 73 NPG suicides were obtained from informants and hospital records. Problem gamblers were twice as likely to have a personality disorder (OR 1.332 -- CI 0.664–2.775). Compared to non-PG suicides, PG suicides were less in contact with mental health services in their last month, their last year, and their lifetime. NPGs consulted front-line health and social services 13 times as often prior to the last year compared to PG suicides. NPGs also utilized specialized services more than three times as often in the last month.

Kausch, Rugle and Rowland (2006 – n=111) suggest that childhood abuse-related trauma is related to suicide attempts.

Desai and Potenza (2009 – n=337) report that 19% of their schizophrenia or schizoaffective disorder patients were past year problem gamblers, and that they were more likely to have thoughts of either hurting or killing themselves than non-gamblers (20.3% versus 16.8%), but surprisingly less likely than recreational gamblers (22.2%).

In the USA, Potenza, Steinberg, McLaughlin, Wu et al (2001 – n =562) described the characteristics of male and female gamblers utilizing a gambling helpline in order to identify gender-related differences. “Female gamblers were more likely to report receiving nongambling-related mental health treatment. Male gamblers were more likely to report a drug problem or an arrest related to gambling. High rates of debt and psychiatric symptoms related to gambling, including anxiety and depression, were observed in both groups” (p. 1500). Authors state that no “statistically significant differences were observed between men and women in reports of depression or suicidality perceived to be caused by gambling” (p. 1502).

Gambling as a cause for suicide

Kausch (2003b) found that among suicide attempters, 64.3% reported that their most recent attempt was related to gambling. The relationship to suicide depended on the history of substance abuse. Among clients with a history of substance abuse problems, only 54.8% reported that their most recent attempt was related to gambling. But with attempters without a history of substance abuse problems, 90.9% reported that their most recent attempt was related to gambling. However, it should not be assumed that those gamblers who attempted suicide did so because of their gambling problems. Hodgins et al., (2006) found that only 7% reported that they attempted suicide because of gambling. Rather, nearly all (97%) of those who'd attempted suicide were depressed at the time, and the suicide attempts were related to depression. Gambling losses can lead to depression, but gambling is also used by some as a means of coping with negative affect. It is likely that the relationship between gambling and suicide is complex.

Summary

In summary it would appear that suicidal thoughts are often found with problem gambling, but estimates vary tremendously (see Table 3). According to Potenza, Flelin, Heninger, Rounsaville and Mazure (2002), high rates of suicidal tendencies have been reported in clinical populations of pathological gamblers, with estimates of attempted suicide in the range of 17% to 24%. Another review of the literature by Pfuhlmann and Schmidtke (2002) reported that the frequencies of suicide attempts among PGs range between 8% and 42%. Other studies have found estimates ranging from 20% to 81.4% reporting suicidal thoughts. Many of the papers that we examined did not report the prevalence of suicide related thoughts or attempts. Suicidal thoughts were reported in 22 papers and suicide attempts were reported in 25 papers. In this review, we found that the number of people reporting suicidal thoughts ranged from 2% to 81% with an average of 39.7% (SD = 22.0%). Suicide attempts ranged from 3% to 40% with an average of 19.4% (SD = 12.9%).

Table 3: Summary of Suicidal thoughts and Suicide attempts by the type of study.

Type of study	Suicidal thoughts				Suicide attempts			
	N	M	SD	Range	N	M	SD	Range
Problem gamblers in Clinical populations	18	44.1%	21.3%	20% to 81%	23	20.0%	13.2%	3% to 40%
Problem gamblers in the General population	4	19.6%	12.4%	25% to 29%	2	11.6%	2.0%	10% to 13%
Total	22	39.7%	22.0%	2% to 81%	25	19.4%	12.9%	3% to 40%

Comparing clinical and general population results shows that the two types of studies largely overlap, but that the clinical samples tend to have higher rates of suicide ideation among pathological gamblers than general population samples. In addition, within clinical samples, severity of problems and the combination with other psychiatric problems such as depression and substance abuse increase the chances of suicidal ideation.

Of the 17 studies that reported suicide ideation, 13 were clinical and four were from the general population. Clinical studies reported significantly higher rates of suicide ideation ($t(7.6) = 3.1, p < .05$) and suicide attempts ($t(14.2) = 2.7, p < .05$) than the general population studies. The means are shown in Table 2.

These figures are rough estimates that do not take into account the different sample sizes. As we continue to explore this topic we will use more rigorous mathematical techniques to compute the prevalence of suicide thoughts and attempts amongst problem gamblers. In addition we could contact other authors to find out the prevalence figures for their studies.

There are studies (e.g., Cunningham-Williams et al., 1998) that did not find a relationship between gambling and suicide, but that is to be expected given the nature of random chance. It still remains that most of the studies we examined found a positive relationship.

Actual gambling related suicides are not particularly common, but make up a disproportionate number of suicides in the general population. On a final note, many articles dealing with suicide are primarily studies of comorbidity (e.g., depression). Unsurprisingly that is a powerful determinant (with depression especially poignant). These correlational matters are discussed in our summary of comorbidity in general.

Part 5: Comorbidity Survey; Key Informants.

The RFA also requested that the study review whether problem gambling is currently assessed and treated with other disorders and/or behaviours in Ontario and other jurisdictions. Published literature does not necessarily represent standard practices in clinics, and thus where necessary our efforts involved contacting various treatment agencies and asking them if they would participate in a short survey of approaches to comorbidity of PG with SUD and mental health issues.

Method

This aspect of the study was conducted entirely using email. We have an extensive network of contacts in the treatment sector. The key informant participants were sought through the Gambling Issues International listserv that is run from CAMH by Nina Littman-Sharp. More than 500 professionals in the problem gambling field are connected with this listserv directly or indirectly. People who responded were emailed a consent form and short questionnaire. They then returned the survey (N = 40) to the second author who extracted the survey results and forwarded only the survey to the PI. This was done to ensure anonymity of the respondent, and minimize any feelings of coercion because of professional relationship that may exist between the GII members and the PI. A large portion of our respondents were from Australia and Canada. Other respondents were from South Korea, the United States, and the United Kingdom. Because of the anonymity of the survey, exact figures are not known.

The survey consisted of 4 questions, each with multiple response options. Respondents were free to endorse multiple options as needed. In total 40 counsellors completed the survey.

Key Informant Data. The answers to the email questionnaire were compiled and organized in terms of the 4 questions that were asked, and percentages for responses were computed. The results were summarized as percentages of agencies that assess for comorbid depression, anxiety, substance abuse, alcoholism, smoking, suicidal thoughts and other issues. In addition, we asked the respondents about their approach to treatment including the type of treatment methods, orientation, or topics that were addressed during counselling. The survey was conducted anonymously. However, in some cases we do know the country of the respondent (but no other information). These results are summarized in part five of the results which includes several tables that break down the information about how comorbidities are dealt with by gambling treatment services. The evidence is summarized in terms of overall endorsement.

Results

The first question was on the counsellor's approach to assessing comorbid disorders. Namely we were interested in whether the counsellor routinely assessed clients for comorbid disorders. The most common response (60.0%) to question 1 was the agency/therapist routinely assessed the patient for co-occurring disorders, followed closely (37.5%) by sometimes assessing the client depending on the client or therapist. In addition, 27.5% responded that they assess the patient only if a problem is suspected. These results are given in Table 4.

Table 4: Approach to assessing comorbid disorders (percent).

During an assessment for problem gambling does your agency	
(a) Routinely assess the patient for co-occurring disorders?	60.0%
(b) Sometimes assess the patient for co-occurring disorders depending on the client or therapist?	35.0%
(c) Assess the patient for co-occurring disorders only if a problem is	25.0%

suspected?

The second question listed a number of disorders that are known or suspected to be associated with gambling and asked the counsellors which disorders they routinely scan⁴ for during their assessment. The results are shown in Table 5. According to the respondents the most common co-occurring issue they assess for is suicidal thoughts. This should come as no surprise to anyone working with clients calling during an emotional crisis brought on by a bout of heavy loses. All of the respondents endorsed this item (100.0%). Depression (97.5%), drug abuse (95.0%), and alcohol abuse (95.0%) were all endorsed by nearly all of the counsellors. In fact the only condition of those listed on the questionnaire that was not endorsed by more than half of the respondents was attention deficit hyperactivity disorder (22.5%). In general the counsellors appear to screen for most of these disorders, and in particular screen for the disorders that are most commonly associated with problem gambling: suicidal ideation, substance abuse, depression, and anxiety.

Table 5: Percentage of respondents that scan for various disorders.

During an assessment for problem gambling does your agency scan for	
(a) Suicidal thoughts	100.0%
(b) Depression	97.5%
(c) Attention deficit hyperactivity disorder	22.5%
(d) Drug Abuse	95.0%
(e) Alcohol Abuse / Dependence	95.0%
(f) Smoking	62.5%
(g) Psychosis	67.5%
(h) Anxiety or related disorders (excluding OCD)	85.0%
(i) Obsessive-Compulsive Disorder	60.0%
(j) Personality disorder	60.0%
(k) Other (please specify)	10.0%

For the third question they were asked what they would do if a patient showed signs of a particular disorder. The results are shown in Table 6. The most commonly endorsed item was to refer the patient to a specialist or other agency (80.0%). Nearly two thirds (62.5%) reported being able to arrange treatment within their agency, and 65.0% reported having the therapist deal with the issue. Many counsellors endorsed more than one option and it likely depended on the specific disorder with some disorders being easily dealt with in the agency and others requiring a referral to another resource. One counsellor noted that they have access to a psychiatrist on staff and are therefore able to take care of any psychiatric issue within the agency. This seamless approach to therapy would likely be an ideal situation, but is not always available for clients with specific needs.

Table 6: Percentage of agencies that endorse different approaches.

If a patient does show signs of a co-occurring disorder do you?	
(a) Have the client's therapist deal with the issue?	65.0%
(b) Arrange treatment within your agency?	62.5%
(c) Refer the patient to a specialist or other agency?	80.0%

The final question asked the counsellors about the treatment approach of their agency. It is of note that 100% of the agencies that responded stated that they teach coping skills and use solution focused problem solving. Motivational interviewing and relapse prevention were also endorsed by

⁴ The counsellors do not necessarily use a formal screening tool for these disorders, but look for evidence of them during their assessment or treatment.

100% of the respondents. Other common approaches were learning alternative leisure activities (95.0%), cognitive behavioural therapy (97.5%), brief treatment (87.5%) and dealing with traumatic life events (87.5%). At the other end of the spectrum only 17.5% endorsed the 12-step approach, though two additional respondents mentioned that they do refer clients to GA or support the 12-step approach bringing the total to 22.5%. Only 40.0% of the respondents endorsed addressing spirituality and 40.0% endorsed addressing vocational issues. About half endorsed “addressing social /community / culture-related issues such as poverty, immigration, marginalization, discrimination?” needs (52.4%) and “Case management issues such as housing, income support?” (47.5%). All of the other items were endorsed by more than 70% of the respondents. Some respondents noted that they address vocation or case management issues if appropriate, but not routinely.

Table 7: Treatment approaches and techniques used by each agency.

Treatment approaches used at your agency (all that apply)	
(a) Teaching coping skills?	100.0%
(b) Learning alternative leisure activities?	95.0%
(c) Solution focused problem solving?	100.0%
(d) Dealing with marital or relationship issues?	72.5%
(e) Dealing with financial issues?	72.5%
(f) Dealing with substance abuse issues?	85.0%
(g) Dealing with other mental health problems?	87.5%
(h) Cognitive behavioural therapy?	97.5%
(i) Relaxation / yoga / meditation?	77.5%
(j) Nutrition / exercise / or other lifestyle changes?	75.0%
(k) Dealing with traumatic life events?	87.5%
(l) Twelve step?	17.5%
(m) Motivational interviewing / Motivational enhancement?	100.0%
(n) Brief treatment?	87.5%
(o) Relapse Prevention?	100.0%
(p) Addressing spirituality?	40.0%
(q) Addressing vocational issues?	40.0%
(r) Addressing social / community / culture-related issues such as poverty, immigration, marginalization, discrimination?	52.5%
(s) Case management issues such as housing, income support?	47.5%
(t) Other (Please Specify)?	10.0%

In addition, several respondents added additional information about their approach to comorbid issues. Additional methods mentioned by the respondents included mindfulness, psychoanalysis, auricular acupuncture, group sessions, prevention, awareness and health promotion, dealing with affected others, family therapy, graded exposure and urge reduction treatment, psychoanalytical treatment, grief and loss, horticultural therapy, prevention and awareness, relationship services, disability services, and career services.

In terms of how concurrent disorders are integrated into the client's program, one counsellor stated that "severe problems including psychosis, major depression with psychotic feature, severe insomnia, and strong suicidal ideation have to be referred to psychiatrist." The counsellor went on to say that issues such as major depression and personality disorders must be treated simultaneously with the gambling problem. Another respondent noted that they work with what the "client bring into the room but offer referral options for mental health, drug and alcohol services where required and referrals to financial counselling services." Another respondent noted that they co-work with mental health and alcohol and other drug clinicians when sharing mutual clients. This was also echoed by another respondent who said that "in Australia we have specialist agencies and I would preference those services for treatment if the issue was acute. If the problem is chronic and I am able to follow the treatment plan which is primarily cue exposure and response prevention any way, I do." One respondent noted that their service has a psychiatrist on staff who will assess and consult with the staff, but also noted that the psychiatrist is "very overworked."

Some counselling is done over the telephone. One respondent told us that "all counselling at our service is done on the telephone or in an online capacity. There are programs which offer 6-8 sessions on the telephone for gambling (and related) issues, but the bulk of the work is single session on the phone and involves brief interventions." Thus the approach depends on the type of service.

Another important suggestion was the importance of matching a client's needs to the therapist's skills. A respondent told us that the counsellors at their agency have training in different modalities and that the client is matched to the therapist depending on what issues the client wishes to work on.

The “counsellors have training in distinct treatment modalities (e.g. psychoanalytic psychotherapy; family therapy; CBT; behaviour therapy; emotion focused therapy) that are utilised to work with a complex array of issues. People are allocated a counsellor who has an interest or expertise in a particular area (i.e. personality disorders, or relational issues etc.) that accords with the request made by the client. For instance, some new clients state that they wish to better understand, and work through a range of longstanding issues that appear to have some relation to their gambling. Whereas, other new clients state that they wish to establish strategies to manage the physical urge to gamble, and are in a position to engage in this work. All counsellors utilise a relapse prevention framework to guide their work with clients.”

Although few respondents endorsed the 12-step program, one counsellor noted that “we also have a relationship with GA in the area and encourage referral as well as support the 12 step program ideology.” Another made reference to referring clients to GA and having discussions with clients about 12-step groups.

A holistic approach was advocated by a few respondents. One counsellor reported that they “treat gamblers and their relatives”. In addition the counsellor said that their approach is holistic and so may deal with anxiety and depression or with trauma alongside the gambling. For social issues they would deal with them only where they were related to gambling. Another reported that “generally a holistic approach is taken and the most pressing needs are addressed by counsellors and appropriate referrals given (i.e., MH services, housing, material aid, AOD services, face-to-face counselling etc).” The need for a holistic approach was also echoed by another respondent who argued for the importance of “including families from Day One” in the treatment process. “Clients do not exist in a bubble; they are part of a family and community.”

While integration of services is ideal, one respondent told us that the “key problem regarding concurrent disorders is the lack of resources for mental health issues, and the “silos” which make navigation of the system difficult.” This respondent went on to say that there is a need for (1) “more resources and funding for MH programs.” (2) a need to “encourage more physicians to go into addiction medicine”, (3) and to “mandate collaborative approaches to care of the whole person, rather than the silo approach.”

In summary, different counsellors approach comorbid disorders in different ways. Although many deal with the comorbid issue themselves, others refer clients to specific specialists. The approach often depends on the specific issue that needs to be dealt with, and the skill sets of the therapists, and the availability of specialist services. The issue most often dealt with was suicidal thoughts which would most likely be the most urgent need to address. Other issues are dealt with as they are found.

The approach to the treatment of problem gamblers with comorbid disorders appears to be most centred on modern professional counselling approaches including cognitive behavior approaches, brief treatment, solution focused treatment, and motivational interviewing. In particular 100% of those surveyed reported screening for suicide and 100% endorsed using motivational interviewing. The data suggests that the older 12-step approach is not the method of choice, but referrals to 12-step programs are made as needed. The results are mostly representative of the services offered in Canada and Australia. However, those who completed the survey who we knew were from the US (N = 3) were very similar to the results from Canada and Australia with the exception of endorsing the 12-step programs.

Discussion

This report was initiated in response to an RFA regarding a need to summarize the literature regarding the comorbidities of problem gambling. Currently a lot of information exists on the topic of comorbidities, but it had not been summarized in a convenient manner that would facilitate further exploration in this area. The objective of this study was to provide a review and synthesis of available knowledge on the association between problem gambling and workplace absenteeism, suicide, mental health disorders, and addictions (in particular smoking).

In this paper we report on the number of papers that have examined evidence regarding the link between problem gambling and four major areas of comorbidities: (1) substance abuse, (2) psychiatric comorbidities, (3) smoking, and (4) suicide. As mentioned, we were unable to find any empirical information on work absenteeism. Although it is acknowledged by many counsellors as linked to problem gambling, this particular symptom has not received much scientific attention.

In addition, the project also involved contacting various treatment centres in order to determine the extent to which assessment and/or treatment of problem gambling takes into account comorbid disorders and behaviours.

In total we examined 136 articles on substance abuse including 68 studies that examined treatment samples, 40 studies of the general population (e.g., telephone surveys), and 17 other types of samples (e.g., targeted by advertisement, correctional). High correlations between PG and SUD are well established for problem gambling. The relationship has been shown in PG samples, SUD samples, as well as studies of other clinical populations such as the general patient population. PGs with SUD as well often represent more severe cases of problem gambling. Alcohol appears to be the most common SUD amongst gamblers. The percentage of comorbidity is particularly strong in the US where alcohol is served for free to problem gamblers.

We examined a total of 54 studies examining smoking and PG. Of these studies, 18 were studies of clinical samples, 26 were studies of the general population, and 9 were studies of other types of samples (e.g., recruited through advertisements, prison studies, casino employees). Smoking amongst problem gamblers is more common than it is in the general population. Based on the data from twelve studies we computed a rough prevalence estimate of 55% smokers amongst problem gamblers. This figure is substantially higher than the rate of smokers in the general population of either Canada (17% Health Canada, 2012) or the United States (21% Schiller et al., 2010) suggesting that smoking is much more common in this population. This estimate, however, was not weighted for sample size, so it is only rough estimate. We will be continuing to investigate these studies and plan to extract more exact figures for the estimate.

We examined a total 116 papers that addressed the issue of the relationship between problem gambling and various comorbid psychiatric disorders. Of these studies, 55 were studies of clinical populations, 41 were studies of the general population, and 20 were other types of samples. The most frequently studied comorbidity was depression which was found in 64 of the papers. Nearly all studies that examined depression found a positive relationship with PG. The second most common comorbidity studied was impulsivity. In total 43 studies examined impulsivity in one form or another; of these, 6 examined ADHD. The results for impulsivity were more mixed, but the bulk of the findings indicate that impulsivity is an important correlate of PG. Evidence for bipolar or manic disorder was examined in 14 papers. Anxiety was examined in 34 studies. In nearly all cases the relationship was positive. OCD was examined in 15 studies but the results were mixed with some studies not finding any link and other studies finding a strong link. Personality disorders were examined in 19 studies. The most frequently cited personality problem correlated with problem gambling was antisocial personality disorder. Evidence for comorbidities in general is very strong, but the strength of the findings depends on how many studies examined a particular issue.

In total 51 papers discussed the relationship between gambling problems and suicide. These papers were divided into four general types. We found 8 papers on actual cases of suicides. These ranged from a single case to large samples of cases (e.g., $n = 150$). We found 29 studies that examined suicidal thoughts or suicide attempts with clinical and helpline samples. We found 11 studies of suicidal thoughts in the general population. We found 3 studies of statistics on suicide rates in a given area that examined if suicide rates were higher in areas with casinos. Suicides apparently increase, but the interpretation depends on whether or not one includes visitors in the population. In most clinical and general population papers a link between suicide and gambling was found. However, a small number of papers reported no link. An examination of these papers found that on average the number of problem gamblers reporting suicidal thoughts ranged from 2% to 81% with an average of 39.7% ($SD = 22.0\%$). Suicide attempts ranged from 3% to 40% with an average of 19.4% ($SD = 12.9\%$). Clinical studies reported higher levels of suicidal thoughts and suicide attempts than general population studies. As with the caution about the prevalence of smoking, these figures are rough estimates that do not take into account the different sample sizes. As we continue to explore this topic we will use more rigorous mathematical techniques to compute the prevalence of suicide thoughts and attempts amongst problem gamblers.

The results of the counsellor survey found that counsellors take a variety of approaches in dealing with problem gambling. Most have specific plans for dealing with comorbidity and they take a client-centered approach to dealing with the problem. Nearly all of the counsellors reported scanning for suicidal thoughts, depression, drug abuse and alcohol abuse. On the other hand, very few reported scanning for ADHD. In spite of global nature of the responses, they were largely in agreement about the key issues they needed to deal with and the appropriate approaches. More than half of the counsellors reported scanning for nearly all of the disorders listed. Most have specific plans for dealing with comorbidity and they take an individual approach to dealing with the problem. The most common approach was to refer the client to a specialist or other agency, but it was also noted that it depends on the nature of the disorder. Some disorders can be dealt with by the agency; other disorders require a referral to a psychiatrist. All of the respondents endorsed a number of cognitive behavior methods of treatment including teaching coping skills, brief interventions, motivational interviewing, and solution focused problem solving. Twelve step and spirituality were the least often endorsed approaches.

The results indicate that problem gambling is related to a number of psychiatric comorbidities. Genetic and longitudinal twin studies research suggests that some of this comorbidity is linked to genetic vulnerability. The most common comorbidities appear to be alcoholism, nicotine dependence, and depression. It is likely that the cause and effect relationship for these various disorders is complex with some coming before problem gambling, and other resulting from the consequences of problem gambling. Comorbidities represent a very vulnerable population for developing problem gambling as well as a variety of other disorders. More research is needed to determine cause and effect relationships. In addition, complex statistical modelling is needed to determine which disorders are key to understanding the comorbidity of PG. In terms of treatment needs, more resources are needed to help counsellors deal with comorbid disorders. This is especially true for complex problems (e.g., personality disorders, psychosis) that require psychiatric consultations. Better access to credit counselling and vocational counselling would also be helpful.

Limitations

The reader should note that a measure of ambiguity in writing this report was unavoidable. For example, obsessive-compulsive tendencies can be treated as an anxiety disorder or as a personality disorder. Plus, there are several types of anxiety disorders, and anxiety is also related to certain dimensions in personality (e.g., Neuroticism). The issue is that there are problems with psychiatric nosology in general. Add to this the many differences among PG researchers pertaining to nosology

(subtypes) within PG itself (e.g., Blaszczynski & Nower, 2002) and it could legitimately be argued that ambiguity haunts the project at both ends. This matter could be even further complicated (muddled) if we tried to take into account preferences for assorted games such as cards, slots and bingo. We caution readers interested in these issues to take terminological inconsistencies into account. The most serious example of this is that “problem” and “pathological” can mean different things in the PG field; at times, “problem” refers to subclinical PG (as opposed to pathological), in other studies “problem” encompasses both categories, and in still other cases authors use “problem gamblers” to specifically refer to those in treatment or in need of treatment.

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Appendix 1: Substance abuse details

Note: for the sample size and sex ratio columns: M = Male; F = female; NPG = non-problem gamblers; NG = non-gamblers; MPG Moderate or subclinical problem gamblers; PG pathological gamblers; SUD = substance abuse; AD alcohol disorder.

Author	Date	Country	Sample Size	Sex Ratio	Summary	Type of Sample
Adamson, Todd, Sellman, Huriwai & Porter	2006	New Zealand	105	68% M	To describe the extent of psychiatric disorder and mental health service utilization in a representative outpatient alcohol and other drug (AOD) treatment sample in New Zealand.	Clinical SUD
Alvarez-Moya, Jimenez-Murcia, Aymami et al	2010	Spain	1,171 (all PG)	92.3% M	To classify into subgroups a sample of pathological gambling (PG) patients according to personality variables and to describe the subgroups at a clinical level. Cluster 2 showed the highest percentage of alcohol abuse and Cluster 1 showed the highest percentage of substance abuse. Cluster 3 showed the highest percentage of tobacco smokers.	Clinical PG
Andrade & Petry	2012	USA	226	SUD: 50.4% M No SUD 62.6% M	The goal of the current study was to compare rates of probability and delay discounting in a large population of pathological gamblers with and without a history of substance use problems	Clinical PG
Barnes, Welte, Hoffman, Tidwell	2009	USA	2274	F 1126; M 1148	Frequency of gambling was related to frequency of heavy alcohol use, tobacco use, and marijuana use.	General population Y
Barnes, Welte, Hoffman & Dincheff	2005	USA	522	226 M; 296 F	Measures from 3 explanatory domains—socio- demographic factors (age, race, and socioeconomic status), individual factors (impulsivity and moral disengagement), and socialization factors (parental monitoring and peer delinquency)—were tested for links to problem behaviours in 2 longitudinal samples of adolescents.	General population Y
Black & Moyer	1998	USA	30	23.3% M	Sociodemographic features, phenomenology, and psychiatric comorbidity of 30 subjects reporting pathological gambling behavior were examined	Other
Blankenship, Starling, Woodall & May	2007	USA	2674		Data regarding both drinking habits and gambling behavior were obtained from a stratified random sample of the adult population (N = 2674) across the entire State of New Mexico via phone survey	General population A
Blaszczynski & Farrel	1998	Australia	44	88.6% M	Paper presents an analysis of 44 case records of suicide occurring between 1990 and 1997 in the State of Victoria, Australia, in which the State Coroner identified the presence of a putative gambling problem.	Other
Blinn-Pike & Worthy	2008	USA	179	0% M	The aim of this study is to describe female undergraduates who have gambled in casinos compared with their peers who have never participated in casino gambling or gambling in any form	General population S Youth Undergradua
Boughton & Falenchuck	2007	Canada	365	0% M	Focuses on the gambling behaviours, family and personal histories and comorbid psychological disorders of 365 female gamblers from across Ontario, Canada, who responded to a mail-in survey.	Other
Brooker, Clara & Cox	2009	Canada	742	50.8% M	Examined the factor structure of the CPGI using 742 moderate to high risk gamblers drawn from a randomly drawn sample of 36,984	General population A
Carvalho, Collakis, de Oliveira & de Silvera	2005	Portugal	74	89.2% M	investigate the frequency of pathological gambling among alcohol and other substance abusers who sought specialized treatment.	Clinical SUD
Cho, Hahm, Suh, Suhm Cho, & Lee	2002	Korea	5,176		This study investigated the patterns of alcohol disorder comorbidity with other psychiatric disorders, using Korean nationwide epidemiological data.	General population A

Comings, Rosenthal, Lesieur, Rugele et al	1996	USA	102		Determined DRD2 gene's relevance to PG. Of the 171 pathological gamblers 50.9% carried the D2A1 allele versus 25.9% of the 714 controls. For the 102 gamblers who filled out the questionnaires, 63.8% of those in the upper half of the Pathological Gambling Score (more severe) carried the D2A1 allele (OR versus controls = 5.03), compared to 40.9% in the lower half (less severe). Of those who had no comorbid substance abuse, 44.1% carried the D2A1 allele, compared to 60.5% of those who had comorbid substance abuse. These results suggest that genetic variants at the DRD2 gene play a role in pathological gambling, and support the concept that variants of this gene are a risk factor for impulsive and addictive behaviours.	Clinical
Cunningham-Williams, Abdallah, Callahan, & Cottler	2007	USA	425	0% M	Out of treatment women recently enrolled in 2 National Institutes of Health- funded, community-based HIV prevention trials. Logistic regression indicated that substance abusers with violent tendencies were about 3 times as likely as those without such tendencies to be PGs.	Clinical
Cunningham-Williams, Cottler, Compton & Spitznagel	1998	USA	2,954	NG 29.5% M NPG 61.7% M PG 78.2% M	Info from the National Institute of Mental Health-funded Epidemiologic Catchment Area Study of mental disorders in the general population.	General population Y
Cunningham-Williams, Cottler, Compton, Spitznagel & Be-Addalah	2000	USA	990	68% M	Studied the prevalence of problem gambling (27%) and pathological gambling (11%) amongst drug users comparing those recruited from treatment with those recruited from the community (68% male). There were no statistically significant differences in problem and pathological gambling rates for subjects recruited from drug treatment and those recruited from the community. Use of drugs and alcohol was very high in the sample. Nonetheless, problem gamblers tended to be more involved with substances than non-gamblers.	Clinical SUD
Cunningham-Williams, Grucza, Cottler, Womack, Books, et al	2005	USA	1142	49% M	Found that PG was associated with alcohol dependence/abuse 26% and Tobacco dependence 38%.	General population A
Currie, Schopflocher & Wild	2011	Canada	3,511	49.4% M	Examined the prevalence and correlates of prescription drug misuse in a population-based sample of adults from Alberta. Past-year problem gambling, illicit drug use, and alcohol use and dependence were each associated with PDM, while past-year binge drinking and daily smoking were not.	General population A
Dannon, Lowengrub, Sasson, Shalgi, Tuson et al	2004	Israel	44 PG 19 kleptomaniacs	Kleptomaniac: 63% F; PG: 2% F	Forty-four pathological gamblers and 19 kleptomaniacs were included in this study: SUD 7%, Alcohol Abuse 21%. More PGs than Kleptomaniacs had substance abuse issues.	Clinical PG & Other
Dannon, Lowengrub, Shalgi, Sasson et al	2006	Israel	78	36 F; 42 M	Examined patterns of psychiatric comorbid diagnosis across gender. Our male patients suffered from high rates of comorbid SA and alcohol abuse.	Clinical PG
Delfabbro, Winefield, Dollard, Metzger et al	2006	Australia	1281	516 boys; 765 girls	All students were in their final year of compulsory schooling and were recruited from both state-funded and private schools located in both metropolitan Adelaide (n = 946, 74%) and regional South Australia (n = 335, 26%). Substance abuse and problem gambling were correlated activities.	General population Y
Desai & Potenza	2008	USA	43,093	18518 M; 24575 F.	Data from the national epidemiological survey of alcoholism and related disorders (NESARC) (n = 43,093) were analyzed. PG was found to be associated with alcohol and drug abuse.	General population A
Desai & Potenza	2009	USA	337	NG 31,6% F NPG 24.8% F PG 27.7% F	Outpatients with schizophrenia or schizoaffective disorder were interviewed for signs of PG. A substantial proportion of individuals in treatment for psychotic disorders report past-year gambling problems. Patients with co-occurring alcohol use problems and	Clinical Other

					depression may be at particularly high risk.	
Edens & Rosenheck	2012	USA	1,102,846	91.5% M	A case-control study of all veterans who used VA mental health specialty services in FY2009 (n = 1,102,846) and compared those with a diagnosis of pathologic gambling (n = 2,283, cases) to those without this diagnosis (n = 1,100,563, controls). Alcohol use disorder 44.5% OR = 3.60 and drug use disorder 30/0% OR = 2.47, were more common amongst the pathological gamblers.	Other Adult
el-Guebaly, Patten, Currie, Williams et al	2006	Canada	14,934	51.7% F	A large national community survey conducted by Statistics Canada included questions about problems arising from gambling activities as per the Canadian Problem Gambling Index (CPGI). Problem gamblers were more likely to have substance use problems. For persons with substance dependence or harmful alcohol use, the risk of moderate/high severity gambling was 2.9 times higher	General population A
Ella & Jacobs	1993	USA	85	100% M	Alcohol treatment sample. 22% of the Native Americans studied scored in a range indicating a probable pathological gambling addiction. 7.3% of Caucasians scored in a range indicating a probable pathological gambling addiction. 41 % of the Native Americans studied (compared to 2 1.3% Caucasian) admitted to some difficulty with gambling	Clinical SUD
Ellenbogen, Derevenski & Gupta	2007	Canada	5313	2750 M; 2563 F	Data from five recent studies using self-reports were merged to explore gender differences in the characteristics of adolescent problem gambling, including comorbidity with other youth problems. Drugs and alcohol use was strongly associated with problem gambling.	General population A
Feigelman, Kleinman, Lesieur, Millman, & Lesser	1995	USA	220	67% M	Measured SOGS scores in a methadone treatment sample. 10 % were Problem Gamblers of which 70% of these qualified as pathological.	Clinical SUD
Feigelman, Wallisch & Lesieur	1998	USA	6308	M: 2916; F: 3392	Contrasted 4 groups: problem gamblers (n = 196), persons with drug or alcohol problems (n = 343), dual-problem individuals (n = 69), persons with neither gambling nor substance use problems (n= 5700). People with PG & SUD were more likely to have seen someone for mental health problem: 23%	General population A
French, McLean & Ettner	2008	USA	41,270	47.7% M	The dataset for this investigation was obtained from the National Epidemiological Survey on Alcohol and Related Conditions Wave 1, which is a large and nationally representative survey. Presents strong evidence that problematic gambling and alcohol consumption are complementary activities.	General population A
Fuentes, Tavares, Artes & Gorenstein	2006	Brazil	214	112 F; 102 M	Compared 214 PG (162 with comorbidity and 52 with no comorbidity) to 82 healthy volunteers regarding reaction time and number of errors. PGs with comorbidities scored higher than PGs without comorbidity. Substance abuse disorder, other than nicotine dependence, was found in 45 subjects.	Clinical SUD
Goldstein, Walton, Cunningham et al	2009	USA	1128	54.1% F	Measured correlates of past year gambling in a diverse sample of 1128 youths ages 14 to 18 presenting to an inner-city emergency department (ED). Past year gambling was associated with smoking marijuana, smoking cigarettes, severe dating violence and general violence.	Clinical Other
Goodyear-Smith, Arroll, Kerse, Sullivan et al	2006	New Zealand	2,536		Compared patients identified as worrying about their gambling behavior with the total screened patient population for co-morbidity in 51 urban and rural New Zealand practices. Problem gamblers were significantly more likely to have concerns about smoking, use of recreational drugs, alcohol, depression, and anxiety.	Clinical PG
Grant, Brewer & Potenza	2006	NA	NA	NA	Literature study reported that biochemical, functional, neuroimaging, genetic studies and treatment research suggest strong neurobiological link between PG & SUD.	Literature Re

Grant, Schreiber, Odlaug et al	2010	517	USA	54.7% F	Five hundred seventeen consecutive subjects were grouped into 2 categories: those who had (n = 93; 18.0%) and had not (n = 424; 82.0%) declared bankruptcy secondary to gambling. Gamblers who had declared bankruptcy were more likely to report SUD, depression, and daily use of nicotine.	Clinical Other Adult
Griffiths	1994	210	UK	.NA	This exploratory study of gambling cross addictions attempted to gather information and data regarding gambling cross addictions in the UK. To achieve this, 456 letters were sent to all drug and alcohol helping agencies in England. The main types of gambling cross addictions as reported by respondents were alcohol, drugs, and both alcohol and drugs.	Other
Griffiths, Parke & Wood	2002	Literature study	.	.	A literature review on the evidence regarding excessive gambling and substance abuse. Argues that there is a need for longitudinal research, research that controls for sociodemographic variables, family and twin studies, studies with diverse samples, studies of risk taking, studies to determine if risk factors are consequences or determinants of comorbidity, and research into specific game types.	Literature Re
Hall, Carriero, Takushi, Montoya, Preston & Gorwlick	2000	USA	313		A study of a cocaine outpatient treatment sample. Lifetime PG rate among this group was 8%, and 9% among those who also had an opiate addiction.	Clinical SUD
Hardoon, Gupta, & Derevensky	2004	Canada	2,336 students in Grades 7–13	981 M; 1326 F	A study of 2,336 students in Grades 7–13 (981 males and 1,326 females). Students completed a questionnaire regarding gambling activities, gambling severity, perceived social support, drug and alcohol dependence, and various social, emotional, and behavioural problems. 8.0% were classified as at-risk gamblers, and 4.9% as probable pathological gamblers. Use of substances increased with gambling involvement and likewise the severity of problems with substances significantly increased with degree of gambling problems.	General population Y
Henderson	2004	USA	162	112 Fs	Psychiatric outpatients completed measures used in this study as a part of their initial evaluation at an urban, university-affiliated training clinic. 2% of the sample met criteria for lifetime pathological gambling. Alcohol Dependence scale was a predictor of gambling involvement for males only.	Clinical Other
Hinwest, McKie & Anderson	2011	USA	24	15 F; 9 M	Recruited participants with behaviours that have been linked to impulsivity (gambling N = 15, and recreational drug use N = 10) and those without these behaviours (N = 9). Drug users tended to have higher venturesomeness scores than gamblers and non-gambling/non-drug using participants.	Clinical PG
Hodgins & el-Guebaly	2010	Canada	52	33% F	A naturalistic sample of pathological gamblers who had recently quit gambling (N = 101). Those participants with a drug diagnosis during their lifetime were less likely to have a minimum 3 month period of abstinence. Sixty-two percent reported alcohol abuse or dependence over the study period, while 79% were assessed as experiencing a lifetime alcohol use disorder. Both gambling treatment and an alcohol diagnosis follow up predicted an increase in the odds of experiencing a relapse from a minimum 6 month period of abstinence.	Other Longitudinal
Hodgins, Peden & Cassidy	2005	Canada	101	36 F; 65 M	A naturalistic sample of pathological gamblers (N = 101; 65 male) who recently quit gambling was followed prospectively for a year. Both alcohol and other drug disorders were more likely to precede the onset of the gambling disorder, but mood disorders were equally likely to predate or follow gambling disorders. Time to stable abstinence was significantly predicted by current alcohol disorder, current mood disorder, and lifetime mood disorder.	Other Longitudinal
Ibanez, Blanco, Donajue, Lesieur, de Castro et al	2001	Spain	69	47 M; 22 F	Gamblers with comorbid psychiatric disorders had gambling scores and psychological scale scores indicating greater severity of gambling and psychopathology. A third suffered from alcohol abuse or dependence. Significantly more men (31.9%) had current	Clinical PG

					comorbid alcohol abuse/dependency than women (4.5%).	
Kaminer, Burleson & Judamec	2002	North America (?)	97	64 M; 33 Fs	Clients in an adolescent SUD treatment sample were examined. 8% met criteria for subclinical gambling problems, but only 1% (n = 1) met criteria of both the MAGS and DSM-IV for pathological gambling.	Clinical SUD Youth
Kausch	2003	USA	113	103 M; 10 Fs	A PG treatment sample of 113 (103 males). 75 (66.4%) had a lifetime history of abuse or dependence of some substance.	Clinical PG
Kausch	2004	USA	135 37 elderly; 98 younger	127 M	Reports on the findings of a retrospective chart review for 37 elderly gamblers and 98 younger gamblers admitted to the Gambling Treatment Program of the Louis Stokes VA Medical Center at Brecksville between December 1999 and December 2002. Nearly all participants had a history of trauma. A third of the older and 72.4% of the younger clients reported a history of substance abuse or dependence history with alcohol abuse/dependency being the most common.	Clinical PG
Kausch, Rugle, Rowland	2006	USA	111	91.9% M	A PG treatment sample of 111 (91.9% male), 71 (64.0%) reported some history of abuse: 56.8% reported a history of emotional abuse, 40.5% reported physical abuse, and 24.3% reported a history of sexual abuse. High rates of substance abuse were observed amongst those who had suffered abuse. A history of trauma was associated with a greater relative frequency of suicide attempts and drug and alcohol dependence, more severe scores in measures of psychiatric distress, and limited effects on personality functioning.	Clinical PG
Kennedy, Welsh, Fulton, Soczynska et al	2010	Canada and USA		379 F; 200 M	People with manic depression (MDD) and bipolar (BD) were recruited through adds at hospitals and mood disorder clinics and psychiatric clinics. No significant difference in PG rates between MDD (12.5%) & BD (12.3%). More males in the BD group. PGs were more likely to have a mood disorder, OCD, phobia, alcohol dependence, or lifetime SUD.	Clinical Other
Kerber, Black & Bickwater	2008	USA	40	62.5% M; 37.5% F	Adults 55 years of age or older (n = 40) were recruited through word-of-mouth from Gamblers Anonymous meetings and from gambling treatment centers in Illinois and Iowa. 82.5% of the participants suffered from a mood disorder. 47.5% suffered from an anxiety disorder. Alcohol dependence was a problem for 13 (32.5%) respondents.	Clinical PG
Kofoed, Morgan, Buchkoski	1997	USA	63		Examined the Dissociative Experiences Scale and MMPI-2 Scores in Video Poker Gamblers, Other Gamblers, and Alcoholic Controls. Seventy-three percent of the video-lottery-only, 75% of video lottery and other forms of gambling, and 86% of non video lottery gambling groups had diagnoses of alcohol dependence. Overall, DES scores in this sample were high for the gamblers compared to alcoholic controls, but were highest for those who gambled on multiple forms of gambling.	Clinical PG
Ladd & Petry	2003	USA	341	39.9% F	Compared pathological gamblers with and without substance abuse treatment histories. PGs with substance abuse treatment histories had more severe problems and were more likely to be currently receiving psychological treatment.	Clinical PG
Ladouceur, Sylvain, Sevigny, Poirer et al	2006	Canada	233	inpatients 74.6% M; outpatients 70.7% M	The study compares the characteristics of pathological gamblers seeking inpatient and outpatient treatment. A total of 233 pathological gamblers (inpatients = 134, outpatients = 99) participated in the study. Inpatients scored higher on personality disorders, depression, anxiety, impulsivity, alcohol and drug problems.	Clinical PG
Langenberger, Bavly, Labouvie et al	2001	USA	372	83% M	Reported on the clinical features of pathological gambling in a heterogeneous treatment sample of 372 substance users. About 14% of male participants and 10% of female participants were identified as probable pathological gamblers (PGs) based on the South Oaks Gambling Screen. The 49 PGs showed more disturbance than the 323 NPGs on some measures of premorbid risk, pathological substance use, social consequences of use, and psychiatric comorbidity.	Clinical SUD
LaPlante, Nelson,	2008	USA	729	81% M	Substance and psychiatric disorders among men and women repeat driving under the	Clinical SUD

Odegaard et al					influence offenders who accept a treatment-sentencing option. Of the 729, 81% were male. Males and females showed different patterns of comorbidity. Only 2% of men and 1.5% of women were identified as current PGs.	
Ledgerwood & Downey	2002	USA	62	50% M	Examined the relationship between problem gambling and substance use in a methadone maintenance population. Of the sample, of 62 (50% male), Eleven (17.7%) met current SOGS criteria for probable pathological gambling. Probable PGs were more likely to use cocaine through therapy, and were more likely to drop out of the treatment program.	Clinical SUD
Lejoyeux, Feuche, Loi, Solomon, & Ades	1998	France	90 (30 AD+ICD, 30 AD & 30 control)	3 groups age & sex matched	Compared the levels of impulsivity and sensation seeking in age- and sex-matched groups of alcohol-dependent patients with concomitant ICD (ICD+, n=30), alcohol-dependent patients without ICD (ICD-, n=30) and control subjects (n=30). They argue that measures of sensation seeking, rather than impulsivity, are relevant in distinguishing between alcohol-dependent patients with and without concomitant impulse control disorders.	Clinical SUD
Lessieur & Blume	1991	USA	72	70 M; 2 F	Reports on the evaluation of patients treated for pathological gambling in a combined alcohol, substance abuse and pathological gambling treatment unit using the Addiction Severity Index. Patients reduced their intake of alcohol, other drugs and their gambling as well as improved in legal, family/social, and psychological functioning. The study supports the idea that combined treatment is an effective way of dealing with patients with both SUD and PG.	Clinical PG
Levens, Dyer, Zubritsky et al	2005	USA	843	70.2% M	Assessed the rate of gambling in a sample of elderly patients completing the gambling questionnaire. 69.6% reported that they had participated in at least one gambling activity in the last year. The strongest predictors of at-risk gambling behavior were being a binge drinker, presence of current posttraumatic stress disorder symptoms, minority race/ethnicity, and being a VA clinic patient. At-risk gambling behavior was not significantly associated with gender, current or past depressive symptoms, or cigarette smoking.	Clinical Other
Linn, Ball, Hsiao, Chiang et al	2004	Taiwan	325	180 M; 145 F	Psychiatric comorbidity and gender differences of persons incarcerated for methamphetamine abuse in Taiwan. Methamphetamine abusers from a detention center in Taipei were assessed with the Diagnostic Interview for Genetic Studies. PG: male 17 (9.4%); female 10 (6.9%).	Clinical SUD
Liu, Maciejewski & Potenza	2009	USA	1390 past-year recreational gamblers	SUD 68.7% M Non-SUD 48.8% M	The relationship between recreational gambling and substance abuse/dependence: Data from a nationally representative sample. Substance-abusing recreational gamblers, as compared to non-substance-abusing recreational gamblers, differed in gambling motivations, began gambling at earlier ages, reported heavier gambling, and preferred and performed strategic forms of gambling.	Other
Lloyd, Doll, Dutton, Geddes, et al	2010	Europe	3983	79.1% M	This study used Latent Class Analysis to examine the behaviours and health experiences of a self-selected sample of Internet users. The players were clustered into five profiles: 'non-to-minimal gamblers'; 'sports bettors'; 'casino & sports gamblers'; 'lottery players'; and 'multi-activity gamblers'. These subgroups of respondents differed on other demographic and psychological dimensions, with significant inter-cluster differences in proportion of individuals scoring above threshold for problem gambling, mood disorders and substance misuse, and history of deliberate self-harm. The 'casino & sports' and 'multi-activity-gamblers' clusters had the highest prevalence of mental disorder. Internet gamblers appear to be heterogeneous but composed of several subgroups, differing markedly on both demographic and clinical characteristics.	Other
Lorains, Cowlishaw & Thomas	2011	Literature study	.	.	Results from across the studies indicated that problem and pathological gamblers had high rates of other comorbid disorders. The highest mean prevalence was for nicotine dependence (60.1%), followed by a substance use disorder (57.5%), any type of mood	Literature Re

					disorder (37.9%) and any type of anxiety disorder (37.4%). However, there was evidence of moderate heterogeneity across studies, suggesting that rate estimates do not necessarily converge around a single population figure, and that weighted means should be interpreted with caution.	
Lynch, Maciejewski & Potenza	2004	USA	3481		Examined the psychiatric correlates of gambling in adolescents and young adults grouped by age at gambling onset. The study used a sample of 3481 public access data set derived from random-digit-dialling telephone surveys. Strong associations with alcohol and other drug use and abuse/dependence were observed with gambling in adolescent and early-onset adult gamblers, and these associations were, except for alcohol use, not observed in the adult onset gamblers.	General population A
MacCallum & Blaszczyński	2002	Australia	75	48 M; 27 F	The objective of this study was to determine the rates of substance use problems in a sample of diagnosed pathological gamblers seeking treatment in a university teaching hospital cognitive behavioural outpatient clinic. The rates for substance use disorder were higher compared to general population. Gender differences were found with more current alcohol-abuse problems reported among male than female participants. Non-alcohol-related substance abuse was relatively lower than rates reported by other studies in the literature.	Clinical PG
MacKillop, Amlung, Few, Ray et al	2011	literature study	.	.	A meta-analysis of data on delayed reward discounting and addictive behavior. Of the 46 studies examined they found 64 group contrasts of which 10 contrasted problem gamblers with some other group. Results provide strong evidence of greater delayed reward discounting in individuals exhibiting addictive behavior in general and particularly in individuals who meet criteria for an addictive disorder.	Literature Re
Martinez-Pina, de Parga, i Vallverdu et al	1991	Spain	57	47 M; 20 F	Fifty-seven PG casino gamblers were studied. 45.6 % of the pathological gamblers admitted to having suffered some kind of nervous disorder such as: anxiety, sadness, behavioural problems, doubts, etc., versus only 20% of the controls. The results show that pathological gambling correlates with other addictions including alcohol.	Other
Martins, Ghandour, Lee & Storr	2010	CANADA	9,481	51% M	Data were drawn from the CPGI consolidated dataset, which contains individual datasets from seven separate Canadian studies. Respondents who scored 8 or more points on the Canadian Problem Gambling Research Index were more likely to report being “drunk or high” while gambling and admit to having an alcohol or drug problems.	General population A
Martins, Tavares, Lobo et al	2004	Brazil	156	78 F; 78 M	PG treatment sample was examined for depression and suicide. Females attempted more suicide than males (22% vs. 6%). Males had higher rates of alcohol abuse compared to females (18% vs. 4%).	Clinical PG
Mason & Arnold	2007	New Zealand	12,529		Analysis of gambling results from the New Zealand health survey. The estimated prevalence rate of problem gambling was 1.2% (1.0–1.5) of the New Zealand adult population. A key finding was that approximately half (53.5%) of all problem gamblers have potentially hazardous drinking behaviour, compared to only one in six non-problem gamblers. 71.9% of PGs had tried marijuana.	General population A
Mathias, Vargens, Kessler & Cruz	2009	Brazil	147	Mostly M	Studied differences in addiction severity between social and probable pathological gamblers among substance abusers in treatment in Rio de Janeiro. The objective of this study was to identify the differences between substance abusers with and without gambling problems. Cocaine was the major reason for treatment among drug abusers with gambling problems. This group had more severity problems in the areas of drug use, psychiatric, legal and family-social. Furthermore, they had more suicidal ideas, parents with gambling problems and started to play earlier than the social gamblers group.	Clinical SUD
McCormick	1993	USA	2171 NPG 87%	1.6% F	Disinhibition and negative affectivity in substance abusers with no significant gambling problem (87%); those with a probable problem (7.2%) and those with a severe problem	Clinical SUD

			MPG 7.2%; PG 5.8%		(5.8%), in a cohort of 2, 171 substance abusers. Substance abusers with gambling problems scored significantly higher on measures of: impulsivity; disinhibition of aggressive/hostile responses; and negative affectivity. They also abused more substances than the non-gamblers. The results underscore the importance of assessing a wide range of impulsive behaviours in substance abusers.	
McIntire, McElroy, Konarski, Soczynska et al	2007	Canada	36,984		Results from the Canadian Community Health Survey.	General population A
Momper, Delva, Grogan-Kaylor et al	2010	USA	3,596	60% F	Telephone survey of the general population. About 33% of PGs had experienced at least a depressive symptom and 13% had been arrested in their lives. Individuals with problem gambling were more likely to use tobacco (OR = 5.40) several times per week, but this association became non-significant when demographic controls were entered in the model . Being at risk for problem gambling was significantly associated with alcohol (OR = 3.87) and tobacco (OR = 2.83) use. Pathological gambling was also strongly and significantly associated with marijuana use	General population A
Nathan	2003	USA	Literature Study	.	Most PGs and alcohol abusers recover on their own, yet such people are at greater risk for relapse than those who've been through successful treatment. Some PGs who recover on their own will continue to gamble, though not pathologically. While pathological gamblers with comorbid substance abuse are more difficult to treat than those without it, the impact of comorbid substance abuse on the decision to change has not yet been explored.	Literature Re
Neumark & Bar-Hamburger	2011	Israel	7,166	boys: 48.3%	Volatile substance misuse among youth in Israel: results of a national school survey (ages 12-18). Volatile substance misuse was associated with internet gambling.	General population Y
Nower, Derevenski & Gupta	2004	Canada	1,339	637 M; 702 F	Student participants were recruited through professors who volunteered their classes. Impulsivity increased with the degree of gambling involvement. Overall, substance use, coping through distraction, and impulsivity proved the most predictive of disordered gambling for males, and intensity seeking and impulsivity proved most predictive for females. Gamblers were more likely than non-gamblers and social gamblers to cope with stress by abusing substances.	General population Y
Park, Cho, Jeon, Lee, Bae et al	2010	Korea	5,333	Controls: 48.1% M MPG 87.3% M PG 90.7% M	Based on the National Epidemiological Survey of Psychiatric Disorders in South Korea conducted in 2006. Of pathological gamblers, 79.1% had at least one psychiatric illness in comparison to the control level of 28.1%, and 62.0% of problem gamblers also had psychiatric conditions. Among PGs 69.8% had at least one SUD.	General population A
Patterson, Holland & Middleton	2006	USA	38	PG 56% M Controls 35% M	20 controls and 18 patients. Controls were recruited from friends and unrelated family members (in-laws) of the patients to control for differences in socioeconomic status (SES). All patients had a comorbid psychiatric disorder. five patients (22%) were diagnosed with alcohol abuse or dependence in the past year.	Clinical PG
Pelletier, Ladouceur & Rheume	2008	Canada	100	72 M; 28 F	PG treatment sample. Sixty-four per cent of the participants had at least one comorbid PD. The most frequent comorbid PD was antisocial personality disorder (29.0%). Alcohol: 15 (16.0%) and drugs: 5 (5.3%)	Clinical PG
Petry	2000	USA	134	NPG SUDs: 63% M; PGs with SUD: 87% M	Subjects were recruited from newspapers & social service agencies. Compare SUD clients with and without PG. SUDs with PG were more likely to be male than those without PG.	Clinical SUD
Petry	2000	USA	103	NPG SUDs: 86% M; PGs with SUD: 87% M	SUD subjects were recruited using newspaper advertisements and flyers distributed at local substance abuse treatment programs, in low-income housing projects, and at social service agencies. The study compared SUD clients with and without PG. Somatisation, obsessive-compulsive, interpersonal sensitivity, hostility, and paranoia scales differed	Clinical SUD

					significantly between groups. Scores on the depressive, anxiety, phobic anxiety, and psychotism scales did not differ significantly between the groups. Out of 103 SUDs, 31 were PG.	
Petry	2001	USA	111	100% M	Substance use, pathological gambling, and impulsiveness were studied in a sample of PGs in treatment with SUD, without SUD, & controls. 35% of the PGs had histories of SUD. The most common substances were alcohol (71%); marijuana (66%); and cocaine (33%).	Clinical PG
Petry	2007	.	Literature study	.	This paper reviewed the clinical presentation of pathological gambling and presents data related to the co-occurrence of pathological gambling and substance use disorders. Both epidemiological and treatment data are reviewed. The putative physiological substrates underlying pathological gambling are described, along with the limited genetics data. Types of treatments applied to gamblers are described, including data on efficacy and overlap of issues that relate to both gambling and substance use disorders.	Literature Re
Petry & Casserella	1999	USA	81	Control 84% M SUD/NPG 82%M PG & SUD 86%M	Substance abusers discounted delayed rewards at significantly higher rates than non-substance abusing controls, and problem gambling substance abusers discounted delayed rewards at higher rates than their non-problem gambling substance abusing counterparts.	Clinical PG Youth
Petry & Tawfik	2001	USA	225	NPG 79.8% M; PG 98.2% M	In a SUD treatment sample 225 marijuana-abusing youths, 22% reported experiencing gambling problems.	Clinical SUD
Phillips & Ogeil	2011	Australia	462	133 M; 329 F	University students (n = 462) completed online the Melbourne Decision Making Questionnaire, Alcohol Use Disorders Identification Test, and the South Oaks Gambling Screen. Participants at risk for alcohol related problems differed in their decisional styles from those at risk for gambling problems. A greater risk of alcohol related problems was linked to lower vigilance scores and increased tendencies towards procrastination. A higher risk of gambling problems was associated with lower decisional self-esteem and an increased proneness to hypervigilance or panic. Problem drinkers were more likely to have an avoidant decisional style.	General population Y
Pietrzak, Morasco, Blanco, Grant & Petry	2007	USA	10,563	NG 38.8%M NPG 54.2% M PG 64.4% M	Data on 10,563 U.S. older adults (age 60 or older) were analyzed from the National Epidemiologic Survey on Alcohol and Related Conditions. PGs had higher rates of several disorders including alcohol dependence and any drug abuse.	General population A
Potenza	2006	Opinion paper	.	.	An opinion paper in which the author discusses PG and ICD. PG and other ICDs have historically received relatively little attention from the mental health research and treatment communities. The improved understanding of the relationship between ICDs and other psychiatric disorders, particularly SUDs, has important implications not only for the categorization of ICDs, but also for improving prevention and treatment strategies.	Literature Re
Potenza, Steinberg & Wu	2005	USA	960	AD 74.3% M; no-AD 57.0% M	The data from a study of helpline callers. A relatively low proportion of callers reported a problem with alcohol use (173/960 or 18.0%), and of those acknowledging an alcohol use problem, the majority reported a past rather than current problem (143/173 or 82.7%). Those reporting past or current alcohol use problems were more likely to be male and had more problems caused by gambling, past or current alcohol problems and more gambling related suicide attempts.	Clinical PG
Potenza, Steinberg, McLaughlin, Wu et al	2001	USA	562	62.1% M; 37.9% F	Examined gender related differences in comorbidities in a sample of helpline callers. Male and female gamblers reported significantly different patterns of drug and alcohol problems. Female gamblers were more likely to report receiving non-gambling-related mental health treatment. Male gamblers were more likely to report a drug problem or an arrest related to gambling. High rates of debt and psychiatric symptoms related to gambling, including anxiety and depression, were observed in both groups.	Clinical PG

Preston, McAvoy, Saunders, Gillam, Saied & Turner	In Press	Canada	254	100% M	Offenders were assessed using self-report tests, interviews, and a file review. Results indicated that problem gambling was significantly correlated with drug problems and alcohol problems.	Other
Rowan & Galasso	2000	Canada	54		Identifying office resource needs of Canadian physicians to help prevent, assess and treat patients with substance use and pathological gambling disorders. Information was collected from 54 key informants in the medical field. The majority of respondents were more aware of resources for substance use disorders than for pathological gambling disorders. Materials (for physicians and patients) were generally the most often cited resource for substance use and pathological gambling disorders, followed by courses.	Other
Rupcich, Frisch & Govoni	1997	Canada	328	220 M; 108 F	Studied the comorbidity of pathological gambling in addiction treatment facilities. The percentage of probable pathological gamblers was 13% for males and 17% for female.	Clinical SUD
Rush, Bassani, Urbanoski & Castel	2008	Canada	36,885	16723 M; 20162 F	Influence of co-occurring mental and substance use disorders on the prevalence of problem gambling in Canada from a cross-sectional national survey. The prevalence of low risk gambling in the population was 2.8%; the prevalence of moderate risk gambling was 1.5%; and the prevalence of problem gambling was 0.5%. Compared to the general population, higher prevalence rates of PG are observed when the severity of SUD is higher, but are not impacted by the co-occurrence of mood and anxiety disorders.	General population A
Sacco, Cunningham-Williams, Ostmann & Spitzanel	2008	USA	153	55% F	Using targeted advertising, we enrolled 153 gamblers (55% female; 32% minority; Mean age = 47; SD = 18.2) in a clinical validation study of the newly developed computerized gambling assessment module. Significant effects were found for borderline, histrionic, and avoidant personality disorder. In addition depression was significantly related to severity of problem gambling. Alcohol and drug abuse were not related to problem gambling.	Clinical PG
Scherrer, Xian, Shah, Volberg et al	2005	USA	1346 controls, 53 pathological gamblers, 270 subclinical problem gamblers	100% M	Male twin members of the Vietnam Era Twin Registry: 53 pathological gamblers, 270 subclinical problem gamblers, and 1346 non-problem gamblers (controls). Pathological and problem gambling are associated with significant decrements in health-related quality of life. Compared to non-problem gamblers, pathological gamblers were more likely to have problems with alcohol (66%), nicotine (74.4%), and drugs (30.2%).	General population Longitudinal
Schneier, Foose, Hasin, Heimberg et al	2010	USA	43,093	18518 M; 24575 F	Among respondents with Social Anxiety Disorder, alcohol dependence and abuse were most strongly associated with more substance use disorders, pathological gambling and antisocial personality disorders. SAD occurred before alcohol dependence in 79.7% of co-morbid cases, but co-morbidity status did not influence age of onset for either disorder.	General population A
Sellman, Adamson, Robertson, Sullivan, Coverdale	2002		124 patients with mild-moderate "alcohol dependence," defined by the DSMIV criteria	58.1% M; 41.9% F	Gambling in mild-moderate alcohol-dependent outpatients. 124 patients with mild-moderate "alcohol dependence," defined by the DSMIV criteria. 19.4% scored 1 to 4, and five subjects (4.0%) scored 5 or more on SOGS	Clinical SUD
Shaffer & Hall	2002	USA	6067 Casino employees	Time 1 42.1% M; Time 2 39.2% M; Time 3 38.3% M	The paper reports on the findings from a study of gambling and drinking problems among casino employees. They found a strong relationship between gambling and drinking problems. The results suggest that the employees showed considerable changes in their gambling behavior within the context of regular exposure to gambling. Amongst the employees, 22.6% improved their gambling status and 11.6% became more disordered. Comorbid drinking problems did not preclude improvement in disordered gambling.	Other

Shaffer, Freed & Healea	2002	USA	164	53% M	Examined 171 homeless persons seeking psychiatric and substance abuse treatment at a community services program in order to determine the PG rates among this cohort. Consistent with other information on PG among persons with substance abuse and psychiatric problems, PG rates higher than those among the general population were found, suggesting that clinicians working with the homeless should screen for this disorder.	Clinical Other
Shaffer, Nelson, LaPlante, Labrie et al	2007	USA	729	81% M	Studied the rates of psychiatric disorders among repeat DUI offenders who accepted a treatment-sentencing option. Participants included all consenting eligible admissions (N = 729) to a 2-week inpatient treatment facility for court-sentenced repeat DUI offenders. Almost half qualified for lifetime diagnoses of both addiction (i.e., alcohol, drug, nicotine, and/or gambling) and a psychiatric disorder. Older offenders were more likely to be pathological gamblers.	Clinical SUD
Shah, Bazargan-Hejazi, Lindstrom & Wolf	2009	USA	2710 medical students from 36 U.S. medical schools	60% F	Studied the prevalence of at-risk drinking among a national sample of medical students. Medical students from 36 U.S. medical schools completed the survey. Problem gambling was one of several variables related to "at risk" drinking.	Other
Shepherd	1996	USA	93	100% M	Assessed the prevalence of problem gambling among veterans in Methadone and Alcohol Clinics. In total 17% of the sample population in the study were probable pathological gamblers and an additional 34% were potential subclinical problem gamblers. A number of clinical obstacles were encountered in administrating the SOGS in this environment. Both client and staff noncompliance during the screening were major concerns in this respect.	Clinical SUD
Slutske, Caspi, Moffitt & Poulton	2005	New Zealand	939	475 M; 464 F	Examined personality and problem gambling using a prospective method with a birth cohort of young adults. Problem gambling at age 21 years was associated with higher scores on the higher-order personality dimension of negative emotionality (d = 0.90) and with lower scores on the personality dimension of constraint (d = -0.72) measured at age 18 years compared with control subjects who did not have a past-year addictive disorder at age 21 years. From the perspective of personality, problem gambling has much in common with the addictive disorders, as well as with the larger class of "externalizing" or "disinhibitory" disorders.	General population Longitudinal
Slutske, Eisen, True et al	2000	USA	6,744	100% M	Studied common genetic vulnerability for pathological gambling and alcohol dependence (AD) in men. Men with sub-clinical PG were at significantly elevated risk for AD compared with men with no PG symptoms. The risk of AD was also significantly elevated among both MZ and DZ co-twins of men with subclinical PG compared with MZ and DZ co-twins of men with no PG symptoms. Subclinical PG, or problem gambling, may be a milder form of PG, rather than an etiologically distinct syndrome. Risk for alcohol dependence accounts for a significant but modest proportion of the genetic and environmental risk for PG.	General population Longitudinal
Specker, Carlson, Edmonson & Johnson	1996	USA	40 gambler, 64 controls	PG 62.5% M; Control 64.0% M	All patients were at least two weeks into treatment between March and June 1993 (n = 67) at Gamblers Choice, a Minneapolis outpatient treatment program for PG's. A total of 40 subjects (15 female, 25 male), consisting of 60% of those in treatment, volunteered and completed the interview. Sixty-four controls (23 female, 41 male) were recruited through newspaper advertisements. Alcohol and drug abuse were more common amongst the problem gamblers.	Clinical PG
Spunt	2002	USA	462		Studied pathological gambling and substance misuse in a sample of 462 SUD treatment sample. That study found that 21% of the sample were probable pathological gamblers,	Clinical SUD

					while an additional 9% were subclinical problem gamblers. Males were more likely than females to be pathological gamblers and subclinical problem gamblers.	
Spunt, Dupont, Lesieur, Liberty & Hunt	1998	Literature Study	.	.	The authors review the literature on pathological gambling and substance misuse. They note that most of the research has focused on treatment populations. The authors note a lack of awareness in treatment settings about problem gambling. In addition, they discuss a number of significant gaps in the literature including links with specific kinds of substances, (e.g., alcohol, cocaine, heroin, and tobacco products), and substance abuse amongst females gamblers.	Literature Re
Spunt, Lesieur, Hunt & Cahill	1995	USA	117	60% M	Studied gambling among 117 methadone patients. 15% of the patients had some problem with gambling, and an additional 16% were probable pathological gamblers.	Clinical SUD
Spunt, Lesieur, Libery & Hunt	1996	USA	99	72 M; 27 F	Examined pathological gamblers in methadone treatment focusing on differences between men and women. 25% of the males in the sample were identified as pathological gamblers as opposed to 15% of the females. Males were somewhat more likely than females to be subclinical problem gamblers (12% vs. 4%). Males were also more likely to have ever used hallucinogens.	Clinical SUD
Steinberg, Kosten & Rounsaville	1992	USA	298	SUD with PG 89% M SUD with NPG 66% M	Studied pathological gambling in a sample of 298 treatment-seeking cocaine abusers. 44(15%) were pathological gamblers. That is 10 times the rate of gamblers found in community samples. There was a significant difference in the gender of the two groups with the gamblers having a much higher percentage of males (89% vs. 66%). Dually diagnosed addicts were more likely to have had attention deficit disorder and alcoholism, were more likely to be polydrug abusers, had more legal problems and showed somewhat higher sensation-seeking behavior.	Clinical SUD
Ste-Marie, Gupta & Derevenski	2006	Canada	1,044	512 M; 532 F	Studied anxiety and social stress amongst adolescence and its relationship to gambling behavior and substance use. Probable pathological gamblers reported more daily and weekly alcohol consumption, used more uppers, downers, and hallucinatory drugs, and smoked more cigarettes on a daily basis compared with non-gamblers, social gamblers, and at-risk gamblers.	General population Y
Stewart, Zack, Colloins & Klein	2008	Canada	158	77% M	Reports on a study to determine subtypes of pathological gamblers on the basis of affective motivations for gambling. Used cluster analysis to define three groups of gamblers: coping vs. enhancement vs. low emotion regulation gamblers. Validity analyses showed that coping gamblers scored higher than the other groups on a variety of different gambling activities, gambling problems, drinking frequency, drinking problems, and coping drinking motives, whereas low emotion regulation gamblers scored lower than the other groups on gambling frequency, gambling problems, drinking quantity, and enhancement drinking motives.	Other
Stinchfield	2000	USA	78,582	50.9% M	Studied gambling and correlates of gambling among Minnesota public school students. Variables associated with gambling frequency included antisocial behavior, gender (being a male), alcohol and tobacco use, age, feeling bad about the amount of money they bet, a desire to stop gambling, and increased sexual activity. Gambling appears to be related to other risk-taking behaviours and may be a part of the adolescent experimentation with adult behaviours.	General population Y
Stinchfield, Kushner & Winters	2005	USA	765	464 M; 301 F	The purpose of this study is to explore the effect of current alcohol use level and previous substance abuse treatment on the symptoms of a large cohort of pathological gamblers as well as on their response to treatment for pathological gambling. The sample included 464 men and 301 women recruited at six gambling treatment programs in Minnesota. The level of pre-treatment alcohol use and substance abuse were related to greater gambling problem severity. Treatment outcomes for pathological gambling were not adversely	Clinical PG

					affected by substance use.	
Sussman, Lisha & Griffiths	2011	NA	Data from 83 studies (each study n = at least 500 subjects) were presented and supplemented with small-scale data.	.	Prevalence of addictions: a problem for the majority or the minority? Data from 83 studies (each with n >= 500) were presented and supplemented with small-scale data. Depending on which assumptions are made, overall 12-month prevalence of an addiction among U.S. adults varies from 15% to 61%. The authors assert that it is most plausible that 47% of the U.S. adult population suffers from maladaptive signs of an addictive disorder over a 12-month period and that it may be useful to think of addictions as due to problems of lifestyle as well as to person-level factors; 26% of gambling addicts had substance abuse problems.	Literature Re
Teo, Mythily & Anatha	2007	Singapore	150	87.3% M	Demographic and clinical features of 150 pathological gamblers referred to a community addictions program. The most common comorbid disorders were mood disorders (n = 22, 14.7%), substance abuse (n = 11, 7.3%) and alcohol abuse or dependence (n = 7, 4.7%).	Clinical PG
Toneato, Skinner & Dragonetti	2002	Canada	169	.	Reported on patterns of substance use in treatment-seeking problem gamblers and on their impact on treatment outcomes. Two thirds of the sample had used drugs at least once in their lifetime, and almost half had been prescribed a psychiatric medication at least once. Illicit drug use declined 50% between pre-treat to post treatment. Gambling treatment outcomes were unrelated to history of drug or medication use. No evidence was found for substitution of psychoactive substance use for gambling during the follow-up year. Gamblers in treatment are more likely to be involved with drug and medication use compared to the general population, but that such histories are not associated with gambling treatment outcomes.	Clinical PG
Toneatto	2002	Canada	200	74.9% M	Relationship between gender and substance use among treatment-seeking gamblers was studied using a PG treatment sample. Females were more likely to report lifetime use of psychotropic medications, primarily anti-depressants. Males were more likely than females to drink alcohol in the month prior to seeking treatment for gambling as well as during the 12-month follow-up period.	Clinical PG
Toneatto & Brennan	2002	.	580	Lifetime drug use: 77.3% M Lifetime medication use: 58% M	Examined the presence of pathological gambling in treatment-seeking substance abusers. Male alcohol patients were more likely to have a subclinical pathological gambling problem (9.1% male vs. 0% female). Similarly, male cocaine patients were also more likely to score in the clinical range on the SOGS (14.2%) compared to 4.7% of the female cocaine patients. In addition, 7.8% of males but only 1% of females who had been assigned psychiatric diagnosis at some point in their life time scored in as subclinical problem gamblers.	Clinical SUD
Turner, Ialomiteanu, Paglia-Boak & Adlaf	2011	Canada	2,243	51% M	The analysis of clusters of youth regarding drugs, alcohol and gambling behaviours. The data suggested four clusters: Mainstreamers (66.0%), Party Goers (26.2%), Drug Takers (5.9%), and Heavy Gamblers (1.9%). Probable pathological gamblers were found in all four clusters, but they were most concentrated in the heavy gambling cluster. The results suggest that troubled youths are not a single entity, but display heterogeneity in their configuration of risk behaviours.	General population Y
Vitaro, Brendgen, Ladouceur & Trembay	2001	Canada	717	100% M	Participants were part of an ongoing longitudinal study started in 1984 with 1,034 kindergarten boys. Included in this study were 717 boys. The present findings contradict previous findings about the influence of gambling on other problem behaviours and support the notion of a "general problem behavior syndrome" fed by generic risk factors. Gambling frequency was also positively related to drug/alcohol use, but this relation also became stronger from age 16 to age 17 years.	General population Longitudinal

Wanner, Vitaro, Carbonneau, & Tremblay	2009	Canada	sample A: 1,037, 100% M; sample B: 2000, 1,001 boys, 999 girls	sample A: 1037 100% M; sample B: 1001 boys; 999 girls	Used cross-lagged method of analysis to examine gambling, substance use, and delinquency from mid-adolescence to young adulthood. Adolescent substance use was related to subsequent theft and violence but not to gambling. Gambling problems were linked to subsequent gambling participation. For adolescents with deviant peers, gambling problems were linked to subsequent theft; this was not the case for adolescents without deviant peers.	General population Longitudinal
Wareham & Potenza	2010	literature study	.	.	Reviewed the relationship between pathological gambling and substance use disorders. They report that problematic gambling is more common among people with alcohol use disorders (AUDs) (i.e., either alcohol abuse or dependence) compared with those without AUDs. This association holds true for people in the general population and is even more pronounced among people receiving treatment. Similarities between PG and SUDs have important implications for categorizing, assessing, preventing and treating both PG and SUDs. Additional research into possible endophenotypes should help better characterize PG and SUDs and lead to improved and more precisely targeted prevention and treatment strategies.	Literature Re
Welte, Barnes, Wieczorek & Tidwell	2004	USA	2631	1369 M; 1262 F	Studied risk factors for pathological gambling using a phone survey. Alcohol abuse is strongly predictive of gambling pathology, even with gambling behaviours held constant. Males were more likely than females to drink while gambling. Those gamblers who are drinkers, but did not drink while gambling, had a prevalence of problem gambling of close to zero.	General population A
Welte, Barnes, Wieczorek, Tiwell, Parker	2001	USA	2638	1,268 M, 1,369 F	Examined the prevalence and demographic distribution of problem gambling, pathological gambling, alcohol abuse and alcohol dependence in the United States, and to examine the co-occurrence of gambling pathology and alcohol pathology. Current pathological gambling and alcohol dependence were correlated, and the highest correlation was found among higher SES respondents.	General population A
Westermeyer, Canive, Garrard, Thuras & Thompson	2005	USA	1228	Indian: 628 M; 90 F; Hispanic: 475 M; 35 F	Lifetime prevalence of pathological gambling among American Indian and Hispanic American veterans. PG & SUD were significantly associated.	Other
Westphal & Johnson	2007	USA	78		Examined multiple co-occurring behaviours among gamblers in treatment. The majority of participants (76.6%; n 1/4 77) self-reported that one or more behaviours co-occurred with their gambling problem. The majority of the sample (55.8%) had at least two other psychiatric or substance use behaviours. In a regression analysis, co-occurring behaviours, depression, use of drugs in general, and the use of 'uppers' were significant predictors lifetime SOGS scores.	Clinical PG
Westphal, Rush, Stevens & Johnson	1996	135	.	black boys: 59%; white boys 22%; white girls 14%, black girls 9%; other: 5%	Studied gambling behavior of adolescents in residential placement in Northwest Louisiana. In this adolescent PG treatment sample, alcohol, cigarettes & gambling began on average at 11 years of age.	Clinical PG
Willoughby, Chalmers, & Besseri	2004	Canada	7,430	3,475 M; 3,815 F	The authors examined co-occurrence among a wide range of adolescent problem behaviours including alcohol, smoking, marijuana, hard drugs, sexual activity, major and minor delinquency, direct and indirect aggression, and gambling. Then a confirmatory factor analysis was used to test the problem syndrome model proposed by problem behavior theory. A 3-factor model provided better overall fit than did a single problem syndrome factor model.	General population Y

Winters & Anderson	2000	USA	Literature study	.	Reviewed the literature on gambling involvement and drug use among adolescents. Claims that the prevalence rate of problem/ pathological gambling among adolescents is comparable or higher than the rate of substance use disorders are not supportable at this time given the weaker methodological studies in the gambling area. While research suggests that similar risk factors may be important determinants for both behavior domains, prospective studies of adolescent development are needed to further clarify which factors are unique and common to adolescent gambling.	Literature Re
Wu, Woody, Yang & Blazer	2011	USA	43,093	18518 M; 24575 F	Studied how prescription opioid users differ from users of heroin or other drugs in psychopathology. Data was taken from the National Epidemiologic Survey on Alcohol and related conditions. Approximately 23% of all respondents were lifetime drug users (0.3% used heroin, 5% used other opioid, and 18% used other nonopioid drugs). Nonopioid drug users had reduced odds of all SUDs and other mental disorders (mood, anxiety, pathologic gambling, and personality) when compared with other opioid-only users. The results indicate that different types of drug users (e.g., heroin vs. other opioid etc..) may have different natural histories and treatment needs.	General population A
Zack, Stewart, Klein, Loba & Fragopoulos	2005	Canada	144	34 F	This study investigated the effects of contingent gambling-drinking patterns and problem drinking severity on implicit gambling-alcohol associations. Participants who reported drinking when they won displayed faster response time (i.e., priming) on trials where alcohol words were paired with gambling win (e.g., jackpot) vs. gambling loss (e.g., forfeit) words. The tendency to drink in response to losses did not influence the priming effect of win cues or moderate the effects of Win-Drinking Pattern on priming. Severity of problem drinking also correlated positively the priming effects of win cues. These findings indicate that a tendency to drink in response to gambling wins and more severe alcohol problems each coincide with stronger associations between gambling win and alcohol concepts in memory.	Other
Zimmerman, Chelminski & Young	2006	USA	1,709	62.05% F	Prevalence and diagnostic correlates of DSM-IV pathological gambling in psychiatric outpatients. Examined the current and lifetime prevalence of PG in 1,709 psychiatric outpatients. Forty (2.3%) patients had a lifetime history of DSM-IV PG. Twelve (.7%) patients had current PG, five (.3%) had PG in partial remission, and 23 (1.3%) had a past diagnosis. Three (.2%) of the 1,709 patients had PG as their principal diagnosis. The most common lifetime diagnoses were MDD (62.5%), alcohol abuse/dependence (62.5%), social phobia (47.5%), panic disorder with agoraphobia (42.5%), and drug abuse/dependence (37.5%).	Clinical Othe

Appendix 2: Comorbid psychiatric disorders details

Authors	Date	Country	Sample Size	Sex Ratio	Summary	Type of Sample	Disorders Ex
Affifi, Brownbridge, MacMillan & Sareen	2010	USA	3334		Data were drawn from the US National Comorbidity Survey Replication. Pathological gambling was associated with increased odds of the perpetration of dating violence.	General population: Adult	Aggression /
Alegria, Petry, Hasin, Liu et al	2009	USA	43,093	White: 72.1%M Black: 54.1%M Native: 76.7%M Hispanic: 80.5%M	Analyses based on the National Epidemiologic Survey on Alcohol and Related Conditions. Black and Native / Asian individuals have higher prevalence of disordered gambling. Psychiatric comorbidity differed between black, Hispanic and white PGs. For example, anxiety was lower amongst Hispanics, but mood disorders were higher. Alcohol use was higher amongst white than other groups.	General population: Adult	General com
Alvarez-Moya, Jimenez-Murcia, Aymami et al	2010	Spain	1,171 (all PG)	7.7% F	Found several specific disorders were common amongst PGs including OCD, depression, anxiety and general symptoms.	Treatment / help seeking: Frequencies	Depression, phobias, Imp control, Gen comorbidity
Bagby, Vachon, Bulmash & Quilty	2008	Canada	204	102 M; 102 F	Found elevated levels of psychiatric symptoms amongst PGs.	Targeted sample: PG vs. NPG	General com
Bernardi & Pallanti	2009	Italy	50	60% F	Found several comorbid disorders amongst PGs including ADHD, Social anxiety and borderline personality.	Treatment / help seeking: Frequencies	Anxiety / ph Impulse con Other, Bipol
Biddle, Hawthorne, Forbes & Coman	2005	Australia	153	all M	There was no significant relationship between problem gambling, posttraumatic stress disorder (PTSD), anxiety, depression, or alcohol use, however all client had PTSD and the rate of PG was 28% according to the SOGS, which is very high.	Treatment / help seeking: Other	Depression,
Bienvenu, Samuels, Riddle, Hoehn-Saric et al	2000	USA.	796	OCD 19%M; Control: 3%M	OCD clients were assessed for various psychiatric disorders. Among 80 cases of OCD, none were PG. The sample consisted of 80 case & 73 control probands and well as 343 case & 300 control first-degree relatives.	Treatment / help seeking: Other	Obsessive-co disorder
Black & Moyer	1998	USA	30	23 M; 7 F	Of the 30 participants 60% had a lifetime mood disorder and 40% had a lifetime anxiety disorder.	Targeted sample	Depression, phobias
Black, Moyer & Schlosser	2003	USA	52 30 PG, 22 controls)	PGs 23.3% F	Found elevated levels of depression, OCD, and deficits in overall functioning.	Targeted sample	Depression, Obsessive-co disorder, Ge comorbidity
Blanco, Alegria, Petry, Grant, et al	2010	USA	43000	Gen Pop, 47.4%	A face-to-face survey of more than 43,000 adults aged 18 years and older residing in households was conducted during the 2001-2002 period to determine the causes of fire setting. The findings suggest that fire-setting may be better understood as a behavioral manifestation of a broader impaired control syndrome and part of the externalizing spectrum that includes pathological gambling, antisocial personality disorder, drug dependence and bipolar disorder.	General population: Adult	Other, Perso disorder

Blanco, Potenza, Kim, Ibanez, Zaninelli	2009	USA	38	20 M; 18 F	The results suggest that, although PG exhibits features of both obsessiveness / compulsivity and impulsivity and elements of both decrease with treatment, impulsivity predominates and changes in gambling severity are most associated with changes in impulsivity.	Treatment / help seeking: Frequencies	Impulse control Obsessive-compulsive disorder
Blaszczynski & Farrel	1998	Australia	44	88.6% M	An analysis of 44 case records of suicide occurring between 1990 and 1997. In almost a third (31.81%) of the cases there was sufficient evidence to suggest a premorbid history of depression or the presence of depression at the time of death.	Targeted sample: Case records	Depression
Blaszczynski & Steel	1998	Australia	82	73% M	Nearly all of the clients examined (93%) met the criteria for at least one personality disorder. The most common were borderline (70%), histrionic (66%), narcissistic (57%), and paranoid (40%).	Treatment / help seeking: Frequencies	Personality disorders
Blinn-Pike & Worthy	2008	USA	179	all F	Participants were 179 women from a variety of courses at a southeastern university completed a written survey during spring and summer 2005. Compared women who had gambled at a casino in the past there was significant group main effect was observed on the disinhibition.	General population: Student / youth	Impulse control
Breyer, Botzet, Winters et al	2009		235	179 M; 56 F	Longitudinal study of the relationship between gambling and ADHD among an epidemiological sample of young adults. ADHD persisters were significantly more likely to be categorized as possible problem gamblers.	General population: Longitudinal	Impulse control
Brooker, Clara & Cox	2009	Canada	36984 total 742 PG	M: 50.8%	Studied 742 moderate to high risk gamblers taken from a total sample of 36984. Positive associations between problem gambling and various past-year disorders and mental health behaviours were found, with the strongest association being for suicide attempts. The study found elevated levels of mania and depression amongst moderate to severe problem gamblers. No effect of anxiety was found.	General population: Adult	Depression, Anxiety
Carter et al	2005	New Zealand	211 with bipolar	121 F; 90 M	Out of a sample of 211 bipolar clients, five men and no women had pathological gambling.	Treatment / help seeking: Other	Bipolar
Champine & Petry	2010	USA	231		More serious problem gamblers were more likely to seek mental health treatment, but they found that individual cognitive-behavioral therapy was efficacious in reducing gambling problems irrespective of mental health treatment utilization.	Treatment / help seeking	General comorbidity
Cunningham-Williams, Abdallah, Callahan & Cottler	2007	USA	605 SUD + PG: 180 SUD no PG: 425	all F	Logistic regression indicated that substance abusers with violent tendencies were about 3 times as likely as those without such tendencies to be PG	Treatment / help seeking: SUD	Aggression / violence Personality disorders
Cunningham-Williams, Cottler, Compton & Spitznagel	1998	USA	2,954		Analyses showed that increasing levels of gambling severity were associated with a corresponding increase in the likelihood of meeting criteria for various psychiatric disorders.	General population: Adult	Depression, Anxiety Personality disorders Psychosis / schizophrenia
Cunningham-Williams, Cottler, Compton, Spitznagel & Be-Addalah	2000	USA	990	68% M	Studied the prevalence of problem gambling (27%) and pathological gambling (11%) amongst drug users comparing those recruited from treatment with those recruited from the community (68% male). There were no statistically significant differences in problem and pathological gambling rates for subjects recruited from drug treatment and those recruited from the community. Problem gamblers scored higher on antisocial personality disorders, higher on phobia in their treatment sample but not their community sample, but were not more depressed than the other substance abusers.	Treatment / help seeking: SUD	Personality disorders Anxiety / phobias Depression

Cunningham-Williams, Grucza, Cottler, Womack, Books, et al	2005	USA	1142	49% M	Found that PG was associated with depression and anxiety.	General population: Adult	Depression, phobias
Dannon, Lowengrub, Sasson, Shalgi, Tuson et al	2004	Israel	44 PG & 19 K	K: 63% F; PG: 2% F	The most common problem for the PGs was affective disorders, but fewer PGs were depressed compared to Kleptomaniacs (K) but more PG had substance abuse issues.	Treatment / help seeking: PG vs. other	Depression, Obsessive-compulsive disorder
Dannon, Lowengrub, Shalgi, Sasson et al	2004	Israel	78	36 F; 42 M	Examined patterns of psychiatric comorbid diagnosis across gender. Females scored higher on OCD, panic, eating disorders, and depression.	Treatment / help seeking: Frequencies	Depression, phobias, Obsessive-compulsive disorder
Desai & Potenza	2008	USA	43,093	18,518 M; 24,575 F	PG was found to be associated with depression, OCD, ASPD anxiety, however for anxiety both general anxiety and panic disorders were only found for females.	General population: Adult	Depression, phobias, Panic disorder, Obsessive-compulsive disorder
Desai & Potenza	2009	USA	337		Outpatients with schizophrenia or schizoaffective disorder were interviewed for signs of PG.	Treatment / help seeking: PG vs. other	Depression, Anxiety / schizophrenia
di Nicola, Tedeschi, Mazza, Martinoti et al	2010	Italy	252	Bipolar: 41% M Control: 40% M	Participants were recruited from September 2006 to October 2008 among outpatients referring to the Bipolar Disorder Unit Treatment of the Day-Hospital of Clinical Psychiatry	Treatment / help seeking: Other	Depression, Impulse control disorder, Generalized anxiety disorder, Bipolar
Dussault, Brendgen, Vitaro, Wanner & Tremblay	2011	Canada	1004	All M	Analyses revealed a positive predictive link between impulsivity at age 14 and depressive symptoms and gambling problems at age 17.	General population: Longitudinal	Depression, control
Edens & Rosenheck	2012	USA	1,102,846	91.5% M	A case-control study of all veterans who used VA mental health specialty services in FY2009 (n = 1,102,846) and compared those with a diagnosis of pathologic gambling (n = 2,283, cases) to those without this diagnosis (n = 1,100,563, controls).	General population: Adult	Depression, phobias, PTSD
el-Guebaly, Patten, Currie, Williams et al	2006	Canada	14934 gamblers	51.7% F	Problem gamblers were more likely to have problems with mood and anxiety problems.	General population: Adult	Depression, phobias
Ellenbogen, Derevenski & Gupta	2007	Canada	5313	2,750 M; 2,563 F	Males and females with severe gambling problems had remarkably similar prevalence rates of depression, substance use and weekly gambling. In the non-problem gambling group, depression was more likely to afflict females whereas substance use and frequent gambling were more prevalent among males	General population: Student / youth	Depression
Ellenbogen, Gupta, Derenvensky	2007	Canada	1,265	605 M; 660 F	Consistent with numerous studies indicating that gambling problems are more widespread among minority youth, cultural and ethnic minority individuals demonstrated the greatest risk for problem gambling. Youth who indicated that they experienced acculturation difficulties were more than three times more	General population: Student / youth	Other

					likely to experience gambling problems.		
Feigelman, Wallisch & Lesieur	1998	USA	6308	2916 M; 3392 F	Contrasted 4 groups: problem gamblers (n = 196), persons with drug or alcohol problems (n = 343), dual-problem individuals (n = 69), persons with neither gambling nor substance use problems (n= 5700). People with PG & SUD were more likely to have seen someone for mental health problem: 23%.	General population: Adult	General com
Fernández-Aranda, Jiménez-Murcia et al	2006	Spain	269	all F	This study compared female patients admitted for bulimia with and without impulse control disorders and patients admitted for pathological gambling.	Treatment / help seeking: Other	Impulse con General com Other
Fuentes, Tavares, Artes & Gorenstein	2006	Brazil	214	112 F	Compared 214 PG (162 with comorbidity and 52 with no comorbidity) to 82 healthy volunteers regarding the reaction time and number of errors. PGs with without comorbidity scored higher on the impulsivity scale and cognitive deficits compared to Healthy volunteers. PGs with comorbidities scored higher than PGs without comorbidity.	Treatment / help seeking: PG vs. NPG	Depression, phobias, Obs compulsive c
Giddens, Xian, Scherrer, Eisen & Potenza	2011	USA	7,869	all M	Data from the Vietnam Era Twin Registry (n=7869, male twins) was examined. . While both genetic and unique environmental factors contributed individually to PG, GAD (anxiety), and PD (panic), the best fitting model indicated that the relationship between PG and GAD was attributable predominantly to shared genetic contributions.	General population: Longitudinal	Anxiety / ph
Goldstein, Walton, Cunningham et al	2009	USA	1128	54.1% F	Measured correlates of past year gambling in a diverse sample of 1128 youth ages 14 to 18 presenting to an inner-city emergency department (ED). Past year gambling was associated with smoking marijuana, smoking cigarette, severe dating violence and general violence.	Treatment / help seeking: Other	Aggression /
Goodyear-Smith, Arroll, Kerse, Sullivan et al	2006	New Zealand	2,536		Compared patients identified as worrying about their gambling behavior with the total screened patient population for co-morbidity in 51 urban and rural New Zealand practices. Problem gamblers were significantly more likely to have concerns about smoking, use of recreational drugs, alcohol, depression, anxiety.	Treatment / help seeking: Other	Depression, phobias,
Goudrian, Oosterlan, Beurs, et al	2005	Holland	190	PG:81%M AD:78%M TS:69%M Control: 69% M	Compared 4 groups -- (1) pathological gamblers (n = 48), (2) a recently detoxified alcohol dependents group (n = 46), (3) a Tourette syndrome group (n = 47), and (4) a normal control (NC) group (n = 49). The PG, AD, and TS group had a higher ADHD, and anxiety score than the NC group.	Targeted sample: PG vs. NPG	Anxiety / ph Impulse con
Grant & Kim	2003	USA	96	F: 44.8%	Examined other impulse control disorders amongst pathological gamblers. Twenty-two (22.9%) of the 96 subjects were diagnosed with a current comorbid impulse control disorder.	Treatment / help seeking: Frequencies	Impulse con
Grant & Potenza	2006	USA	105	all M	Consecutive male PG outpatients aged 18 years or older and who met DSM criteria for PG were recruited by advertisements and referrals. Gay and bisexual men were more likely than heterosexual men to report a lifetime or currency ICD: 68.2% vs 34.9%.	Treatment / help seeking: Frequencies	General com
Grant, Levine, Kim & Potenza	2005	.	112	54.9% F	Studied the rate of Impulsive Disorders including pathological gambling, trichotillomania, kleptomania, pyromania, intermittent explosive disorder, compulsive buying, and compulsive sexual behavior, to screen 204 consecutively admitted psychiatric inpatients. Impulse control disorders appear common among psychiatric inpatients.	Treatment / help seeking: Other	Impulse con
Grant, Schreiber, Odlaug et al	2010	.	517	54.7% F	Five hundred seventeen consecutive subjects were grouped into 2 categories: those who had (n = 93; 18.0%) and had not (n = 424; 82.0%) declared bankruptcy secondary to gambling. Gamblers who had declared bankruptcy were more likely	Treatment / help seeking: Frequencies	Depression

					to report SUD and depression.		
Hardoon, Gupta, & Derevensky	2004	Canada	2,336	981 M; 1,326 F	Students (Grades 7–13) completed a questionnaire regarding gambling activities, gambling severity, perceived social support, drug and alcohol dependence, and various social, emotional, and behavioural problems. Predictor of problem gambling includes having family problems, having conduct problems, being addicted to drugs or alcohol, and being male.	General population: Student / youth	Impulse control
Henderson	2004	USA	162	112 F	Psychiatric outpatients completed the measures used in this study. Avoidant and compulsive personality, and the Self-Defeating and Dysthymic Disorder scales were positively associated with gambling involvement. The Alcohol Dependence scale was predictive of gambling involvement for males only.	Treatment / help seeking: Other	Depression, Personality disorder, Obsessive-compulsive disorder
Hinwest, McKie & Anderson	2011	.USA	24	15 F, 9 M	Participants were recruited with behaviors that have been linked to impulsivity (gambling N = 15, and recreational drug use N = 10) and those without these behaviors (N = 9) . The groups did not differ significantly.	Treatment / help seeking: PG vs. other	Impulse control
Hodgins & Engel	2002	.	62	35 F	Compared the future time perspective of pathological versus, psychiatric day patients, and social gamblers. They found few differences between pathological gamblers and psychiatric patients suggesting that the future time perspective is not unique to gamblers.	Treatment / help seeking: PG vs. other	General comorbidity
Hodgins, el-Guebaly	2010	Canada	52	33% F	Follow-up of natural recovery from problem gambling. Lifetime history of a mood disorder also predicted a longer time to reach a minimum 3 months of continuous abstinence. Comorbid mental health disorders are predictive of shorter term but not longer term outcome.	Treatment / help seeking: Frequencies	Depression
Hodgins, Peden & Cassidy	2005	Canada	101	36 F; 65 M	A naturalistic sample of pathological gamblers (N = 101) who recently quit gambling was followed prospectively for a year. Both alcohol and other drug disorders were more likely to precede the onset of the gambling disorder. Time to stable abstinence was reliably predicted by this set of covariates: current alcohol disorder, current drug use disorder, current mood disorder.	Targeted sample: Frequencies	Depression
Hollander, Pallanti, Allen, Sood & Rossi	2005	USA	40		Forty pathological gambling patients with bipolar spectrum disorders entered a 10-week randomized, double blind, placebo-controlled treatment study of sustained-release lithium carbonate. Gambling severity was lower in the lithium group than in the placebo group at endpoint based on the Yale-Brown Obsessive Compulsive Scale total pathological gambling score.	Treatment / help seeking: Frequencies	Depression, phobias, Obsessive-compulsive disorder, Bipolar
Ibanez, Blanco, Donajue, Lesieur, de Castro et al	2001	Spain	69	47 M; 22 F	Gamblers with comorbid psychiatric disorders had gambling scores and psychological scale scores indicating greater severity of gambling and psychopathology.	Treatment / help seeking: Frequencies	Depression, phobias,
Issler, Monkul, de Mello et al	2010	Brazil	30	all F	Study sample consisted of 30 clinically stable female outpatients with Bipolar Depression. Female BD patients with OCD may represent a more severe form of disorder than those without OCD, having more depressive episodes and residual symptoms, and being at a higher risk for treatment-emergent mania, as well as presenting a greater anxiety and impulse control disorder burden.	Treatment / help seeking: Frequencies	Depression, Bipolar
Jime nez-Murcia, lvarez-Moya, Stinchfield, Ferna ndez-	2010	Spain	904	92.4% M	A total of 904 consecutive pathological gambling patients were administered several instruments about gambling behavior, psychopathology and personality. Older age of onset of gambling problems was associated with higher general psychopathology (SCL-90-R Paranoid Ideation, Psychoticism, Depression; P < 0.015). Younger age of onset was related to greater severity of pathological	Treatment / help seeking: PG subtypes	Personality disorder, General comorbidity

Aranda et al					gambling ($P < 0.015$), higher novelty seeking, and lower self-directedness ($P < 0.015$).		
Kausch	2004	USA	135 (37 elderly; 98 younger)	127 M	A retrospective chart review was initiated for 37 elderly gamblers consecutively admitted to the Gambling Treatment Program of the Louis Stokes VA Medical Center at Brecksville between December 1999 and December 2002. Depression was the most common comorbid diagnosis.	Treatment / help seeking: Frequencies	Depression, PTSD
Kausch, Rogle, Rowland	2006	USA	111	91.9% M	Among those for whom more detailed information was available, the vast majority (91.5%) of patients reported that abuse occurred in childhood.	Treatment / help seeking: Frequencies	Other
Kenangil, G., Ozekmekc, S., Sohtaoglu, M., & Erginoz, E.	2010	Turkey	554	339 M; 215 F	Among 554 PD patients examined in a 3-year period, we identified 33 patients with ICDs. However, in contrast to the Western series, the number of gamblers was quite low because gambling is illegal in our country. We did not find any association between ICDs and severity of PD as well as doses of dopaminergic agents.	Treatment / help seeking: Other	Impulse control disorder, Obsessive-compulsive disorder
Kennedy & Grubin	1990		.51	all M	A sample of men in prison was interviewed and rated for the presence of six behaviours commonly thought to be impulsive: alcohol abuse (CAGE positive), sedative dependence, other drug abuse, pathological gambling, repeated aggression and self-harm	Targeted sample: Other	Depression, Aggression
Kennedy, Welsh, Fulton, Soczynska et al	2010	Canada and USA	579	379 F; 200 M	People with manic depression (MDD) and bipolar (BD) were recruited through adds at hospitals and mood disorder clinics and psychiatric clinics. No significant difference in PG rates between MDD (12.5%) & BD (12.3%). More males in the BD group. PGs were more likely to have a mood disorder, OCD, phobia or alcohol dependence.	Treatment / help seeking: Other	Depression, Obsessive-compulsive disorder, Anxiety disorders, Phobias, Bipolar
Kerber, Black & Buckwater	2008	USA	40	25 M; 15 F	Adults 55 years of age or older ($n = 40$) were recruited through word-of-mouth from Gamblers Anonymous meetings and from gambling treatment centers in Illinois and Iowa. 82.5% of the participants suffered from a mood disorder. 47.5% suffered from an anxiety disorder.	Treatment / help seeking: Frequencies	Depression, phobias, Personality disorder, Generalized anxiety disorder
Kessler, Hwang, Labrie, et al	2008	USA	3435		Data from the US National Comorbidity Survey Replication (NCS-R), a nationally representative US household survey, were used to assess lifetime gambling symptoms and PG along with other DSM-IV disorders.	General population: Adult	Depression, phobias, Impulse control, Bipolar
Kwak, Zinkha, & Lester	2004	USA & South Korea	443		This research uses cross-cultural data from the USA and South Korea to study compulsive consumption behavior. The findings reveal that comorbidity (i.e. coexistence of more than two related compulsive consumption behaviors) is found in both countries and related to compulsive consumption behaviors in both countries.	General population: Adult	Impulse control disorder, Obsessive-compulsive disorder
Ladouceur, Sylvain, Sevigny, Poirer et al	2006	Canada	233	inpatients 74.6%, M outpatients 70.7% M	The study compares the characteristics of pathological gamblers seeking inpatient and outpatient treatment. A total of 233 pathological gamblers (inpatients = 134, outpatients = 99) participated in the study. Inpatients scored higher on personality disorders, depression, anxiety, impulsivity, alcohol and drug problems.	Treatment / help seeking: PG subtypes	Depression, phobias, Impulse control, Personality disorder
Ledgerwood & Petry	2006	North America	149	72 M; 77 F	Treatment seeking PGs were screened for childhood trauma. A total of 34.2% ($n = 51$) of participants scored high on PTSD symptoms, including 41.6% ($n = 32$) of the women and 26.4% ($n = 19$) of the men. Clients who scored higher on PTSD reported greater lifetime gambling severity, psychiatric symptom severity, impulsivity, and dissociation than participants who had low PTSD symptom scores.	Treatment / help seeking: Frequencies	Other, Impulse control, Generalized anxiety disorder, Comorbidity

Lee, Labrie, Grant, Kim & Shaffer	2006	Korea	89	60 M; 29 F	Conducted an on-site survey of casino gamblers during January 2005. We obtained a convenience sample of Korean gamblers by distributing project announcement leaflets at the casino entrances for Korean citizens, approaching casino gamblers. A third had mood disorders, 27% had anxiety, and 24.7 had eating disorders.	Targeted sample: Adult	Depression, phobias, Other
Lee, Storr, Ialango & Martins	2011	USA	678	53% M	The data was collected from the John Hopkins Center for Prevention and Early Intervention Cohort which was initiated as a randomized prevention trial targeting academic achievement and aggression. Early adolescence depressive symptoms appear to be more positively associated with late adolescence problem gambling than early adolescence impulsivity. Impulsivity had little effect.	Treatment / help seeking: Other	Depression, control
Lejouyeux, Arbaretaz et al	2002	France	107		This study assessed the frequency of impulse control disorders (ICDs) and their association with bulimia, compulsive buying, and suicide attempts in a population of depressed inpatients. ICDs were associated with depression, bipolar disorder and impulsivity.	Treatment / help seeking: Other	Depression, control, Other
Levens, Dyer, Zubritsky et al	2005	USA	843		This study was conducted as a site-specific component of a larger, multisite study. The strongest predictors of at-risk gambling behaviour were being a binge drinker, presence of current posttraumatic stress disorder symptoms, minority race / ethnicity, and being a VA clinic patient.	Treatment / help seeking: Other	General comorbidity, Other, PTSD
Lloyd, Doll, Dutton, Geddes, et al	2010	Europe	3983	79.1% M	A self-selected sample of Internet users were recruited between July and November 2007, via hyperlinks placed with a number of gambling and gambling-related websites registered within Europe.	Targeted sample: Adult	General comorbidity, Depression, phobias
Lynch, Maciejewski & Potenza	2004	USA	3481		Public access data set derived from random-digit-dialing telephone surveys . Strong associations with alcohol and other drug use and abuse / dependence were observed with gambling in adolescent and early-onset adult gamblers, and these associations were, except for alcohol use, not observed in the adult-onset gamblers.	General population: Adult	Depression
Martinez-Pina, de Parga, i Vallverdu et al	1991	Spain	57	47 M; 10 F	Fifty-seven PG casino gamblers were studied. 45.6 % of the pathological gamblers admitted to having suffered some kind of nervous disorder such as: anxiety, sadness, behavioral problems, doubts, etc., versus only 20% of the controls.	Targeted sample: Frequencies	General comorbidity, Personality disorders, Anxiety / phobias
Martins, Storr, Ialango & Chilcoat	2008	USA	452	53.9% M	Data are from a prospective study of a community sample of 452 urban African-American youths who began at entry into first grade and were followed for ten years.	General population: Longitudinal	Depression, phobias
Martins, Tavares, Lobo et al	2004	Brazil	156	78 F; 78 M	PG treatment sample was examined for depression and suicide. Females attempted more suicide than males (22% vs. 6%). Males were more involved in sexual risky behaviors than females (32% vs. 11%).	Treatment / help seeking: PG subtypes	Depression, control
Mason & Arnold	2007	New Zealand	12,529		Analysis of gambling results from the New Zealand health survey. Problem gamblers are 2.6 times more likely to have worse self-rated mental health status than non-problem gamblers.	General population: Adult	General comorbidity
McCormick	1993	USA	2,171	35 F	Subjects in the present study consisted of 2171 admissions to the assessment unit of a comprehensive substance abuse treatment program at the Cleveland VA Medical Center. Emotional negativity is associated with PG amongst substance abusers. Thus even compared to other substance abusers, those who also have a gambling problem, have more emotional negativity.	Treatment / help seeking: SUD	Depression, control
McIntire, McElroy,	2007	Canada	36,984		Results from the Canadian Community Health Survey. Comorbid alcohol dependence and illicit drug dependence each conferred an increased risk for	General population: Adult	Other, Bipolar

Konarski, Soczynska et al					problem gambling. Physical activity level (moderate to active) was associated with a decreased risk for problem gambling. The weighted prevalence of problem gambling was significantly higher amongst the population with bipolar disorder as compared to the general population and those with major depressive disorder. Compared to those without bipolar disorder, the odds of problem gambling for bipolar individuals were over twice as high, even when controlling for potential confounders.		
McNamara, Vervaeke & Willoughby	2008	Canada	7,290		Students from 25 high schools encompassing a school district in a southern Ontario region in Canada took part in the study. No between-group difference was found for gambling, suggesting that adolescents with LD, with comorbid LD / ADHD, and without LD were comparable in their engagement in gambling activities	General population: Student / youth	Impulse control
Momper, Delva, Grogan-Kaylor et al	2010	USA	3,596	60% F	Telephone survey of the general population. About 33% of PGs had experienced at least a depressive symptom and 13% had been arrested in their lives.	General population: Adult	Depression, Aggression /
Najavitz	2010	Canada	106	59.4% F	The sample comprised 106 adults from the community (35 with current PG; 36 with current PTSD, and 35 with BOTH) . Results indicated that the presence of PTSD was associated with higher treatment utilization	Targeted sample: PG vs. other	General comorbidity: Depression,
Nower, Derevenski & Gupta	2004	Canada	1,339	637 M; 702 F	Student participants were recruited through professors who volunteered their classes. Impulsivity increased with the degree of gambling involvement. Overall, substance use, coping through distraction, and impulsivity proved the most predictive of disordered gambling for males, and intensity seeking and impulsivity proved most predictive for females.	General population: Student / youth	Impulse control
O'Toole, Marshall, Schurek & Dobson	1996	Australia	.	all M	Epidemiological cohort study with a random sample of male Australian vets. PG was not associated with PTSD or most other associated risk factors.	Targeted sample	Other, Depression, PTSD
Pagani, Derevenski & Japel	2010	Canada	377	53% boys	Using a prospective longitudinal design, an intentional subsample of children from the 1999 kindergarten cohort of the Montreal Longitudinal Preschool Study (Quebec) from intact families were retraced in 2005 for follow-up in Grade 6. The relation between emotional distress and child gambling involvement in children was explained by its comorbidity with early impulsivity.	General population: Longitudinal	Impulse control
Park, Cho, Jeon, Lee, Bae et al	2010	Korea	5,333		Based on the National Epidemiological Survey of Psychiatric Disorders in South Korea conducted in 2006. Of pathological gamblers, 79.1% had at least one psychiatric illness in comparison to the control level of 28.1%, and 62.0% of problem gamblers also had psychiatric conditions.	General population: Adult	General comorbidity: Depression, phobias, Bipolar
Patterson, Holland & Middleton	2006	USA	38	patients 56% M; controls 35% M	20 controls and 18 patients. Controls were recruited from friends and unrelated family members (in-laws) of the patients to control for differences in socioeconomic status (SES). All patients had a comorbid psychiatric disorder.	Treatment / help seeking: PG vs. NPG	Depression, comorbidity, control, Anxiety, phobias, Bipolar
Pelletier, Ladouceur & Rheume	2008	Canada	100	72 M; 28 F	Sixty-four per cent of the participants had at least one comorbid PD. The most frequent comorbid PD was the antisocial personality disorder (29.0%)	Treatment / help seeking: Frequencies	Other, Personality disorder,
Petry	2000	USA	134	All M	Subjects were recruited from newspapers & social service agencies. Compare SUD clients with and without PG.	Treatment / help seeking: SUD	Impulse control

Petry	2000	USA	103	M: Non PG SUD: 86% PG & SUD: 87%	SUD subjects were recruited using newspaper advertisements and flyers distributed at local substance abuse treatment programs, in low-income housing projects, and at social service agencies. The study compared SUD clients with and without PG. Somatization, obsessive-compulsive, interpersonal sensitivity, hostility, and paranoia scales differed significantly between groups. Scores on the depressive, anxiety, phobic anxiety, and psychotism scales did not differ significantly between the groups.	Treatment / help seeking: SUD	General com Obsessive-co disorder, Oth
Petry	2001	USA	111	all M	Compared pathological gambling substance abusers (n=27), non-pathological gambling substance abusers (n=63), and non-pathological gambling / non-substance abusing controls (n=21). The presence of both substance abuse and pathological gambling was associated with increased impulsiveness on a variety of behavioral and self-report measures.	Treatment / help seeking: PG vs. other	Impulse com
Pietrzak, Morasco, Blanco, Grant & Petry	2007	USA	10,563	NG: 44%M NPG:51%M PG: 62%M	Data on 10,563 U.S. older adults (age 60 or older) were analyzed from the National Epidemiologic Survey on Alcohol and Related Conditions. PGs had higher rates of several disorders.	General population: Adult	Depression, phobias, Obs compulsive c Other, Perso disorder, Bip
Potenza, Steinberg, McLaughlin, Wu et al	2001	USA	562	349 M; 213 F	Examined gender related differences in comorbidities in a sample of helpline callers.	Treatment / help seeking: PG subtypes	Depression, phobias,
Potenza, Xian, Shah, et al	2005	USA	7,869	mostly M	Survey data from the vietnam twin registry were examined to compute the shared and unique variance of PG and Major Depression.	General population: Longitudinal	Depression,
Potone, Williams, Basset & Marsh	2006	UK	100	66 M; 34 F	participants recruited from outpatient clinics, ongoing research programs, and community outreach. Psychiatric interviews revealed ICDs in six men and three women, yielding a prevalence of 9% for the three types of ICDs (hypersexuality, pathologic gambling, and excessive spending).	Treatment / help seeking: Other	Impulse com
Preston, McAvoy, Saunders, Gillam, Saied & Turner	In Press	Canada	254	all M	Offenders were assessed using self-report tests, interviews, and a file review. PG was associated with anxiety, depression, ADHD, and impulsiveness.	Targeted sample: Frequencies	Depression, phobias, Imp control
Quilty, Mehra, Toneatto & Bagby	2010	Canada	275	100 M; 175 F	Participants were recruited from the community using newspaper advertisements for a study of mood disorders and behaviour. Regressions of impulsivity on gambling pathology as indexed by the CPGI revealed that only urgency was predictive of gambling pathology. The interaction between lack of perseverance and mood disorder diagnosis was also significant.	Targeted sample: Other	Depression, control
Rogrigues-Jimenez, Avila, Jimenez-Arriero, Ponce et al	2006	Spain	95	all M	Compared a group of pathological gamblers with a history of childhood ADHD (PG-ADHD; n = 16), a group of pathological gamblers without this history (PG-non-ADHD; n = 39), and a control group (n = 40).	Treatment / help seeking: PG vs. other	Impulse com
Rush, Bassani, Urbanoski &	2008	Canada	36,885	16723 M; 20162 F	Cross-sectional national survey (Canadian Community Health Survey—Mental Health and Well-Being) data collected through a multi-stage stratified cluster design. Prevalence of all levels of PG increased with SUD severity, but the	General population: Adult	Depression

Castel					pattern did not appear to be affected by MD co-occurrence. Results suggest particular attention be given to SUD in treatment-seeking clients with co-occurring disorders.		
Sacco, Cunningham-Williams, Ostmann & Spitzanel	2008	USA	153	55% F	Using targeted advertising, we enrolled 153 gamblers (55% female; 32% minority) in a clinical validation study of the newly developed computerized gambling assessment module (C-GAM). For these analyses, we classified gamblers into three groups based on their endorsement of DSM-IV PGD: Non-gamblers (0 criteria; n=64; 44%); PG (1-4 criteria; n=60; 41%); and PGD (5-10 criteria; n=22; 15%).	Targeted sample	Depression, Obsessive-compulsive disorder, Personality disorder
Saez-Abad & Bertolin-Guillen	2008	Spain	100	PG: 94% M; control: 94% M	Cross-sectional study of two prospective matched-pair cohorts: 50 pathological gamblers versus a control group of 50 normal volunteers (non-patient and non-pathological gamblers). To sum up, pathological gamblers are more impulsive and higher sensation seekers than normal controls.	Targeted sample: PG vs. NPG	Personality disorder, Impulse control
Scherrer, Slutske, Xian, Waterman, Shah et al	2007	USA	7375	all M	Diagnoses of DSM-III-R lifetime PG were derived in 1992 and past-year P and PG in 2002 from 1675 individual twins from the Vietnam Era Twin Registry. Education and substance dependence, mood and antisocial personality disorders were associated with current gambling. A history of PG symptoms is the strongest predictor of past-year problem gambling.	General population: Longitudinal	General comorbidity, Depression, Personality disorder
Scherrer, Xian, Shah, Volberg et al	2005	USA	1669	all M	Male twin members of the Vietnam Era Twin Registry: 53 pathological gamblers, 270 subclinical problem gamblers, and 1346 non-problem gamblers (controls). Pathological and problem gambling are associated with significant decrements in health-related quality of life.	General population: Longitudinal	General comorbidity
Schneier, Foose, Hasin, Heimberg et al	2010	USA	43,093	M: 18518 F: 24575	Among respondents with Social Anxiety Disorder, alcohol dependence and abuse were most strongly associated with more substance use disorders, pathological gambling and antisocial personality disorders. SAD occurred before alcohol dependence in 79.7% of co-morbid cases, but co-morbidity status did not influence age of onset for either disorder.	General population: Adult	Personality disorder
Slutske, Caspi, Moffitt & Poulton	2005	New Zealand	939	475 M; 464 F	Longitudinal population-based study.	General population: Longitudinal	Depression, control
Specker, Carlson, Edmonson & Johnson	1996	USA	40 gambler, 64 controls	25 M; 15 M	All patients were at least two weeks into treatment between March and June 1996 (n = 67) at Gamblers Choice, a Minneapolis outpatient treatment program for PG's. A total of 40 subjects (15 female, 25 male), consisting of 60% of those in treatment, volunteered and completed the interview. Sixty-four controls (23 female, 41 male) were recruited through newspaper advertisements.	Treatment / help seeking: PG vs. NPG	Depression, phobias, General comorbidity
Stinchfield	2000	USA	78,582	51% M	Multiple regression between gambling frequency and related variables.	General population: Student / youth	Personality disorder, Impulse control
Tavares & Gentil	2007	Brazil	120	50% M;	40 pathological gambling and 40 obsessive-compulsive disorder subjects matched to 40 healthy volunteers according to gender, age, and education were assessed in terms of PG & OCD. Impulsivity and compulsivity should be regarded as orthogonal constructs, and as drives implicated in volition aspects of behavioral syndromes.	Treatment / help seeking: PG vs. NPG	Impulse control, Obsessive-compulsive disorder
Teo, Mythily & Anatha	2007	Singapore	150	13% F	The most common comorbid disorders were mood disorders (n = 22, 14.7%), substance abuse (n = 11, 7.3%) and alcohol abuse or dependence (n = 7, 4.7%).	Treatment / help seeking: Frequencies	Depression

Thomsen, Calleson, Linnet, et al	2009	Denmark	40	17 F; 23 M	Twenty controls and 20 pathological gamblers with different levels of depressive symptoms were studied during slot machine gambling. Gamblers with high levels of depressive symptoms exhibited significantly more pathological gambling symptoms compared with gamblers with low levels of depressive symptoms.	Targeted sample: PG vs. NPG	Depression, control
Turner, Jain, Spence & Zangeneh	2008	Canada	141	77 M; 68 F	A large battery of questionnaires was administered to a sample of 141 gamblers who ranged from non-problem gamblers to severe pathological gamblers. The results measured the relative importance different risk factors and found the importance of factors was as following from most to least: emotional, experiential, cognitive, and impulsive.	Targeted sample: PG vs. NPG	Depression, phobias, Imp control
Turner, Zanganeh & Littman-Sharp	2006	Canada	105	56% M	A large battery of questionnaires was administered to a sample of 105 gamblers who ranged from non-problem gamblers to severe pathological gamblers. The results number of people who had risk profiles matching emotional, impulsive, and cognitive pathways.	Targeted sample: PG vs. NPG	Depression, phobias, Imp control
Vitaro, Brendgen, Ladouceur & Trembay	2001	Canada	717	All M	Participants were part of an ongoing longitudinal study started in 1984 with 1,034 kindergarten boys. Included in this study were 717 boys. The present findings contradict previous findings about the influence of gambling on other problem behaviors and support the notion of a "general problem behavior syndrome" fed by generic risk factors.	General population: Longitudinal	Aggression /
Vitaro, Wanner, Ladouceur, Brendgen et al	2004	USA	1,161	All M	Subjects were part of an ongoing longitudinal study started in 1984 with 1,161 kindergarten boys.	General population: Student / youth	Anxiety / ph Impulse con
Wanner, Vitaro, Carbonneau & Tremblay	2009	Canada	sample A: 1,037; sample B: 2000	1;037 boys; 1,001 boys; 999 girls	Longitudinal study of two community samples. Only for individuals high on disinhibition did stability of gambling problems resemble moderate stabilities of other problem behaviors.	General population: Student / youth	Impulse con
Welte, Barnes, Tidwell & Hoffman	2009		.		In a National Survey of Adolescents and Young Adults in the United States high levels of impulsivity predicted more frequent gambling.	General population: Student / youth	Impulse con
Westermeyer, Canive, Garrard, Thuras & Thompson	2005	USA	1228 Indian: Hispanic:	628 M; 90 F; 475 M; 35 F	Community based survey of Hispanic & Native veterans.	General population: Adult	Depression, phobias, Oth Personality c
Westphal & Johnson	2007	USA	78		Treatment & GA sample. The majority of participants (76.6%) self-reported one or more behaviours co-occurred with their gambling problem. The majority of the sample (55.8%) had at least two other psychiatric or substance use behaviours. Those with more than one concurrent disorder had more serious gambling problems.	Treatment / help seeking: PG subtypes	General com Depression
Wohl, Matheson, Young & Anisman	2008	Canada	140 66 NPG: 51 MPG: 7 PGs:	31 M; 35 F; 35 M; 16 F; 8 M; 1 F	The sample included 66 recreational gamblers (31 males and 35 females), 51 problem gamblers (35 males and 16 females), and 8 pathological gamblers (7 males and 1 female). Consistent with the view that problem and pathological gambling are associated with elevated life stressors, the rise of morning cortisol from awakening to 30 min following awakening was greater than in recreational gamblers. Heightened impulsivity was evident among both problem and	Targeted sample: PG vs. NPG	Depression, control

					pathological gamblers, whereas depressive symptoms were only evident among pathological gamblers.		
Zimmerman, Chelminski & Young	2006	USA	1,709	F 62.0%	Examined the current and lifetime prevalence of PG in 1,709 psychiatric outpatients. Forty (2.3%) patients had a lifetime history of DSM-IV PG. Twelve (.7%) patients had current PG, five (.3%) had PG in partial remission, and 23 (1.3%) had a past diagnosis. Three (.2%) of the 1,709 patients had PG as their principal diagnosis. Patients with PG had significantly more axis I disorders than patients without PG, and had significantly higher rates of bipolar disorder, social phobia, panic disorder with agoraphobia, alcohol use disorder, and other impulse control disorders.	Treatment / help seeking: Other	Depression, phobias, Gen comorbidity.

Appendix 4: Smoking – details.

Notes:

1. For signif. Column, NS means there was no significant relationship between gambling and smoking; NG>NPG means there was a significant relationship between PG and smoking; male vs. female means there was a gender difference, and other means that some other effect was significant.
2. The Smoking prevalence column records either the percentage of PG’s who smoke, the statistic reported that indicates the relationship between the smoking and PG (e.g., odds ratio, Chi-Square). “X/2” indicate a Chi-Square analysis.

Author	Date	Country	Sample size	Sex ratio	Summary	Type of population studied	Signif.
Alvarez-Moya, Jimenez-Murcia, Aymami et al	2010	Spain	1,171 (all PG)	7.7% F	To classify into subgroups a sample of pathological gambling (PG) patients according to personality variables and to describe the subgroups at a clinical level. Cluster 2 showed the highest percentage of alcohol abuse and Cluster 1 showed the highest percentage of substance abuse. Cluster 3 showed the highest percentage of tobacco smokers.	Treatment / Help seeking PG	other
Barnes, Welte, Hoffman, Tidwell	2009	USA	2,274	1126 F; 1148 M	Frequency of gambling was related to frequency of heavy alcohol use, tobacco use, and marijuana use.	General population Adult	PG > NPG
Blanco, Hasin, Petry, Stinson & Grant	2006	USA	43 093; MPG: 2081; PG 195	1247 M: 834 F; 123 M 72 F	Data come from a large (n=43 093) representative sample of the adult US population. Among sub-clinical PGs, men were more likely to smoke more than two packs a day.	General population Adult	PG > NPG
Boughton & Falenchuck	2007	Canada	365	all F	Sampled frequent gamblers. Smoking: past 68%; current 48%.	Targeted Targeted sample	PG > NPG
Businelle, Kendzor, Rash, et al	2009	USA	71 39 heavy smokers 32 never-smokers	56.3% M	Heavy smokers' performance on the Gambling Task was significantly worse than that of never-smokers.	Targeted Targeted sample	other
Chaumeton, Ramowski, & Nystrom	2011	USA	15,865 NG 6888 Active Gamblers 1372	52.1% F 57.4% F 35.4% F	Gamblers were more likely to be active tobacco users. Active tobacco users: female non-gamblers: 9.1%; female gamblers: 16.1% Active tobacco users: male non-gamblers: 6.6%; male gamblers: 16%.	General population Youth / student	PG > NPG
Cunningham-Williams, Cottler, Compton & Spitznagel	1998	USA	2,954 NG: NPG: PG:	29.5% M 61.7% M 78.2% M	Analyses showed that increasing levels of gambling severity were associated with a corresponding increase in the likelihood of meeting criteria for various psychiatric disorders. The majority (76.3) of problem gamblers consumed nicotine; the odds ratio was 2.1.	General population Adult	PG > NPG
Cunningham-Williams, Cottler, Compton, Spitznagel & Be-Addalah	2000	USA	990	68% M	Studied the prevalence of problem gambling (27%) and pathological gambling (11%) amongst drug users comparing those recruited from treatment with those recruited from the community (68% male). There were no statistically significant differences in problem and pathological gambling rates for subjects recruited from drug treatment and those recruited from the community. Use of drugs, nicotine and alcohol was very high in the sample, nonetheless, problem	Treatment / Help seeking SUD	PG > NPG

					gamblers tended to be more involved with substances than non-gamblers.		
Cunningham-Williams, Grucza, Cottler, Womack, Books, et al	2005	USA	1142	49% F	Found that PG was associated with alcohol dependence/abuse 26% and Tobacco dependence 38%.	General population Adult	PG > NPG
Delfabbro, Winefield, Dollard, Metzger et al	2006	Australia	1281	516 boys; 765 girls	All students were in their final year of compulsory schooling and were recruited from both state-funded and private schools located in both metropolitan Adelaide (n = 946, 74%) and regional South Australia (n = 335, 26%). Smoking was correlated with all other risky behaviors.	General population Youth / student	PG > NPG
Desai & Potenza	2008	USA	43,093	18518 M; 24575 F.	Data from the national epidemiological survey of alcoholism and related disorders (NESARC) (n = 43,093) were analyzed. PG was found to be associated with nicotine dependence.	General population Adult	NS
Desai & Potenza	2009	USA	337	31.6% F	Outpatients with schizophrenia or schizoaffective disorder were interviewed for signs of PG. A substantial proportion of individuals in treatment for psychotic disorders report past-year gambling problems. Problem gambling was also associated with nicotine dependence.	Treatment / Help seeking Other	PG > NPG
Dickerson, O'Malley, Canive, Thuras, Westermeyer	2009	USA	480	All M	Examined nicotine dependence and psychiatric and substance use comorbidities in a sample of American Indian male veterans. Current nicotine dependence was present in 19% of the sample and significantly associated with current affective and gambling disorder.	Targeted sample	PG > NPG
Fong, Campos, Brecht, Davis, Marco, et al	2011	USA	176	78% M	Self-identified smokers had significantly higher mean NODS scores than those who reported not smoking.	Targeted sample	PG > NPG
Forrest & Gulley	2009	UK	6000 households		Study found a significant correlation of spending on tobacco and spending on lotteries.	General population Adult	PG > NPG
Fuentes, Tavares, Artes, & Gorenstein	2006	Brazil	214	112 F; 102 M	Compared 214 PG (162 with comorbidity and 52 with no comorbidity) to 82 healthy volunteers regarding the reaction time and number of errors. PGs with comorbidities, scored higher than PGs without comorbidity. 68.7% of participants (all PG) were nicotine dependent.	Treatment / Help seeking PG	PG > NPG
Goldstein, Walton, Cunningham et al	2009	USA	1128	54.1% F	Measured correlates of past year gambling in a diverse sample of 1128 youth ages 14 to 18 presenting to an inner-city emergency department (ED). Past year gambling was associated with smoking marijuana, smoking cigarettes, severe dating violence and general violence.	General population Adult	PG > NPG
Goodyear-Smith, Arroll, Kerse, Sullivan et al	2006	New Zealand	2,536		Compared patients identified as worrying about their gambling behavior with the total screened patient population for co morbidity in 51 urban and rural New Zealand practices. Problem gamblers were significantly more likely to have concerns about smoking, use of recreational drugs, alcohol, depression, anxiety.	Treatment / Help seeking Other	PG > NPG
Grant & Kim	2003	USA	96	45.8% F	Examined other impulse control disorders amongst pathological gamblers comparing those with comorbid problems and those without. Rates of nicotine consumption were similar for both groups.	Treatment / Help seeking PG	NS
Grant,	2010	USA	28	18 F	PG treatment sample, twelve (41.4%) subjects met criteria for current nicotine	Treatment / Help	PG >

Chamberlain, Odlaug, Potenza, & Kim					dependence.	seeking PG	NPG
Grant, Desai, Potenza	2009	USA	43093 total 945 at risk 233 PG	58.1% M; 65.6% M	National Epidemiological Survey. Face- to-face interviews were conducted with 43,093 adults living in households and group-quarters in the United States. Nicotine-dependent respondents had numerically higher estimates of co-occurring psychiatric disorders at each gambling severity level.	General population Adult	PG > NPG
Grant, Kim, Odlaug, Potenza	2008	USA	465	46.2% M	Compared to non-smokers, daily tobacco Gamblers had higher SOGS scores.	Treatment / Help seeking PG	PG > NPG
Grant, Schreiber, Odlaug et al	2010	USA	517	54.7% F	Five hundred seventeen consecutive subjects were grouped into 2 categories: those who had (n = 93; 18.0%) and had not (n = 424; 82.0%) declared bankruptcy secondary to gambling. Gamblers who had declared bankruptcy were more likely to report SUD and depression, & daily use of nicotine. Gamblers who had declared bankruptcy (51.6%) were more likely to smoke than those who had not declared bankruptcy (38.7%).	Treatment / Help seeking PG	Other
Griffiths, Wardle, Orford, Sproston, Erens	2010	UK	9003		British Gambling Prevalence Survey of gambling, alcohol, consumption, cigarette smoking and health. Cigarette smokers were over three times more likely than non-smokers to be problem gamblers.	General population Adult	PG > NPG
Ida & Goto	2009	Japan	692	64.5% M	Examined the interdependency among addictive behaviours (smoking, drinking, gambling on horse, and gambling on pachinko) and time/risk preferences. There were significant interdependencies among the four addictive behaviours. The higher the time preference rate and the lower the risk aversion coefficient becomes, the more likely individuals smoke, drink frequently, and gamble on pachinko and the horses. Pachinko is a popular Japanese form of pinball gambling.	General population Adult	.
Ladouceur, Boudreault, Jacques, Vitaro	1999	Canada	3,426	49.1% boys	In a general population sample of 3426, smoking was associated with gambling, at risk gambling, and PG.	General population Youth / student	PG > NPG
Lau & Kan	2010	Hong Knog	1,029	53.4% M	Self-administered questionnaire was completed by 1029 youth. Smoking status was associated with problem behaviors.	General population Youth / student	PG > NPG
Lee, LaBrie, Rhee, & Shaffer.	2008	Korea	353	188 M 165 F	Survey of casino employees with gambling problem had higher prevalence of smoking.	Targeted sample	PG > NPG
Levens, Dyer, Zubritsky et al	2005	USA	843	70.2% M	Assessed the rate of gambling in a sample of elderly patients completing the gambling questionnaire, 69.6% reported that they had participated in at least one gambling activity in the last year. The strongest predictors of at-risk gambling behavior were being a binge drinker, presence of current posttraumatic stress disorder symptoms, minority race/ethnicity, and being a VA clinic patient. At-risk gambling behavior was not significantly associated with gender, current or	Treatment / Help seeking Longitudinal	NS

					past depressive symptoms, or cigarette smoking.		
MacLaren & Best	2010	Canada	948	250 M; 698 F	This study examined the psychometric properties of the Shorter PROMIS Questionnaire and collected normative data from 948 students at two Canadian universities.	Targeted sample	male vs. female
Mason & Arnold	2007	New Zealand	12,529		Analysis of gambling results from the New Zealand health survey. Problem gamblers had high rates of smoking compared to other people, with 58.3% being daily smokers. Problem gamblers were also more likely to increase the amount smoked while gambling (61.2%) compared to non-problem gamblers (32.4%).	General population Adult	PG > NPG
McGrath & Barrett	2009	.	Literature study		Concludes that a growing body of literature suggests that smoking and gambling might share similar neurobiological, genetic and/or common environmental influences. Comorbid tobacco smoking and gambling are highly prevalent at the event and syndrome levels. However, research investigating how smoking might affect gambling or vice versa is currently lacking. They advocate more studies needed to examine the impact of this comorbidity on rates of tobacco dependence and problem gambling, as well as implications for treatment outcomes.	Literature Review	4
McNamara & Willoughby	2010	Canada	614	50% M	Reports on a longitudinal study of risk-taking behavior in adolescents with Learning Disabilities. Nine risk-taking behavior constructs were studied: alcohol use, smoking, marijuana use, hard drug use, major and minor delinquency, acts of direct and indirect aggression, and gambling activity. Adolescents with learning disabilities gambled more than controls and smoked more than controls. Smoking habits changed and, in fact, increased between Time 1 and Time 2. There also was a significant main effect for group, $F(1, 612) = 3.73, p < .01, \eta^2p = 0.15$.	Targeted sample	other
Momper, Delva, Grogan-Kaylor et al	2010	USA	3596	60% F	Telephone survey of the general population. About 33% of PGs had experienced at least a depressive symptom and 13% had been arrested in their lives. Individuals with problem gambling were more likely to use tobacco (OR = 5.40) several times per week, but this association became non-significant when demographic controls were entered in the model. Being at risk for problem gambling was significantly associated with alcohol (OR = 3.87) and tobacco (OR = 2.83) use.	General population Adult	PG > NPG
Mooney, Odlaug, Kim, & Grant	2011	USA	55	56.4% F	Cigarette smoking status in pathological gamblers and its link to impulsivity and flexibility was investigated. Smoking was associated with fewer directional errors on the Stop-Signal task and higher daily cigarette consumption was associated with fewer total errors on the Intradimensional/Extra-dimensional set-shift tasks. The role of smoking as a cognitive enhancer for PGs warrants further study.	Treatment / Help seeking PG	other
Nordin & Sjodin	2009	Sweden	22	all M	Examined CSF Homocysteine in Pathological Gamblers Compared with Healthy Controls. Compared with healthy controls, pathological gamblers displayed higher CSF levels of homocysteine while the opposite was the case with CSF cobalamine. Smoking decreased the levels of homocysteine while the concentrations of cobalamine were increased. Human studies suggest that homocysteine plays a role in brain damage and cognitive and memory decline.	Treatment / Help seeking PG vs other	other
O'conner, Stewart, Watt	2009	Canada	553	361 F; 192 M	Studied BAS risk for university students' drinking, smoking, and gambling behaviors in a survey of undergraduate students enrolled at an Eastern Canadian university. Fun Seeking was associated with increased risk for being a drinker or smoker. Drive and Fun Seeking were positively and negatively associated with	General population Youth / student	other

					gambling, respectively. Elevated Drive scores were significantly associated with frequent gambling.		
Patterson, Holland & Middleton	2006	USA	38 20 controls 18 patients	35% M 56% M	Controls were recruited from friends and unrelated family members (in-laws) of the patients to control for differences in socioeconomic status (SES). All patients had a comorbid psychiatric disorder. In the patient group, 9 subjects (50%) smoked, and 4 (25%) of the controls smoked.	Treatment / Help seeking PG vs other	PG > NPG
Peles, Schreiber & Adelson	2009	USA	154	35.1% F	Studied pathological gambling and obsessive-compulsive disorders among Methadone maintenance treatment patients. The patients were interviewed with questionnaires of methadone treatment patients. 36 (23.4%) were defined as probable pathological gamblers, and 9 (5.8%) as potential pathological gamblers. Nicotine smoking was not related to PG. However, given that it is extremely difficult to find non-smokers in methadone maintenance treatment this is likely due to range restriction.	Treatment / Help seeking SUD	NS
Pelletier, Ladouceur & Rheume	2008	Canada	100	Seventy-two M and 28 F	PG treatment sample. Sixty-four per cent of the participants had at least one comorbid PD. The most frequent comorbid PD was the antisocial personality disorder (29.0%). alcohol: 15 (16.0%) and drugs: 5 (5.3%); number of assessed PGs having trouble controlling cigarettes: 63 (69.2%).	Treatment / Help seeking PG	PG > NPG
Petry, & Oncken	2002	USA	317 Non-Daily smokers: 107 Daily smokers: 210	64.4% M 56.7% M	Studied cigarette smoking and its association with increased severity of gambling problems in treatment-seeking gamblers. Results from this study found that two-thirds of treatment-seeking gamblers are current daily cigarette smokers (daily smokers n = 210; non-daily n = 107) and smoking status is associated with more severe gambling and psychiatric symptoms. The daily smokers were more likely to have a history of treatment for a substance use disorder than the non-daily smokers. After controlling for substance abuse treatment histories, gender and age, the daily smokers demonstrated more severe gambling, family/social and psychiatric problems.	Treatment / Help seeking PG	PG > NPG
Petry, Stinson & Grant	2005	USA	43,093 Non PG: PG:	 47.8% M; 72.2% M	Comorbidity of DSM-IV pathological gambling and other psychiatric disorders was studied in a large general population sample from the National Epidemiologic Survey on Alcohol and Related Conditions (n = 43,093). The Prevalence of PG was higher amongst smokers OR = 6.7.	General population Adult	PG > NPG
Potenza, Wareham, Steinberg, Rugle et al	2011	USA	2,006	72.67% M	Examined the correlates of at-risk/problem Internet gambling in adolescents. Compared with at-risk/problem gambling in the non-Internet gambling group, at-risk/problem gambling in the Internet gambling group was more strongly associated with poor academic performance and substance use (particularly current heavy alcohol use) and less strongly associated with gambling with friends. At-risk/problem gambling was associated at with multiple adverse measurements including dysphonia/depression, getting into serious fights, carrying weapons, and use of tobacco, marijuana, and other drugs.	General population Youth / student	PG > NPG
Rodda, Brown, Phillips	2004	Australia	81	35 M and 46 F	Studied the relationship between anxiety, smoking, and gambling in 81 non-treatment electronic gaming machine players. Negative affect contributed to both gambling problems and tobacco dependence. They suggest that gambling problems and tobacco dependence have similar characteristics.	Targeted Targeted sample PG	PG > NPG
Ruiter, Veltman, Goudrian, Oosterlaan et al	2009	Holland	19 problem gamblers	all M	An experimental comparison of executive function in problem gamblers and smokers. Problem gamblers showed severe response perseveration, associated with reduced activation of right ventrolateral prefrontal cortex in response to	Treatment / Help seeking PG vs other	PG > NPG

			19 smokers 19 healthy controls		both monetary gain and loss. Results did not fully generalize to smokers. Planning performance and related activation of the dorsal frontostriatal circuit were intact in both problem gamblers and smokers. PG is related to response perseveration and diminished reward and punishment sensitivity as indicated by hypoactivation of the ventrolateral prefrontal cortex when money is gained and lost. The intact planning abilities and normal dorsal frontostriatal responsiveness indicate that this deficit is not due to impaired executive functioning.		
Scherrer, Slutske, Xian, Waterman, Shah, Volberg, Eisen	2007	USA	1675	All M	Diagnoses of DSM-III-R life-time and PG were derived in 1992 and past-year P and PG in 2002 from 1675 individual twins from the Vietnam Era Twin Registry. Education and substance dependence, mood and antisocial personality disorders were associated with current gambling. A history of PG symptoms is the strongest predictor of past-year problem gambling. Nicotine dependence in 1992 was associated with endorsing PG symptoms in 2002.	General population Longitudinal	PG > NPG
Scherrer, Xian, Shah, Volberg et al	2005	USA	1669	all M	Male twin members of the Vietnam Era Twin Registry: 53 pathological gamblers, 270 subclinical problem gamblers, and 1346 non-problem gamblers (controls). Pathological and problem gambling are associated with significant decrements in health-related quality of life. Compared to non-problem gamblers, pathological gamblers were more likely to have problems with alcohol (66%), nicotine (74.4%), and drugs (30.2%).	General population Longitudinal	PG > NPG
Shaffer, Vander Bilt & Hall	1999	USA	3841 full-time casino employees	57.9% F 42.1 % M	Examined gambling, drinking, smoking and other health risk activities among 3841 casino employees. Employees with 3.5 to 4 years experience working for Casinos had a significantly higher prevalence of combined level 2 and level 3 problems than employees who had worked for the organization for a year or less. In addition, casino employees have higher prevalence of smoking, alcohol problems, and depression than the general adult population.	Targeted sample	PG > NPG
Slutske, Caspi, Moffitt & Poulton	2005	New Zealand	939	475 M; 464 F	Examined personality and problem gambling using a prospective method with a birth cohort of young adults. Problem gambling at age 21 years was associated with higher scores on the higher-order personality dimension of negative emotionality ($d = 0.90$) and with lower scores on the personality dimension of constraint ($d = -0.72$) measured at age 18 years compared with control subjects who did not have a past-year addictive disorder at age 21 years. From the perspective of personality, problem gambling has much in common with the addictive disorders (including nicotine), as well as with the larger class of "externalizing" or "disinhibitory" disorders.	General population Longitudinal	PG > NPG
Ste-Marie, Gupta & Derevenski	2006	Canada	1,044	512 M, 532 F	Studied anxiety and social stress amongst adolescents and its relationship to gambling behavior and substance use. Probable pathological gamblers reported more daily and weekly alcohol consumption, used more uppers, downers, and hallucinatory drugs, and smoked more cigarettes on a daily basis compared with non-gamblers, social gamblers, and at-risk gamblers.	General population Youth / student	PG > NPG
Tan, Yen & Nayga	2009	Malaysia	14,084 households		The demand for tobacco, alcohol, and gambling in Malaysia. Estimation results, segmented by ethnicity, suggest that years of formal education, occupation type, and household head's age negatively affect both the likelihood to spend and the overall amounts spent on tobacco by all Malaysians. Additionally, while higher income Malay households are more likely to spend and have higher tobacco expenditures, affluent Chinese and households of other races are more likely to spend and to spend more on smoking, drinking and gambling. Male-headed households of all races are more likely to spend and also spend more on	General population Adult	PG > NPG

					smoking, drinking and gambling than female-led households. A total of 14,084 households responded to this survey, and a final sample of 14,082 observations with complete information is used for the analysis. From this sample, 5,291 (37.57%), 1,108 (7.87%), and 1,050 (7.46%) households reported tobacco, alcohol, and gambling expenditures, respectively, during the survey period.		
Westphal, Rush, Stevens & Johnson	1996	USA	135	black boys 59%; white boys 22%; white girls 14%, black girls 9%; other 5%	Gambling behavior in 135 adolescents in residential placement in northwestern Louisiana was measured using the South Oaks Gambling Screen-Revised for Adolescents. In this population, the first drink of alcohol, the first cigarette, and the first experience with gambling began on average at 11 years of age, with the first use of marijuana and the first episode of alcohol intoxication occurring a year later. The sample included 59% black boys, 22% white boys 22%, 14% white girls, 9% black girls and 55 others. Smoking was very common amongst the residents, but no more common amongst PGs than amongst other clients.	Treatment / Help seeking Youth / student	NS
Westphal, Rush, Stevens & Johnson	2000	USA	11,736	53.4 % F; 46.5% M.	Examined gambling behavior of Louisiana students in grades 6 through 12. Among the respondents, gambling behavior usually preceded smoking tobacco and use of marijuana and alcohol. The mean age of onset was 11.2 years for gambling behavior, 11.3 years for alcohol consumption, 11.6 years for smoking, and 13.2 years for marijuana use. Smoking, alcohol use, drug use were all loaded on a function that differentiated level 1 gamblers from level 2 and 3 gamblers. The association of problem and pathological gambling with use of alcohol, tobacco, and marijuana provides preliminary support for the inclusion of gambling among other adolescent risk behaviors.	General population Youth / student	PG > NPG
Willoughby, Chalmers, & Besseri	2004	Canada	7,430	3475 M; 3815 F	The authors examined co-occurrence among a wide range of adolescent problem behaviors including alcohol, smoking, marijuana, hard drugs, sexual activity, major and minor delinquency, direct and indirect aggression, and gambling. Then a confirmatory factor analysis was used to test the problem syndrome model proposed by problem behavior theory. A 3-factor model provided better overall fit than did a single problem syndrome factor model.	General population Youth / student	PG > NPG

Appendix 4: Suicide

Note: In the last 2 columns we have listed the proportions for suicidal thoughts and suicide attempts.

Author	Date	Country	Sample Size	Sex Ratio	Study summary	Type of paper	Suicidal thoughts	Attempts
Barry, Steinberg, Wu, Potenza	2009	USA	144; 72 White; 72 Asian	61.1% M	Found that Asian gamblers were 9.4 times more likely to report suicide attempts than Caucasian gamblers.	Clinical	Asian: .296 Whites: .232 Total .264	Asian: .113 Whites: .015 Total .064
Battersby, Tolchard, Scurrah, & Thomas	2006	Australia	43	69.8% M	found that 81.4% showed some suicidal ideation and that 30.2% reported one or more suicide attempt in the preceding 12 months. Suicide ideation was associated with debt, SOGS scores, and depression.	Clinical	0.814	0.302
Beaudoin & Cox	1999	Canada	57	38 M, 19 F	found that 51% of PGs under study reported past year suicidal ideation, 16% reported past attempts, 5.3% reported attempts in the past year.	Clinical	0.510	0.160
Blaszczynski & Farrel	1998	Australia	44	88.6% M	Reported that almost a third (31.8%) of suicide cases had previously attempted suicide . While there is no way to determine whether suicide was gambling related, each subject had a PG history and one of suicidal ideation.	Case studies		
Brooker, Clara & Cox	2009	Canada	742 (moderate to high risk gamblers) drawn from a sample of 36,984	50.8% M	found that compared to the rest of the sample (n = 36, 984), the 742 moderate to high risk gamblers were more likely than the rest of the population to report Suicide Attempts, OR 1.25 (1.12-1.38), <.05, and more likely to report suicide ideation OR 1.17 (1.10-1.25), p <.05.	General population		
Carrie, Kennedy, Cook, et al	2005	USA /Japan	35	26 M, 9 F	Reported that 20% (n=7) reported suicidal ideation. Of these, 3 individuals reported suicide attempts related to gambling problems.	Clinical	0.200	0.086
Chan, Chiu, Chen, Chan, et al	2009	Hong Kong	300	M-to-F ratio: 1.78:1	In Hong Kong, study of suicide decedents included 32 cases (21%) with addiction-related disorders (alcohol or substance use disorders or pathological gambling)	Case studies	.	.
Cunningham-Williams, Cottler, Compton & Spitznagel	1998	USA	2,954		Studied problem gamblers (gamblers who reported at least 1 gambling-related problem, n= 161, which includes 29 gamblers who met DIS/DSM-III criteria for pathological gambling). The results found that the odds of PG and suicide were OR: 1.6 (0.4, 6.0) which is not significant and thus St. Louis ECA study found no association between problem/pathological gambling and suicidal tendencies in the general population.	General population	0.020	.
Cunningham-Williams, Grucza, Cottler, Womack, Books,	2005	USA	1142	49% M	29% of the problem gamblers had thoughts of death/harm and this was significantly higher than the rest of the population, but the relationship with making suicide attempts did not reach significance.	General population	0.290	0.130

et al								
Desai & Potenza	2009	USA	337		Report that although 19% of their schizophrenia or schizoaffective disorder patients were past year problem gamblers, they were not more likely to have suicide thoughts than other patients.	Clinical	PG .203	.PG .032
Feigelman, Gorman, & Lessieur	2006	USA	298 at-risk gamblers & 13,000 controls	At risk PG M 255 F: 43	Compared 298 at-risk gamblers & 13,000 controls. Only female gamblers showed higher rates of suicide attempts, and suicidal thoughts.	General population		
Frank, Lester, Wexler	1991	USA	162	94% M	Surveyed 162 GA members (94% male). Of those responding to questions about suicide (132), 34 (21%) said they had never considered suicide, 77 (48%) had thought about suicide and 21 (13 %) had attempted suicide. Gamblers who had been suicidal in the past began gambling at an earlier age, and gamblers who had been suicidal in the past sought help at an earlier age. Gamblers who had been suicidal in the past were more likely to have stolen money or merchandise because of gambling.	Clinical	.48	.13
Garnefski, N., & de Wilde, E	1998	Holland	15,245	51% boys, 49% girls.	Studied the prevalence of addictive behaviors and suicide in a sample of 15,245 students in secondary school aged 16 to 19 years. As regards the prevalence of addiction-risk behaviour, in the male sample highest prevalence rates were found for alcohol consumption (37.1%) and gambling (28.2%). In the sample 6.9% of boys who gambled in the past year had attempted suicide and 13.5% of girls who gambled in the past year had attempted suicide.	General population	.	0.102
Hodgins, Mansley & Thygesen	2006	Canada	101	64% M	Found that only 7% of those who reported that they attempted suicide did so because of gambling. Rather, nearly all (97%) of those who'd attempted suicide were depressed at the time and the suicide was related to depression. Gambling loses can lead to depression, but gambling is also used by some gamblers as a means of coping with negative affect. It is likely that the relationship between gambling and suicide may be complex.	Clinical	0.713	0.327
Ibanez, Blanco, Moreyra & Saiz-Ruiz	2003	Spain	69	47 M, 22 F	Studied gender differences in problem gamblers. In terms of suicide, they found that 27.7% of the males and 22.7% of the females reported suicidal ideation. In addition 2 (9.1%) of the females, but none of the males had attempted suicide. A total suicidal thoughts measure was not significantly different between males and females.	Clinical	0.261	.028
Kaminer, Burleson, Jadamec	2002		97	64 M; 33 F	Report that early age of gambling onset was associated with suicide attempts (64 males and 33 females).	Clinical	.	
Kausch	2003b	USA	113	103 M; 10 F	Reports that among suicide attempters, 64.3% reported that their most recent suicide attempt was related to gambling. The relationship to suicide depended on the history of substance abuse with clients with a history of substance	Clinical	.	0.395

					abuse problems, only 54.8% reported that their most recent attempt was related to gambling, but with attempters without a history of substance abuse problems, 90.9% reported that their most recent attempt was related to gambling.			
Kausch	2004	USA	135	9 F, 126 M	Elderly gamblers were just as likely as the younger gamblers to have a lifetime history of serious suicidal ideation. 22.2% of older PGs had attempted suicide, 42.9% of younger.	Clinical		0.372
Kausch	2003a	USA	114	Suicide attempters: 88.9% M; non-attempters: 92.8% M	39.5% of PGs had made a suicide attempt sometime in their lives.	Clinical	.	0.398
Kausch, Rugle, Rowland	2006	USA	111	91.9% M	The results suggests that childhood abuse may be related to the suicidal ideation among PGs.	Clinical	.	0.387
Kennedy, C., Cook, J., Poole, D., Brunson, C., & Jones, D	2005	USA/Japan	35	26 M, 9 F	Review of the first year of an overseas military gambling treatment program. 20% (n=7) reported suicidal ideation. Of these, 3 individuals reported suicide attempts related to gambling problems.	Clinical	0.200	0.086
Kola, Mansukhani, Barraza & Bostwick	2010	USA	341.		Report on two case studies that illustrate the link between suicide and gambling.	Case studies	.	.
Ladd & Petry	2003	USA	341	39.9% F	Found that PGs (39.9% female) with substance abuse treatment histories had more suicidal thoughts and more suicide attempts.	Clinical	NSATH: .35 SATH: .52 Total .41	NSATH: .12 SATH: .30 Total .18
Ladouceur, Sylvain, Sevigny, Poirer et al	2006	Canada	233	Inpatients: 74.6% M Outpatients: 70.7% M	Study comparing the characteristics of pathological gamblers seeking inpatient (134) and outpatient (99) treatment found that thoughts about committing suicide over the past 12 months were more common amongst inpatients (67.3%) than outpatients (38.6%) and a greater number of inpatients (22.8%) had attempted suicide compared to outpatients (3.9%).	Clinical	0.551	0.134
Langhinrichsen-Rohling, Rohde, Seeley & Rohling,	2004	USA	1,846	NA	Measured suicide proneness and found that it was related to severity of problem gambling.	General population		.
Ledgerwood & Petry	2004		125	NA	PG treatment sample of n=125 reported that 48% had a history of gambling-related suicidal ideation, and an additional 12% reported at least one gambling-related suicide attempt.	Clinical	0.480	0.120
Ledgerwood, Steinberg, Wu, & Potenza	2005	USA	986	suicidality: M, 54.4%; no	n = 986. Problem gamblers who reported gambling-related suicidality (n = 252; 25.6%) were more likely than those who did not report gambling related suicidality (n = 734;	Clinical	0.256	0.215

				suicidality: M, 62.3%	74.4%) to acknowledge family, financial, legal, and mental and substance-related problems. In particular depression was related to suicidality. In addition, those reporting gambling-related suicide attempts (n = 53; 21.5%) were more likely than those who thought about it but didn't attempt suicide (n = 193; 78.5%) to report gambling-related illegal behaviors, mental health and substance abuse treatment.			
MaCCallum & Blaszczyński	2003	Australia	85	57 M and 28 F	The objective of this study was to systematically investigate the nature of suicidal behavior among treatment-seeking pathological gamblers and its relationship to gambling characteristics and depression. Indices of suicidality were assessed in a sample of 85 treatment-seeking diagnosed pathological gamblers. High rates of suicidal ideation, suicidal plans, and attempts were found; however, no clear relationship was observed between suicidality and indices of gambling behavior. Depression rather than gambling specific characteristics, marital difficulties, or the presence of illegal behaviors appears to be related to the risk of suicidality.	Clinical	0.360	.
Martins, Tavares, Lobo, Galetti, & Gentil	2004	Brazil	156	78 M, 78 F	PG treatment sample was examined for depression and suicide. Females attempted more suicide than males (22% vs. 6%). Males were more involved in sexual risky behaviors than females (32% vs. 11%).	Clinical	.	0.140
Mathias, Vargens, Kessler & Cruz	2009	Brazil	147	NPG: 84% M; MPG:89% M PG: 90% M	Found that pathological gambler's were more likely to report suicide attempts -- OR 1.26.	Clinical	PGs: .813	PGs: .375
McCleary, Chew, Merrill & Napolitano	2002	USA	148 (U.S. metropolitan areas)	NA	Studied a cross-section of 148 U.S. metropolitan areas and before and after the advent of legalized casinos. They found that suicide showed a modest net positive correlation with casino presence.	Statistical	.	.
McGrath, Stewart, Klein & Barret	2010	Canada	4,400	Survey 1 52% F; Survey 2: 50% F	Found a trend for increased suicide thoughts/attempts among people who gamble to cope (COP) with distress when compared to both social motive SOC (p 1/4 0.068) and enhancement motive ENH (p 1/4 0.102) gamblers.	General population	0.200	.
Newman & Thompson	2007	Canada	36,984	NA	In Canada, (N = 36,984), the odds ratio for PG and attempted suicide was 3.43 (95% confidence interval, 1.37 to 8.60).	General population	.	.
Newman & Thompson	2003	Canada	7,214	2,819 M, 4,395 F	The odds ratio for pathological gambling and suicidal thoughts was statistically significant (odds ratio = 4.91; 95% confidence interval = [1.41,17.1]) when major depression was the only comorbid mental disorder. However, as additional mental disorders were included in the analysis, pathological gambling ceased to be statistically significant. This finding may suggest that the association of gambling and suicide may be due to a common mental illness factor.	General population	.	.

Nichols, Stitt & Giacompassi	2004	USA	.	.	Using county-level data from eight communities that adopted casinos, there was no statistically significant difference between casino and control counties, suggesting that casino gambling has little significant impact, positive or negative, on suicide.	Statistical	.	.
Nower & Blaszczyński	2008	USA	1,601	49.8% F	Examined the records from 1,601 self-excluders and examined the extent to which people were motivated to self-exclusion to prevent suicide. Older gamblers were more likely to identify suicide prevention as a reason for self-exclusion.	Clinical	.	.
Nower & Blaszczyński	2006	USA	2,670	51.1% M	Found female PGs to be more likely to identify suicide prevention as a reason for self-exclusion.	Clinical	.	.
Nower, Gupta, Blaszczyński, Derevenski	2004	Canada	3,941	M: 1,937, F: 2,004	Found higher rates of suicidality among problem and pathological gamblers as compared to non-gamblers and social gamblers.	General population	.	.
Park, Cho, Jeon, Lee, Bae, et al	2010	Korea	5333 Controls: 5,132 MPG: 158; PG: 43		Based on the National Epidemiological Survey of Psychiatric Disorders in South Korea conducted in 2006. Of pathological gamblers, 79.1% had at least one psychiatric illness in comparison to the control level of 28.1%, and 62.0% of problem gamblers also had psychiatric conditions. Suicidal ideation: controls: 14.4%; problem gamblers: 24.7%; pathological: 30.2%; Suicide plan: controls: 3.2%; problem gamblers: 5.1%; pathological: 11.6%; Suicide attempt: controls: 3%; problem gamblers: 6.3%; pathological: 7%.	General population	0.275	.
Penfold, Hatcher, Sullivan & Collins (a)	2006a	New Zealand	70		Gambling Problems and Attempted Suicide. Part I. High Prevalence Amongst Hospital Admissions: 17.1% of patients admitted to hospital following a suicide attempt tested positive for problem gambling. Seven of those who screened positives for gambling were female (16% of female patients) and five were male (20% of the male patients).	Case studies	.	.
Penfold, Hatcher, Sullivan & Collins (b)	2006b	New Zealand		7 F, 5 M	In Part Two of their study of gambling problems and attempted suicide they report that substance abuse increases the risk for suicide. Of 12 PGs who had attempted suicide, 8 scored positive for alcohol abuse.	Case studies	.	.
Petry & Kiluk	2002	USA	342	No suicide ideation: 43.4% M; Suicide ideation alone 42.8% M; history of attempts: 43.7% M	Found that differences in suicidality emerged in terms of severity of psychiatric, social/family, and gambling problems.	Clinical	0.490	0.170
Philips, Welty, & Smith	1997	USA	NA	NA	Found suicide rates to be higher – both with locals and visitors – in regions with legal gambling.	Statistical	.	.

Potenza, Flelin, Heninger, Rounsaville & Mazure	2002	literature	.	.	High rates of suicidal tendencies have been reported in clinical populations of pathological gamblers, with estimates of attempted suicide in the range of 17% to 24%.	Literature Review	.	.
Potenza, Steinberg, & Wu	2005	USA	960	AD: 74.3% No AD: 57% M	In a sample of 960, suicidality caused by gambling was 22.67%. Suicide attempts caused by gambling were 3.93%.	Clinical	0.227	0.039
Potenza, Steinberg, McLaughlin, Wu et al	2001	USA	562	62.1% M	Described the characteristics of male and female gamblers utilizing a gambling helpline. They were examined to identify gender-related differences. Authors reported that male and female gamblers had significantly different psychiatric symptoms that they perceived to be caused by gambling. Female gamblers were more likely to report receiving nongambling-related mental health treatment. Male gamblers were more likely to report a drug problem or an arrest related to gambling. High rates of debt and psychiatric symptoms related to gambling, including anxiety and depression, were observed in both groups. Reported suicide attempt attributed to gambling female: 201; male: 295.	Clinical	.	.
Schwarz & Lindner	1992	Germany	58	All M	German study reported that of 58 male pathological gamblers, eighteen patients (36.7%) had attempted suicide because of their pathological gambling. Another 17 (34.7 %) talked about very specific thoughts and plans for suicide that were a consequence of their pathological gambling.	Clinical	0.714	0.367
Seguin, Boyer, Lesage, McGirr et al	2010	Canada	122	NPG 96% PG: 92% M	Psychopathology was prevalent in both gambling related and non-gambling related suicide groups. Data on a sample of 49 PG suicides and 73 NPG suicides were obtained from informants and hospital records. Problem gamblers were twice as likely to have a personality disorder OR 1.332 -- CI 0.664–2.775. Compared to non-PG suicides, PG suicides were less in contact with mental health services in their last month, their last year, and their lifetime. NPGs consulted front-line health and social services 13 times as often prior to the last year compared to PG suicides, OR = 13.106; CI95% □ 3.452–49.765. NPGs also utilized specialized services more than three times as often in the last month, OR □ 3.677; CI95% □ 1.304–10.372.	Case studies	.	.
Teo, Mythily & Anatha	2007	Singapore	150	87.3% M	In Singapore, PG treatment sample N = 150 (87.3% male). Sixteen (10.7%) subjects had a history of suicidal attempt.	Clinical	.	0.107
Wong, Chan, Conwell, Conner & Yip	2010	Hong Kong	300	Suicides with pathological gambling included 11 (64.7%) M	Of the 150 suicides and 150 controls examined, 17 suicides (11.3%) and one control case (0.6%) met criteria for the diagnosis of pathological gambling at the time of death or interview. Data was collected from a territory-wide case-control psychological autopsy study of suicide between 15 and 59 years of age in Hong Kong. Suicides with	Case studies	.	.

				and 6 (35.3%) F.	pathological gambling included 11 (64.7%) men and 6 (35.3%) women. There was no significant difference in the mean age between the male and female suicide cases (42.3 years vs. 44.8 years; $t=0.49$, $P=0.63$). All 17 suicide cases with pathological gambling had unmanageable debt at the time of death. Fourteen cases (82.4%) had other associated psychiatric disorders, most often major depressive disorders ($n=10$, 58.9%) and substance-use disorders ($n=3$, 17.6%).			
Yip, Yang, Ip, Law & Watson	2007	Hong Kong	1,088	362 F, 726 M	found a strong relationship between gambling and debt related suicide. OR for gambling = 9.17 (CI = 4.76–17.86). Gambling was among the main causes of debt accumulation and contributed to about 34% of the total. The main cause of financial debt among suicide deaths was linked to the individual's overspending and gambling involvement, rather than any direct impact caused by adverse personal economic situations such as unemployment	Case studies	.	.