An Evaluation of the Pathological Gambling Pathways Model Using the National

Epidemiological Survey on Alcohol and Related Conditions (NESARC)

by

Damien A. Dowd

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Abstract

Blaszczynski and Nower (2002) have theorized that there may be three potential subtypes of pathological gamblers who can be differentiated by the distinct pathways they take towards developing their gambling problems. This study sought to validate Blaszczynski and Nower's pathways model examining nationally representative data from the National Epidemiological Survey on Alcohol and Related Conditions (NESARC; Grant, Dawson, & Hasin, 2001). Latent class analysis revealed three classes (or subtypes) of gamblers, similar to those proposed by Blaszczynski and Nower's behaviorally conditioned, emotionally vulnerable, and antisocial impulsivist pathological gamblers. Between group analyses demonstrated that the three classes differed with regard to gender composition and proportion of pathological gamblers. This study was unique in that it was the first of its kind to use a nationally representative sample to examine gambling subtypes using variables matched to the characteristics specifically proposed by Blaszczynski and Nower (2002). The validation of Blaszczynski and Nower's (2002) pathways model may eventually contribute to the development of more reliable and valid methods of identifying people who are at risk of developing gambling problems, in addition to the development of more refined treatments that take individual differences into consideration.

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According to the Diagnostic and Statistical Manual of Mental Disorders Text Revision

(DSM-IV-TR), the syndrome of pathological gambling is classified as an impulse control

disorder defined by a persistent pattern of recurring maladaptive gambling behavior that leads to

significantly harmful legal, financial, physical and psychosocial consequences as evidenced by

the presence of five (or more) of 10 specified symptoms (APA, 2000). These symptoms include:

increased preoccupation with gambling; a need to gamble with increasing amounts of money in

order to achieve the desired level of excitement; unsuccessful efforts to control, cut back, or stop

gambling; restlessness or irritability when time spent gambling is reduced; gambling to escape

problems or to relieve dysphoric moods; chasing losses (the behavior of continued gambling

despite great losses with the hope the gambler will win his or her money back); lying to others,

such as family members, about gambling; committing illegal acts to fund gambling; relationship,

job and legal difficulties due to gambling; and relying on others for money to relieve gambling-

related financial situations (APA, 2000).

Prevalence

The lifetime prevalence rates of pathological gambling among adults range from 1% to

5% worldwide (National Opinion Research Centre [NORC], 1999; National Research Council

[NRC], 1999). According to Shaffer and Hall (2001), the lifetime prevalence of problem and

pathological gambling is between 1 and 3 percent of the adult population of North America. In

addition, Cox, Yu, Afifi, and Ladouceur (2005) found the 12 month prevalence of problem

gambling in Canada to be 2.0%, with highest prevalence in areas with greater access to VLTs

and casinos and regions that hold more liberal attitudes toward gambling. For instance using

scores from the South Oaks Gambling Scress (SOGS), Cox, Kwong, Michaud, and Enns (2000)

found the highest reported prevalence of probable pathological gambling (2.6%) in a Canadian

epidemiological survey examining gamblers in Winnipeg, Manitoba, a community which had for

several years had widespread access to VLTs and legalized casinos. In addition, 3.0% of the

sample met criteria for problem gambling. Using the Canadian Problem Gambling Index, Cox,

Yu, Afifi, and Ladoucer (2005) found the 12-month prevalence of gambling problems in Canada

to be 2.0%. Furthermore, their results demonstrated that Manitoba and Saskatchewan, provinces

which experienced the expansion of new forms of legalized gambling (e.g., VLTs in casinos),

had the highest prevalence of gambling problems in Canada (2.9%). Walker and Dickerson

(1996) have found that current prevalence rates of pathological gamblers from community

samples in a number of countries range from 1-2%, while lifetime prevalence rates have been

shown to range from 0.1% to 5.1% (Petry & Armentano, 1999). The prevalence rates of

pathological gambling among general psychiatry patients tend to be even higher at 6.7 to 12%

(Lesieur & Blume, 1990; Miller & Westermeyer, 1996). Lastly, prevalence rates of pathological

gambling among substance abusers have been found to range between 7 and 39% (Spunt,

Dupont, Lesieur, Liberty, & Hunt, 1998). Therefore it appears that people with psychiatric

conditions and those who abuse substances are at a higher risk of being pathological gamblers.

This is important to note, as these underlying conditions may be contributing factors in the

development of gambling problems.

Comorbidity

Pathological gambling tends to have a high degree of comorbidity with various mental

health disorders, personality traits and behavioral problems. Pathological gamblers also exhibit

elevated rates of current and lifetime substance use compared to the general population. For instance, el-Guebaly and colleagues (2006) found that the risk of moderate/high severity gambling was 2.9 times higher for people with substance dependence or harmful alcohol use than those without. In addition, analyzing data from the National Epidemiological Survey on Alcohol and Related Conditions (NESARC), Petry, Stinson, and Grant (2005) found that 73.2% of pathological gamblers had an alcohol use disorder, 38.1% had a drug use disorder, and 60.4% had nicotine dependence. Problem gambling seems also to be related to mood disorders. For example, Petry, Stinson, and Grant (2005) found that 49.6% of pathological gamblers surveyed in the NESARC had a mood disorder and el-Guebaly et al. (2006) found that the risk of moderate/high severity gambling was 1.7 times higher in people with a mood or anxiety disorder compared to people with no disorder. Even more alarming, individuals diagnosed with both mood or anxiety and substance use disorders (including alcohol) were five times more likely than individuals without these diagnoses to be moderate/high severity gamblers and 41.3% of pathological gamblers surveyed in the NESARC had an anxiety disorder (el-Guebaly et al., 2006). The comorbidity between substance abuse and pathological gambling has been linked to high rates of stress-related diseases and serious psychiatric problems, including suicide attempts (Ciarrocchi, 1987), as well as a history of childhood experiences of gambling among family members (Daghestani, Elenz & Crayton, 1996).

Numerous researchers have tried to identify core personality traits of pathological gamblers, who appear to be a heterogeneous group. However, there is a consensus among researchers that certain personality traits may act to increase an individual's risk for becoming a pathological gambler. These include, most notably, sensation seeking (Bonnaire, Varescon, & Bungener, 2007) and impulsivity (Bagby et al., 2007; Blaszczynski, Steel, & McConaghy, 1997;

Clark, 2006; Legerwood, Alessi, Phoenix, & Petry, 2009; Nower & Blaszczynski, 2006; Vitaro,

Arseneault, & Tremblay, 1999; Vitaro, Ferland, Jacques, & Ladouceur, 1998), in addition to

psychoticism and neuroticism (Bagby et al., 2007; Clark, 2006; Myreseth, Pallensen, Molde,

Johnsen, & Lorvik, 2009). Antisocial Personality Disorder, Narcissistic Personality Disorder,

and Attention-Deficit Hyperactive Disorder, all of which are associated with the above traits,

have also been linked to pathological gambling (Carlton & Manowitz, 1992; Pietrzak & Petry,

2005; Rugle & Melamed, 1993; Specker, Carlson, Christenson, & Marcotte , 1995).

Pathological Gambling Subtypes

Considering the co-occurrence of multiple psychopathologies, personality traits, and life

experiences with pathological gambling, researchers have proposed using a population health

framework that was designed to examine the relationships between problem gambling and its

correlates (Afifi, Cox, Martens, Sareen, & Enns, 2010). Indeed, it has been suggested that there

may actually be several subtypes of pathological gamblers, each following a different etiological

path to gambling-related problems. For instance, Moran (1970) was the first researcher to

propose that pathological gambling may arise from different causes. He concluded that the term

compulsive gambling was unsatisfactory and instead proposed the term pathological gambling.

Moran defined pathological gambling as "excessive gambling resulting in social, economic

and/or psychological problems for the individual who indulged in it or his family" (p. 596). On

the basis of information obtained through administering structured clinical interviews to 50

males referred to therapy for treatment of pathological gambling, he proposed five varieties of

pathological gamblers differing from one another on both social factors and individual

characteristics. *Subcultural* gamblers were those who gamble due to social influences such as

peer pressure and family influence. Moran notes that although social influences are important,

individual characteristics, such as depression, also contributed to the development of their pathological gambling. The *neurotic* gambler gambles to provide relief from some stressful situation or emotional problem. The *impulsive* gambler was characterized by a loss of control that led to bouts of excessive gambling. This subtype was associated with the most severe social and economic dysfunction. The *psychopathic* gambler's primary abnormality is psychopathy, with pathological gambling being seen as one part of this personality disturbance. Lastly, the *symptomatic pathological* gambler's pathological gambling was seen as a symptom of a preexisting psychiatric condition. Moran noted that although he believed pathological gambling could occur in the context of any psychiatric disorder, it was most commonly associated with depression in his study.

Empirical research examining the characteristics of pathological gamblers began to emerge in the 1980s. Zimmerman, Meeland, and Krug (1985) noted that the majority of research examining problem gambling up to the time their study was completed was based on retrospective methods of observation and analysis. They proposed that the more objective, behavioral aspects of problem gambling needed to be examined. Through an analysis of scores on the Inventory of Gambling Behavior (IGB; Zimmerman et al., 1985), they found that five factors differentiated pathological gamblers from non-pathological gamblers. Zimmerman and colleagues also performed a discriminant analysis to determine which factors best differentiated gamblers from non-gamblers. They noted that the first factor, which they termed *Neurotic Gambling*, was five times more important than any other factor in differentiating gamblers from non-gamblers. Individuals who scored high on this factor reported gambling as a release from frustration or worry. Factor 2 involved delinquent types of behaviors and was therefore labeled *Psychopathic Gambling*. Individuals who scored high on this factor reported a history of school

truancy, theft, and vandalism, as far back as early adolescence. These individuals also reported

being more prone to boredom. Factor 3 was labeled *Impulsive Gambling*. Those who scored high

on this factor described themselves as energetic, risk-taking workaholics who liked initiating

projects. Factor 4 was labeled *White Collar Crime* as it involved activities such as fraud,

embezzlement, and tax evasion. *Employment Problems* was the fifth and last factor to emerge.

This factor involved gambling-induced work problems. Individuals who scored high on this

factor also reported having parents who were compulsive gamblers. Zimmerman et al.'s overall

conclusion was that pathological gambling is a complex expression of neurotic, psychopathic,

and impulsive factors that are correlated but still reasonably independent.

In order to understand the personality traits of gamblers better, Graham and Lowenfeld

(1986) used cluster analysis to examine the Minnesota Multiphasic Personality Inventory

(MMPI) profiles of 100 male gamblers receiving inpatient pathological gambling treatment.

Their analysis revealed four types of pathological gamblers. Cluster 1 gamblers were likely to

have profiles consistent with immaturity, hostility, rebelliousness, restlessness and grandiosity.

Gamblers within Cluster 2 exhibited paranoid tendencies such as being suspicious, jealous, rigid,

withdrawn, and were likely to be irritable and hostile. Strong guilt feelings and frequent use of

alcohol were also common in this group. The most frequent diagnostic markers in Cluster 3

gamblers were anxiety, depression, and alcoholism. Cluster 4 gamblers were characterized as

immature, irresponsible, demanding, and impulsive. They demonstrated low frustration tolerance

and were described as being moody, tense, and depressed. Cluster 4 gamblers had histories of

substance abuse and poor academic and vocational adjustment. This cluster also had a history of

poor family conditions, in addition to being described as the most anti-social of the clusters.

Despite these findings, Graham and Lowenfeld cautioned that the personality traits they

identified as characterizing pathological gamblers are not unique to this clinical group, and may

not be independently useful in identifying pathological gambling subtypes. Instead, they

proposed that gambler personality traits most likely interact with external variables to produce

pathological gamblers. Graham and Lowenfeld therefore recommended that variables such as

family history of gambling, availability of gambling activities, and reinforcement contingencies

in the environment should also be taken into consideration in future research examining the

etiology of pathological gambling.

McCormick (1987) proposed a theory of pathological gambling that was based on two

psychological observations: 1) gambling is a behavior which has effects on the gambler and 2)

pathological gamblers vary tremendously. McCormick proposed a *recurringly depressed*

gambler and a *chronically understimulated* gambler. Recurringly depressed gamblers experience

depression that predates their gambling and demonstrate a history of childhood traumatic

experiences (e.g., that were undefined in the paper). They tend to exhibit depressive cognitive

styles that interact with biochemical abnormalities (such as over secretion of endorphins and

cortisol and catecholamine deficiencies. Euphoria produced by gambling provides escape from

dysphoric feelings in this type of gambler. In contrast, the chronically understimulated gambler

experiences excessive boredom, low frustration tolerance, and a need for constant and varied

stimulation. They exhibit deficiencies in impulse control and may have narcissistic personality

traits. According to McCormick, arousal from gambling reinforces this gambler as it reduces his

or her boredom, which leads to continuation of gambling. One of the strengths of this research

was that it emphasized the importance of both physiological and psychological factors in the

development of pathological gambling. However, these proposed subtypes were not empirically

validated by McCormick.

Research by Blaszczynski, McConaghy, and Frankova (1990) provided empirical support for McCormick's (1987) classification system. These researchers found that pathological gamblers were more prone to boredom and depression than were non-pathological gambler controls. These researchers defined boredom as "a state of mental weariness and dissatisfaction produced by lack of interest or activity". Based on findings from this research, Blaszczynski et al. (1990) proposed three subtypes. Two resembled McCormick's recurringly depressed gambler and chonically understimulated gambler, however the third type of gambler was one who gambles to alleviate both depression and boredom. This study demonstrated that the relationship between boredom and depression on pathological gambling is not simple. For instance, some pathological gamblers report being bored and depressed while others report being bored or depressed, but not both. Therefore, boredom and depression, constructs usually thought to be closely linked, may separately influence pathological gamblers.

Steel and Blaszczynski (1996) noted that past studies examining impulsivity in pathological gamblers (Moran, 1970; Zimmerman, Meeland, & Krug, 1985) failed to use psychometrically validated measures. Therefore, they designed a study using several psychometrically validated measures of impulsivity and other variables, such as antisocial personality disorder and psychological stress. Steel and Blaszczynski found four factors that seemed to underlie problem gambling; namely, psychological distress, sensation seeking, crime and liveliness (i.e., behaving or making decisions spontaneously), and an impulsive antisocial factor. One conclusion Steel and Blaszczynski drew was that the factorial structure uncovered in their study reproduced the factorial structure reported by Zimmerman et al. (1985).

The studies examined so far were designed to understand pathological gamblers based on their motivation to gamble, physiology, co-occurring psychopathology, or personality

characteristics. A consistent pattern seems to occur across these studies. Thus far, there appears to be a subtype of pathological gambler who could be described as neurotic and gambles to avoid or reduce symptoms of depression and/or anxiety. In addition, there appears to be another subtype of pathological gambler who is impulsive, antisocial, and gambles to reduce boredom and increase level of arousal.

Pathological gamblers also differ with regard to the severity of their symptoms. Instead of examining directly the factors that seem to underlie pathological gambling, Lesieur (2001) attempted to use cluster analysis to identify subtypes of gamblers, examining both a two- and a three-cluster solution. Lesieur's two-cluster solution revealed a cluster of pathological gamblers who were relatively low on gambling severity, impulsiveness, depression and trait anxiety, and attentional difficulties. They were also less likely than Cluster 2 gamblers to report using gambling to escape dysphoric mood or to report engaging in criminal activities. Gamblers in Cluster 2 reported having higher levels of gambling-related problems in addition to other forms of psychopathology. Lesieur concluded that this two-cluster solution offers support for the conceptualization that pathological gamblers may be classified as either *normal pathological gamblers* or *severe pathological gamblers*.

Lesieur's (2001) three-cluster solution revealed three subtypes of pathological gamblers; namely, *normal, moderately-impulsive action seekers,* and *impulsive escape seekers*. The normal pathological gamblers reported low levels of psychopathology such as impulsiveness, attention deficit, depression, anxiety, dissociation, and illegal activity. In essence, this cluster resembled the "normal" cluster from the two-cluster solution. The moderately-impulsive action seekers had both elevated gambling severity and moderate levels of the same measures of psychopathology relative to those seen in normal pathological gamblers. Lastly, the impulsive escape seekers fell

in the severely psychopathological range of impulsiveness, attention deficit, depression, anxiety, trauma, dissociation, and gambling to escape. This study was unique for two main reasons. First, pathological gamblers were not differentiated according to different types of psychopathology; instead, Lesieur found pathological gamblers to differ based on the severity of psychopathology. Second, this was the first study to identify a "normal" pathological gambler who did not present with other psychopathologies.

The pathways model (Blaszczynski & Nower, 2002). In an attempt to integrate the relevant biological, psychological, and ecological factors that had been linked to pathological gambling, Blaszczynski and Nower (2002) proposed a theoretical "pathways model" for pathological gamblers. According to their model, there are three subtypes of pathological gamblers that follow distinct pathways in developing gambling problems. In pathway 1, *behaviorally conditioned* pathological gamblers develop gambling problems due to a mixture of ecological factors, classical and operant conditioning, habituation, and chasing losses. In pathway 2, *emotionally vulnerable* pathological gamblers gamble to alleviate distress due to pre-existing emotional vulnerabilities to anxiety and depression. In pathway 3, *antisocial impulsivist* pathological gamblers are distinguished mainly by features of impulsivity, Antisocial Personality Disorder, and Attention Deficit Hyperactivity Disorder. According to the pathways model, all three groups share a common exposure to related ecological factors such as the availability, accessibility, and acceptability of gambling opportunities, and contingencies of reinforcement (Gupta, Nower, Derevensky, & Blaszczynski, 2009). In addition, all three groups would demonstrate distorted cognitive schema such as irrational beliefs and illusions of control. The main factors that differentiate the subtypes are predisposing emotional stressors and affective

disturbances in the *emotionally vulnerable* subtype of pathological gamblers (pathway 2) and impulsivity and antisocial behaviour in the *antisocial impulsivist* subtype (pathway 3).

Since Blaszczynski and Nower (2002) proposed their model, a number of studies have been conducted to address various aspects of it. For example, Gonzalez-Ibanez et al. (2003) found that three distinct subtypes of pathological gamblers emerged when a cluster analysis was performed on pathological gamblers' responses on scales measuring psychopathology and sensation seeking. Cluster 1 pathological gamblers had low scores on psychopathology, impulsivity and sensation seeking. Cluster 2 pathological gamblers presented with high scores on anxiety and depression but low scores on impulsivity and sensation seeking. Finally, while Cluster 3 pathological gamblers (like those in Cluster 2) reported having extreme anxiety and moderate to severe scores on depression, they scored higher than those in Cluster 2 (i.e., in the average range) on measures of impulsivity and sensation seeking. These clusters resemble the subtypes proposed by Blaszczynski and Nower (2002).

By performing a principal components analysis on a measure of the gambling experiences of pathological gamblers, Ledgerwood and Petry (2006) found three factors that described gamblers' motives, namely, *escape*, *dissociation*, and *egotism*. The escape factor was associated with escaping from problems and dysphonic emotions and the female gender. The dissociation factor was related to dissociative experiences (e.g., being in a trance, memory blackouts, feeling outside oneself, etc.). Lastly, the egotism factor was associated with narcissism and attention seeking, impulsivity and male gender. This study provides support for the Blaszczynski and Nower's (2002) model because the escape and egotism factors closely resemble the proposed behaviour of emotionally vulnerable and antisocial impulsivist pathological gamblers, respectively.

While other studies had subtyped pathological gamblers using factor scores, psychopathology and personality characteristics, Stewart and Zack (2008) attempted to evaluate if there were underlying factors in the Gambling Motives Questionnaire (GMQ). They analyzed pathological gamblers' responses on the GMQ using exploratory principal components analysis and three factors emerged from their analysis: *social*, *coping*, and *enhancement*. Gamblers who scored high on the social factor were motivated to gamble to increase social affiliation. Those with high coping factor scores reported gambling to decrease negative affect. Finally, gamblers who scored high on the enhancement factor gambled to enhance positive affect. Stewart and Zack (2008) reported that gamblers' scores on coping and enhancement factors were strong predictors of gambling frequency and that enhancement factor scores predicted loss of control over gambling behavior. Based on these findings, one would expect that Blaszczynski and Nower's (2002) emotionally vulnerable pathological gambler would have high coping factor scores while their antisocial impulsivist pathological gambler would score high on the enhancement factor. Stewart and Zack also found that coping factor scores predicted gambling problems more strongly in women than men, while the opposite was true for the enhancement factor. These findings are consistent with Blaszczynski and Nower's prediction that there would be more women in the emotionally vulnerable subtype and more men in the antisocial impulsivist subtype.

In another study, Stewart, Zack, Collins, Klein, and Fragopoulos (2008) conducted a principal components analysis on gamblers' scores from the Inventory of Gambling Situations (IGS; Turner & Littman Sharp, 2006). This analysis revealed both *negative* gambling situation factors (e.g. gambling in response to conflict with others and unpleasant emotions) and *positive* gambling situation factors (e.g. gambling in response to pleasant emotions and need for

excitement). Stewart et al. (2008) performed a cluster analysis on gamblers' IGS factor scores and found three clusters. The *coping* cluster was characterized by very high negative and high positive factor loadings. The *enhancement* cluster was represented by low negative and high positive factor loadings. Lastly, the *low emotion regulation* cluster was characterized by low negative and low positive factor loadings. Stewart et al. (2008) also found that enhancement and coping gamblers demonstrated elevated rates of alcohol use problems relative to low emotion regulation gamblers. They also noted that the low emotion regulation, coping and enhancement clusters closely resembled Blaszczynski and Nower's (2002) behaviorally conditioned, emotionally vulnerable, and antisocial impulsivist subtypes, respectively. Stewart et al.'s (2008) study is unique because it is the first to identify subtypes of non-treatment seeking pathological gamblers in the general community.

Using various measures of impulsivity, depression, anxiety, erroneous beliefs, and early gambling wins, Turner, Jain, Spence, and Zangeneh (2008) used principal components analysis to identify four distinct components that resembled the Blaszczynski and Nower (2002) pathways model: *emotional vulnerability*, *impulsivity*, *erroneous beliefs*, and *experiences of wins* (the latter component deals with the timing and size of wins, in addition to the feelings evoked by wins). Emotional vulnerability was the most important component in predicting the severity of pathological gambling followed by experiences of wins, erroneous beliefs, and lastly impulsivity. Women tended to score significantly higher on the emotional vulnerability component. The age at which a person started gambling was associated with the impulsivity component, but not with severity of problem gambling. Within pathological gamblers, impulsivity was associated with the most severe levels of pathological gambling -- a finding predicted by Blaszczynski and Nower's (2002) model. Substance use was correlated with

severity of pathological gambling and with the emotional vulnerability factor. Both of these findings also support predictions made by the pathways model. Overall, the results of this study support Blaszczynski and Nower's pathways model in that the emotional vulnerability and impulsivity components resemble those predicted in the emotionally vulnerable and antisocial impulsivist subtypes while the experience of wins and erroneous beliefs components highlight the learning history and distorted cognitions of the behaviorally conditioned pathological gambler. Furthermore, evidence from this study raises the possibility that behaviorally conditioned problem gamblers might be further subdivided into two groups, one based on erroneous beliefs and the other on experiences of wins.

Bonnaire, Bungerner, and Varescon (2009) identified three major subgroups of pathological gamblers according to whether they preferred *active games*, *passive games* or *games that involved strategies*. Pathological gamblers who preferred active games were shown to have high scores on sensation seeking and alexithymia (i.e., the inability to understand, process or describe emotions). Those who played passive games had low sensation seeking scores and high depression scores. Lastly, pathological gamblers who preferred games involving strategy had low sensation seeking, alexithymia, and depression scores. Bonnaire et al. concluded that their subgroups resembled Blaszczynski and Nower's (2002) three subtypes, further supporting the empirical validity of their model. Interestingly, the results of this study were different than those of Blaszczynski et al. (1990) who failed to find significant differences on measures of depression, boredom proneness, or sensation seeking between groups of pathological gamblers who were classified according to their preferred gambling activities.

Most of the studies discussed thus far have focused on treatment-seeking pathological gamblers. However, Vachon and Bagby (2009) used cluster analysis to examine non-treatment

seeking pathological gamblers from the general community based on their personality traits. Vachon and Bagby (2009) identified a three-cluster solution that was further validated using measures of psychopathology. *Simple pathological gamblers* were differentiated from the other two clusters by their relative absence of psychopathology and their normative personality trait scores. The simple pathological gambler resembles Blaszczynski and Nower's (2002) behaviorally conditioned pathological gambler. *Hedonic pathological gamblers* demonstrated high trait scores on excitement seeking, positive emotions, and feelings, and lower scores on dutifulness and deliberation, which demonstrates their tendency to seek out excitement, act carelessly, and plan poorly. This subtype resembles the antisocial impulsivist pathological gambler. The last cluster, *demoralized pathological gamblers,* had high scores on anxiety, angry hostility, depression, self-consciousness, vulnerability, and impulsivity. They demonstrated low scores on deliberation, discipline, trust, warmth, competence, dutifulness, and achievement striving. Therefore, demoralized pathological gamblers could be classified as impulsive and distrustful gamblers who lack motivation and are prone to extreme negative affect. In addition, when compared with the other two clusters, demoralized pathological gamblers were more likely to suffer from mood, anxiety, and substance use disorders. This subtype most resembles Blaszczynski and Nower's emotionally vulnerable pathological gambler but with increased impulsivity.

Legerwood and Petry's (2010) completed the first and only study of gamblers to examine the efficacy of differential treatment based on subtype. Using their scores on measures of anxiety, depression, and impulsivity, Legerwood and Petry (2010) identified different types of treatment seeking pathological gamblers according to the pathways model and found that emotionally vulnerable pathological gamblers had higher psychiatric and gambling severity

compared to behaviorally conditioned pathological gamblers. Emotionally vulnerable gamblers were also more likely to have a parent with a history of psychiatric illness. When compared to behaviorally conditioned pathological gamblers, antisocial impulsivist pathological gamblers were more likely to be diagnosed with antisocial personality disorder and have high scores on legal and family/social severity. These gamblers were also more likely to have a history of substance abuse treatment, inpatient psychiatric treatment, and a family history of substance use and gambling problems. Legerwood and Petry (2010) found that behaviorally conditioned pathological gamblers began treatment with the lowest severity of gambling problems and responded best to treatment, with substantial gains at post-treatment and 12 month follow-up. Emotionally vulnerable and antisocial impulsivist pathological gamblers, while showing improvement, continued to meet pathological gambler criteria at post-treatment and 12 month follow-up. Overall, the authors concluded that differentiating subtypes of pathological gamblers did not help to predict treatment outcomes as all three subtypes of improved at a similar rate and that their findings contradicted past studies that have demonstrated impulsivity being associated with poorer treatment outcomes (Leblond, Ladouceur, & Blaszczynski, 2003). Also, this finding does not support Blaszczynski and Nower's (2002) prediction that antisocial impulsivist pathological gamblers should demonstrate a poorer response to treatment compared to emotionally vulnerable and behaviourally conditioned gambler subtypes.

Latent Class Analysis Studies. LCA is another analytical method used to derive subgroups of individuals. However, it has a number of distinct advantages over cluster analysis. First, cluster analysis is a heuristic method and the way the number of clusters is determined is arbitrary. Conversely, LCA determines an optimal number of classes by using statistically derived maximum-likelihood estimates that can be used to test the goodness-of-fit of an

underlying model. Second, in LCA, cases have a probability of membership in each class instead

of being absolutely assigned to a class as in cluster analysis. For these reasons, LCA has been

described as superior to cluster analysis (Boscardin, 2012). Since 2007, a number of studies

using latent class analysis (LCA) to derive subtypes of gamblers have emerged in the literature.

In the first of these studies, Cunningham-Williams and Hong (2007) collected data from 312

community-recruited gamblers defined as people who had gambled more than 5 times in their

lifetime. They classified six subtypes of gamblers based on eight factors underlying the latent

construct of problem gambling. These factors included: pathological gambling diagnostic

symptoms from the Diagnostic and Statistical Manual (DSM) and the 10th revision of the

International Statistic Classification of Diseases and Related Health Problems (ICD-10) manuals,

reasons to gamble, withdrawal symptoms, perception of being a pathological gambler by self or

others, the number of gambling venues frequented, financial sources for gambling, help seeking

behavior, and spirituality. A driving factor differentiating the classes was the number of DSM

and ICD-10 diagnostic criteria endorsed. Gamblers in Class 1 (57% of sample) were classified as

non-problem gamblers as they did not endorse the majority of the pathological gambling criteria.

Gamblers in Class 2 (3.5% of sample) had slightly elevated endorsement of pathological

gambling criteria ($M = 4.28$) and were classified as low risk gamblers. This class also had a

higher score on number of reasons to gamble ($M = 2.71$) compared to Class 1 ($M = 1.03$). Similar

to Class 1 and 2 gamblers, Class 3 (12.2% of sample) gamblers endorsed a low number of

symptoms and behaviors, but differed from the first two classes because they endorsed a

moderate number of withdrawal-like symptoms when attempting to control gambling behavior.

Gamblers in this class were classified as a mild risk gamblers. Class 4 (8.7% of sample)

gamblers were also classified as mild risk gamblers as they endorsed a moderate number of

pathological gambling symptoms ($M = 9.32$). Furthermore, they scored higher on the number of

different perceptions of pathological gambling than all other classes except Class 6, in addition

to having more financial sources to support their gambling than the first three classes. Class 5

(12.2% of sample) was distinguished from the other classes by having high scores on all factors

except problem gambling perception and help seeking behavior. This class endorsed a high

number of pathological gambling symptoms ($M = 12.12$). Lastly, Class 6 (6.4% of sample)

gamblers were classified as severe-risk as they scored the highest on all factors when compared

to the other classes. Most importantly, this class endorsed the most pathological gambling

criteria ($M = 15.35$). This study illustrates that gamblers can be classified into different classes

based on severity of pathological gambling and other related factors such as reasons to gamble,

access to gambling venues and financial sources for gambling. Although this study included

measures of withdrawal-like symptoms to classify subtypes of gamblers, co-occurring

psychiatric disorders were not considered.

Using the Veteran Era Twin Registry (VETR), a large community sample of Vietnam era

male twins (age range, 36-49), Xian et al. (2008) attempted to differentiate gamblers by applying

LCA to their lifetime endorsement of DSM-III-R criteria. After establishing a three-class

solution, they examined each class's relationship to other psychiatric disorders using chi-square

and logistic regression tests. Classes were distinguished by the number of criteria endorsed,

prevalence of each criterion, and estimated prevalence of pathological gamblers. The results of

the LCA suggest a continuum of gambling severity with Class 3 being the most severe and

reporting higher rates of ASPD and life impairment criteria compared to the other two later

classes. The authors noted this third class was similar to the Antisocial Impulsivist gambler

proposed by Blaszczynski and Nower. Similar to Cunningham-Williams and Hong's (2007) first

class of gambler, Class 1 ($N = 2413$) in this study had the largest number of gamblers and contained few gamblers who endorsed any pathological gambling criteria. Roughly 24% of members in Class 2 ($N = 252$) were pathological gamblers and every member of Class 3 ($N = 55$) met diagnostic criteria for pathological gambling. When compared to Classes 1 and 2, Class 3 gamblers were significantly more likely to endorse all pathological gambling criteria. This was especially true regarding not meeting obligations because of gambling, sacrificing activities because of gambling, and being unable to quit gambling despite having problems. Xian et al. examined the relationship of 11 psychiatric disorders to the classes and found, with the exception of panic disorder (which was only present in two members of Class 3), the prevalence of lifetime psychiatric disorders increased across all classes. An important limitation of this study is that the sample used was restricted to middle-aged, male veterans. Therefore, these findings are not representative of the general population.

McBride, Adamson and Shelvin (2010) conducted the first study examining a nationally representative British sample that used LCA to derive subtypes of pathological gamblers based exclusively on the DSM-IV diagnostic criteria. Their LCA resulted in a three-class solution. Similar to previous studies (Cunningham-Williams & Hong, 2007; Xian et al., 2008), the majority of the sample (88.9%) made up the first class. Class 1, categorized as *non-problematic gamblers* was defined by a low probability for endorsing pathological gambling criterion. Class 2 (9.7% of sample) was named the *preoccupied chaser*, as this class had a low probability for endorsing most items other than Preoccupation and Chasing. Individuals in the third Class (1.4% of the sample) had a high probability of endorsing Chasing, Preoccupation, Increased Bets, Escape, Irritability, Lying to Family, and being unable to control their gambling behavior. Due to this pattern of response probabilities the authors concluded that this class resembled

Blaszczynski and Nower's antisocial impulsivist subtype and therefore labeled it the *antisocial impulsivist* class. The authors noted that the three classes differed more with regard to the severity of the gambling problems they endorsed, than with regard to the specific type of problems they experienced. Approximately 86% of the non-problematic gamblers (Class 1) did not endorse any criteria for pathological gambling disorder. The majority of preoccupied chasers (98.9%) met criteria for problem gambling (1-4 criteria endorsed) but only a very small number met the threshold for a pathological gambling disorder (endorsement of five or more criteria). Lastly, 93% of the antisocial impulsivist class of gamblers met criteria for pathological gambling disorder. All remaining Class 3 gamblers were classified as problem gamblers. The authors note that despite using data from different samples and different diagnostic criteria, the subtypes derived in this study are quite comparable to those described in Xian et al. (2008). This study provided further support for classifying gamblers into classes based on diagnostic criteria. However, it was limited in that it did not examine the presence of co-occurring mental disorders within each class.

Carragher and McWilliams (2011) conducted the second LCA study to use nationally representative data to empirically derive and validate a gambler typology using endorsement patterns of DSM-IV pathological gambling criteria. Furthermore, this was the first study to use the NESARC, an epidemiological data set from the United States. These researchers focused on the subsample of gamblers who had provided complete data on the 15, past-year DSM-IV pathological gambling symptom items ($N = 11{,}104$). Their LCA yielded 3 latent classes distinguished mainly by the extent of their gambling problems. Class 1 (91.2% of sample) exhibited low endorsement probabilities across all 10 DSM-IV pathological gambling criteria and were classified as a no gambling problems class. A moderate gambling problems class was

characterized by respondents who primarily endorsed the preoccupation, tolerance, and chasing criteria. The last class, a pervasive gambling problems class (1.4%), included gamblers who had a high probability of endorsing the majority of the diagnostic criteria, including illegal acts to finance gambling; employment, school, or interpersonal problems; and reliance on others for financial support due to gambling behavior. Carragher and McWilliams also found a number of significant differences between the classes in regard to psychiatric and substance use disorders. Individuals in the moderate gambling problems and pervasive gambling problems classes had an increased risk of having any alcohol use disorder and a specific phobia. The moderate gambling problem class was at an increased risk of meeting diagnostic criteria for hypomania, panic disorder without agoraphobia, and obsessive-compulsive personality disorder. Finally, those gamblers in the pervasive gambling problems class were at higher risk for being diagnosed with mania, social phobia, and antisocial personality disorder. The increased risk of antisocial personality disorder among the most extreme gambling class is congruent with past research (McBride et al., 2010; Xian et al., 2008).

Martins, Ghandour, and Storr (2011) conducted the first LCA study to classify subtypes of gamblers from population-based data from three Canadian provinces. This study was limited to a subsample (14.5%) of gamblers who reported experiencing at least one or more gambling-related problems in the past year. A total of sixteen variables were used in the LCA. Fifteen of the variables were derived from the Canadian Problem Gambling Index (CPGI), an instrument recently developed for measuring problem gambling. The authors note that the CPGI has been described as one of the best instruments for measuring problem gambling in general populations. A total of three classes emerged from the analysis. Class 1, named the *low on most item problems class*, made up 50% of the sample. Gamblers in this class had a low probability of

endorsing all of the variables derived from the CPGI but a moderate probability of endorsing

playing at least one electronic game in the last year. The second class (23% of the sample),

named the *substance abusing/emotionally vulnerable/behaviorally conditioned – all types class*,

had moderate to high probabilities of endorsing all items. Lastly, the *familial*

genetic/behaviorally conditioned class (Class 3, 27% of sample), demonstrated high probabilities

of endorsing having a family history of alcohol and drug problems, in addition to a moderate

probability of endorsing remembering a big win when first starting gambling. This was the first

study to include variables measuring family history of alcohol, drug and gambling problems in a

LCA. In addition, it was the first study to examine a wider range of characteristics of

Blaszczynski and Nower's pathways model in a non-clinical sample of gamblers reporting

gambling-related problems.

Faregh and Derevensky (2011) aimed to classified adolescent gamblers with known

psychoactive substance dependence into subtypes based on DSM-IV endorsement criteria. Their

study consisted of a series of four separate LCAs conducted on both male and female samples

from the community and from treatment programs. Different subtypes were found depending on

whether males or females were examined in a community sample or treatment sample. The LCA

on the community males distinguished four classes with distinct patterns of vulnerability. What

was most striking is that these distinctions were more apparent in at-risk gamblers compared to

problem gamblers. In addition, the results of this study seem to indicate that there were two types

of at-risk gamblers in the community sample: an antisocial type and a neurological type.

However, when examining problem gamblers in this sample there was only one type with both

these vulnerabilities combined. These findings are not congruent with the prediction made by the

pathways model that there is a single path for problem gamblers that contains both antisocial and

neurological vulnerabilities. Another interesting finding observed in the female treatment sample was that the third subtype had a probability of endorsement on the item 'tolerance' that was 1.00. This indicated that females with prior addictions might have a unique path to gambling problems based primarily on this DSM-IV criterion. The results from this study suggest that male and female adolescent gamblers differ in their endorsement profiles and may have divergent pathways based on their gambling behaviors.

Limitations of previous research and purpose of current study. After examining the current subtyping literature on pathological gamblers there appear to be several limitations that need further investigation. The majority of studies reviewed have used samples of treatment seeking pathological gamblers. While it is true that a number of more recent studies have included community samples (e.g., Bonnaire et al., 2009; Cunningham-Williams & Hong, 2007; Faregh & Derevensky, 2011; Martins et al., 2011; Stewart & Zack, 2008; Stewart et al., 2008; Turner et al., 2008; Vachon & Bagby, 2009), these have not necessarily been representative of the population at large. To my knowledge, only two studies have used nationally representative data to investigate gambling subtypes. McBride et al. (2011) examined a nationally representative British sample, and Carragher and McWilliams' (2011) data were derived from the NESARC, a nationally representative US sample. Therefore, because research examining subtypes of gamblers in nationally representative samples is lacking, the first goal of the present research was to use the NESARC to investigate the empirical validity of the pathways model proposed by Blaszczynski and Nower (2002). This analysis utilized data from Wave 1 and Wave 2 of the NESARC collected in 2001-02 and 2003-04, respectively, by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), National Institutes of Health.

There are a number of other limitations of past research that I hoped to address with the NESARC database. First, no subtyping studies to date have examined all gamblers in a nationally representative sample. It is not known if the pathways model generalizes to gamblers who do not meet any criteria for problem and pathological gambling. I planned to explore whether this was the case. Therefore, unlike Carragher and McWilliams (2007) who limited their analysis only to gamblers who provided complete data on the 15 past-year DSM-IV pathological gambling symptom items, I included all respondents in the NESARC who endorsed gambling five or more times in one year. Another limitation in the gambler subtyping research involves using mainly diagnostic criteria for problem or pathological gambling to derive classes of gamblers. I therefore decided to use variables that examined a broader range of gambler characteristics outside of problem and pathological gambling diagnostic criteria, especially those addressed in the pathways model (Blaszczynski and Nower, 2002) such as co-occurring psychiatric disorders. Finally, the majority of studies designed to identify subtypes of pathological gamblers have used predominantly male samples. Indeed, Milosevic and Ledgerwood (2010) noted that only the study reported by Lesieur and Blume (1991) was based on a predominantly female sample. Very little research has been conducted examining the association between gender and gambling subtypes. Most subtyping studies to date where gender analyses were conducted (e.g., Faregh and Derevenski, 2011; Ledgerwood & Petry, 2006; Martins et al., 2011; Turner et al., 2008) have demonstrated that females are more likely than males to be categorized as emotionally vulnerable pathological gamblers, and that males are more likely than females to be categorized as antisocial impulsivist pathological gamblers. Therefore, in order to expand the research examining gender differences in the subtyping of gamblers, the current study also included an analysis of gender differences.

Hypotheses. LCA was used to investigate the empirical validity of the pathways model proposed by Blaszczynski and Nower (2002). I expected to find support for a three-class solution that followed this subtyping classification. Specifically, I expected that the first class would show no gross signs of psychopathology. In addition, I predicted that a second class would emerge demonstrating neurotic psychopathologies such as anxiety and depression. Lastly, I predicted that a third class would be differentiated from the other two classes primarily by the presence of increased impulsivity and antisocial behavior demonstrated through diagnoses of borderline personality disorder (as a proxy for impulsivity) and antisocial personality disorder.

On determining a class solution, I expected that there would be a higher proportion of females in Class 2 compared to males, and a higher proportion of males than females in Class 3. I expected the proportion of males and females in Class 1 to be about the same.

I also predicted the number of pathological gamblers to increase across classes, (i.e., Class 1 would have the lowest proportion of pathological gamblers, followed by Class 2, and Class 3).

Method

Sample

Data for this study came from both Waves 1 and 2 of the NESARC. These data were collected by the NIAAA and are available for public use (Grant & Dawson, 2006). The first wave (Wave 1) was conducted between 2001 and 2002 with a sample size of 43,093 and a response rate of 81%. Between 2004 and 2005, the Wave 2 was conducted with a total of 36,356 respondents who had already participated in Wave 1 (86.9% response rate). The overall response rate of both waves was 70.2%. Both waves were weighted to ensure representativeness of the data. Wave 2

was weighted to account for non-responses relative to Wave 1. Both surveys were administered in respondents' homes by trained lay-interviewers using computer-assisted personal interviews. The NESARC sample is comprised of non-institutionalized civilians living in the United States, which includes residents from the District of Columbia, Alaska, and Hawaii. Respondents were informed in writing about the nature of the survey and its statistical uses. In addition, they were assured that participation was voluntary and that Federal laws were in place to ensure the confidentiality of the survey information. The U.S. Census Bureau and the U.S. Office of Management and Budget conducted a full ethical review of the research protocol including the informed consent procedures and approved it. For more detailed information about the NESARC sampling frames see Grant et al. (2004). Only gamblers who endorsed gambling five or more times in any one year of their life and also participated in both Waves 1 and 2 were included in the current analysis ($n = 9300$).

Measures

DSM-IV Diagnoses. The NIAAA Alcohol Use Disorders and Associated Disabilities Interview Schedule IV (AUDADIS-IV; Grant et al., 2001) was used in the NESARC to determine if DSM-IV Axis I and Axis II diagnoses were present (see Appendix A). This fully structured diagnostic interview was designed to assess alcohol, drug, and mental disorders according to DSM-IV diagnostic criteria in clinical and general populations (Grant et al., 2001).

The diagnostic variables in the NESARC are categorical and based on a diagnosis made when participants endorsed the minimum number of symptoms required by the DSM-IV. For personality disorder diagnoses, at least one of the symptoms must have caused either social or occupational interference. Categorical variables cannot be used in discriminant analysis, and for

this reason I derived continuous variables based on the number of symptoms endorsed by

participants to determine a diagnosis (see below).

   Variables Used in Latent Class Analysis. Overall, seventeen dichotomous variables

measuring various characteristics of gamblers were used in the LCA. The first eight were

diagnostic variables (shortened labels given in parentheses) taken directly from Wave 1 and 2 of

the NESARC dataset: *Lifetime Generalized Anxiety Disorder (anxiety)*, *Lifetime Major*

Depression (depression), Alcohol Abuse in the Last 12 Months (alcohol abuse), *Alcohol Abuse*

or Dependence in the Past 12 Months (alcohol ab/dep), *Lifetime Borderline Personality*

Disorder[1] *(BPD (impulsivity))*, *Lifetime Antisocial Personality Disorder - with Conduct Disorder*

(ASPD 1), *Lifetime Antisocial Personality Disorder* (*ASPD 2)*, and *Lifetime Nicotine*

Dependence (nicotine dep). In addition to these diagnostic variables, *Gamble to Modulate*

Affective States (gamble affective), a (yes/no) dichotomous variable, was taken directly from

Wave 1 of the NESARC dataset. It was derived from asking the gambler "have you ever

gambled to get out of a bad mood?" The remaining dichotomous variables used in this study

were created by combining variables from the NESARC, as described below.

   Self-medication (self-medicate) was a dichotomous (yes/no) variable examining if the

gambler answered yes to any one of the following questions: (a) "Did you ever drink alcohol to

improve your mood or to make yourself feel better when you (felt sad, blue, depressed, or

down/didn't care about things or enjoy things) for at least two weeks?"; (b) "Did this happen

during the last 12 months?"; (c) "Did this happen before 12 months ago?; (d) "Did you ever take

any medicines or drugs on your own, that is, without a prescription, in greater amounts or more

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[1]The lifetime borderline personality disorder variable was used as a proxy for measuring impulsivity as one of the diagnostic criteria for this disorder is impulsivity in at least two areas that are potentially self damaging. A better variable to measure impulsivity was not available (see discussion section).

often or longer than prescribed to help improve your mood or to make yourself feel better when you (felt sad, blue, depressed, or down/didn't care about things or enjoy things)?"; (e) "Did this happen during the last 12 months?"; (f) "Did this happen before 12 months ago?"; (g) "Did you ever drink to calm down or help quite your nerves when you felt tense, nervous or worried?"; (h) "Did this happen during the last 12 months?"; (i) "Did this happen before 12 months ago?"; (j) "Did you ever take any medicine or drugs on your own, that is, without a prescription, in greater amounts, or more often or longer than prescribed to help calm down or quiet your nerves when you felt tense, nervous, or worried?"; (k) "Did this happen during the last 12 months?"; (l) Did this happen before 12 months ago?".

Legal trouble - you or family member (legal) was a dichotomous (yes/no) variable which measured if the gambler answered yes to one of the following questions: (a) "Did you have any legal trouble – like being arrested, held at the police station or put in jail?" or (b) "In the past 12 months did you or a family member have trouble with the police, get arrested or get sent to jail?".

Alcohol abuse/consumption (alcohol ab/consume) was a dichotomous (yes/no) variable examining alcohol abuse and consumption. The gambler scored yes for any one of the following: (a) number of episodes of alcohol abuse was 5 or more; (b) average daily volume of ethanol consumed in the past year is greater than 2 oz; or (c) number of drinks of any alcohol consumed on days when drank alcohol in last 12 months is greater than 5.

Drug abuse/dependence (drug ab/dep) was a dichotomous (yes/no) variable measuring if the gambler answered yes to any one of the following diagnoses in the last 12 months, or prior to the last 12 months: (a) amphetamine abuse or dependence, (b) opioid abuse or dependence, (c)

tranquilizer abuse or dependence, (d) cocaine abuse or dependence, (e) hallucinogen abuse or dependence, (f) cannabis abuse or dependence, (g) heroin abuse or dependence, or (h) other drug abuse or dependence.

Suicidality (suicide) was a dichotomous (yes/no) variable measuring if the gambler answered yes to any one of the following items: (a) "During that time when (your mood was at its lowest/you enjoyed or cared the least about things), did you attempt suicide?"; (b) "During that time when (your mood was at its lowest/you enjoyed or cared the least about things), did you think about committing suicide?"; or (c) "During that time when (your mood was at its lowest/you enjoyed or cared the least about things), did you feel like you wanted to die?".

Poor interpersonal relationships (poor relations) was a dichotomous (yes/no) variable measuring if the gambler answered yes to any one of the following items: (a) "Did you have any serious problems getting along with other people – like arguing with your friends, family, people at work or anyone else?"; (b) "In the past 12 months did you have trouble with your boss or a coworker?"; (c) "In the past 12 months did you get separated or divorced or break off a steady relationship?"; or (d) "In the past 12 months have you had serious problems with a neighbor, friend or relative?".

Family history of antisocial behavior (family ASB) was a dichotomous (yes/no) variable derived on the basis of the gambler's responses to questions pertaining to the following statement, which had been presented aurally:

> Now I would like to ask you about whether any of your relatives, regardless of whether or not they are now living, have ever had behavior problems. By behavior problems I mean being cruel to people or animals,

fighting or destroying property, trouble keeping a job or paying bills, being impulsive, reckless or not planning ahead, lying or conning people or getting arrested. These people also do not seem to care if they hurt others and often have problems at an early age such as truancy, staying out all night or running away.

The gambler was given a score of yes for *family ASB* if, after hearing this statement, he/she answered yes to any one of the following questions: (a) "In your judgment, did your blood or natural father have some of these behavior problems like this anytime in his life"; (b) "Did your blood or natural mother have some of these behavior problems like this any time in her life?"; (c) "Did your full brother(s) have some of these behavior problems at any time in (his life/their lives?)"; or (d) "Did your full sister(s) have some of these behavior problems at any time in (her life/ their lives)?".

Family history of alcohol behavior (family alcohol) was a dichotomous (yes/no) variable derived on the basis of the gambler's responses to questions pertaining to the following statement, which had been presented aurally:

Now I would like to ask you some questions about whether any of your relatives, regardless of whether or not they are now living, have ever been alcoholics or problem drinkers. By alcoholic or problem drinker, I mean a person who has physical or emotional problems because of drinking; problems with a spouse, family, or friends because of drinking; problems at work or school because of drinking; problems with the police because

of drinking - like drunk driving or a person who seems to spend a lot of

time drinking or being hungover.

The gambler was given a score of yes for *family alcohol* if, after hearing this statement, he/she

answered yes to any one of the following questions: (a) "Has your blood or natural father been

an alcoholic or problem drinker at any time in his life?"; (b) "Has your blood or natural mother

been an alcoholic or problem drinker at any time in her life?"; (c) "Was your full brother an

alcoholic or problem drinker at any time in his life?"; or (d) "Was your full sister an alcoholic or

problem drinker at any time in her life?".

Analytic Strategy

Statistical analyses. Appropriate statistical weights were applied to ensure

representativeness of the NESARC data. LCA was conducted using Mplus Version 6.0 (Muthén

and Muthén, 1998-2010) as this software package takes into account the complex sampling

design of the NESARC. Subsequently, upon deriving the best latent class solution, each gambler

was assigned to their respective class and chi-square analyses were conducted to further examine

the utility of specific variables within the latent class model.

Latent class analysis. LCA is a statistical method that uses maximum-likelihood

estimation (MLE) to divide the observed data into classes based on their common characteristics.

Specifically, LCA identifies the optimal number of classes (groups) by comparing the goodness

of fit for various class solutions. The LCA modeling procedure produces criterion endorsement

conditional probabilities that reflect the likelihood that a criterion is endorsed, given membership

in a particular class (Xian et al., 2008). Several proposed models are usually fit to the data,

starting with the most parsimonious solution (one class), and then the number of latent classes is

increased until the best fitting statistical model is arrived at by comparing the fit indices.

Currently, the method for determining the number of classes in LCA consists of using the

Bayesian information criterion (BIC), entropy, and the Lo-Mendell-Rubin (2001) likelihood ratio

test (LMR-LRT) fit indices as well as an examination of the characteristic profile plots to

determine which class structure is most meaningful. The BIC is calculated for each model with

the smallest BIC usually indicating the best-fitting model. Entropy is used to assess the certainty

of classification based on the estimated model. Entropy values can range from 0-1 with the

highest score of entropy indicating the best model classification. The LMR-LRT is a likelihood

ratio-based method for testing k -1 classes against k classes. A low p-value indicates that the $k -$

1-class model has to be rejected in favor of a model with at least k classes.

Post-hoc analyses of variable used in LCA model. In order to further investigate how

well certain variables used in the LCA were at differentiating classes, a number of post-hoc chi-

square tests were conducted. In addition, a series of post-hoc chi-square tests were conducted to

examine if the classes identified using LCA differed with regard to gender distribution and

likelihood of lifetime pathological gambling. Although I had also planned to determine if there

were any differences regarding treatment seeking between classes this proved to be impossible

because there were only 19 gamblers who endorsed either going to gamblers anonymous or any

kind of counselor, therapist, doctor, psychologist, or other professional for help with their

gambling problems. This unfortunately violated the assumption of chi-square tests that at least 80

per cent of cells have expected frequencies of 5 or more. Because such a small proportion of

gamblers endorsed seeking treatment, one can argue that the current sample is fairly

representative of non-treatment seeking gamblers.

Results

Demographics

Table 1 presents the demographic characteristics of the 9300 gamblers in the sample.

Only individuals who endorsed a past year history of gambling involvement were included in

this study.

Table 1

Table 1.
Prevalence Estimates for Class Membership by Demographics Among All Gamblers (N = 9300)

		Gambling Latent Groups		
Demographics	Total	Class 1 (BC, n = 7186)	Class 2 (EV, n = 1589)	Class 3 (AI, n = 525)
Marital Status				
Married/common-law	5127 (55.13)	4158 (57.86)	703 (44.24)	266 (50.67)
Divorced/widowed	2366 (25.44)	1705 (23.73)	540 (33.98)	121 (23.05)
Never married	1807 (19.43)	1323 (18.41)	346 (21.77)	138 (26.29)
Education				
Post-secondary	3054 (32.84)	2429 (33.80)	492 (30.96)	133 (25.33)
Some post-secondary	2160 (23.23)	1628 (22.66)	415 (26.12)	117 (22.29)
Some high-school or less	4068 (43.74)	3113 (43.32)	680 (42.79)	275 (52.38)
No formal education	18 (0.19)	16 (0.22)	2 (0.13)	0 (0.00)
Annual Household Income				
$60,000 or more	2870 (30.86)	2330 (32.42)	413 (25.99)	127 (24.19)
$40,000 to $59,999	1952 (20.99)	1512 (21.04)	321 (20.20)	119 (22.67)
$20,000 to $39,999	2535 (27.26)	1931 (26.87)	447 (28.13)	157 (29.90)
Less than $20,000	1943 (20.89)	1413 (19.66)	408 (25.68)	122 (23.24)
Employment				
Employed	5564 (59.83)	4273 (59.46)	955 (60.10)	336 (64.00)
Unemployed	676 (7.27)	406 (5.65)	187 (11.77)	83 (15.81)
Other	3060 (32.90)	2507 (34.89)	447 (28.13)	106 (20.19)
Age				
65 and older	1677 (18.03)	1528 (21.26)	129 (8.12)	20 (3.81)
35-64 years old	5339 (57.41)	4016 (55.89)	1037 (65.26)	286 (54.48)
Less than 35 years old	2284 (24.56)	1642 (22.85)	423 (26.62)	219 (41.71)
Region				
Northeast	1902 (20.45)	1543 (21.47)	288 (18.12)	71 (13.52)
Midwest	2291 (24.63)	1711 (23.63)	435 (27.38)	145 (27.62)
South	2910 (31.29)	2273 (31.63)	484 (30.46)	153 (29.14)
West	2197 (23.63)	1659 (23.09)	382 (24.04)	156 (29.71)

Notes: All χ^2 analyses were significant at p < .0001.

Latent Class Analysis

Table 2 presents the fit statistics for the estimated model solutions assuming two to six

classes. Five latent class models were tested. Application of the lower BIC for model selection in

our case did not result in an overwhelmingly clear determination of the "best" model as the BIC

continued to improve as classes were added. However, the BIC score only improved slightly as

we moved from a three- to a four-class model, or from a four- to a five-class model. These

results indicated that either the three- or four-class solution fit the data best. Entropy was found

to be best for the three-class solution. As when determining the number of factors using

exploratory factor analysis, the number of classes should ultimately be determined by a

combination of factors in addition to fit indices, including one's research question, parsimony,

theoretical justification, and interpretability (Bauer & Curran, 2003; Muthén, 2003; Rindskopf,

2003). Even though the LMR-LRT statistic indicated that all class solutions were significant

(i.e., $p < 0.001$), comparison of the characteristic profile plots indicated that the three-class

solution was the most meaningful. In addition, when comparing the profiles of the three- and

four-class models, the three-class model was chosen as the best model because the change in BIC

from a three- to a four-class model was negligible but there was a substantial gain in entropy.

Table 2

Table 2. Selected Fit Indices for 2- to 6-Class Latent Class Models Among 5+/year Gamblers (N = 9,300)

Model	BIC	Change in BIC	Entropy	LMR-LRT
2-Class	94000.6	0	0.840	<.001
3-Class	**91490.4**	**-2510.2**	**0.907**	**<.001**
4-Class	90203.7	-1286.7	0.802	<.001
5-Class	89717.0	-486.7	0.826	<.001
6-Class	89331.3	-385.7	0.807	<.001

BIC, Bayesian information criterion; LMR-LRT, Lo-Mendell-Rubin likelihood ratio test.

Table 3 provides the conditional probabilities for endorsing each of the 17 items for the three-class model. As is often the case in a heterogeneous and relatively representative sample, the largest class (77.3%) was mainly asymptomatic and comprised of people who are unlikely to endorse any of the variables. The second class (17.1%) could be classified as *emotionally vulnerable* gamblers, as they had a high probability of endorsing neurotic problems (i.e., depression, anxiety, suicidality, etc.). Class 3 (4.8% of the sample), contained gamblers who had a high probability of endorsing antisocial personality traits, abusing and/or being dependent on drugs, having legal problems, and reporting a family history of antisocial behavior. These gamblers most resembled the anti-social impulsivist subtype proposed by Blaszczynski and Nower (2002). An illustration of these results is presented in Figure 1.

Table 3

Table 3.

*Overall Class Prevalence and Conditional Probabilities for Gambling Characteristics Among Gamblers
(N = 9,300)*

			Latent Classes		
			Class 1[a] % (No.) 77.3 (7186)	Class 2[b] % (No.) 17.1 (1589)	Class 3[c] % (No.) 5.6 (525)
Code	Characteristic	Prevalence (%)	Conditional Probabilities		
E1	Anxiety (GED)	5.8	0.01	0.22	0.14
E2	Depression	21.0	0.06	0.78	0.43
A14	Suicidality	13.3	0.01	0.57	0.36
E7	Gamble to Modulate Affect	4.9	0.03	0.11	0.12
E8	Self-medicate	7.1	0.00	0.30	0.25
E3	Alcohol Abuse	7.0	0.06	0.09	0.12
E32	Alcohol Dependence/Abuse	5.1	0.03	0.12	0.17
A13	Alcohol Abuse/Consumption	12.4	0.10	0.18	0.29
A132	Nicotine Dependence	15.7	0.10	0.31	0.40
A133	Drug Dependence/Abuse	14.3	0.08	0.28	0.52
A9	Borderline PD (Impulsive)	7.2	0.03	0.20	0.23
A10	Anti-Social PD 1	5.6	0.00	0.00	0.98
A102	Anti-Social PD 2	5.9	0.00	0.00	1.00
A12	Legal Troubles	7.7	0.04	0.16	0.23
A15	Poor relationships	21.5	0.13	0.47	0.49
A17	Family Antisocial Behavior	20.9	0.14	0.40	0.52
A18	Family Alcohol Problems	10.1	0.07	0.19	0.23

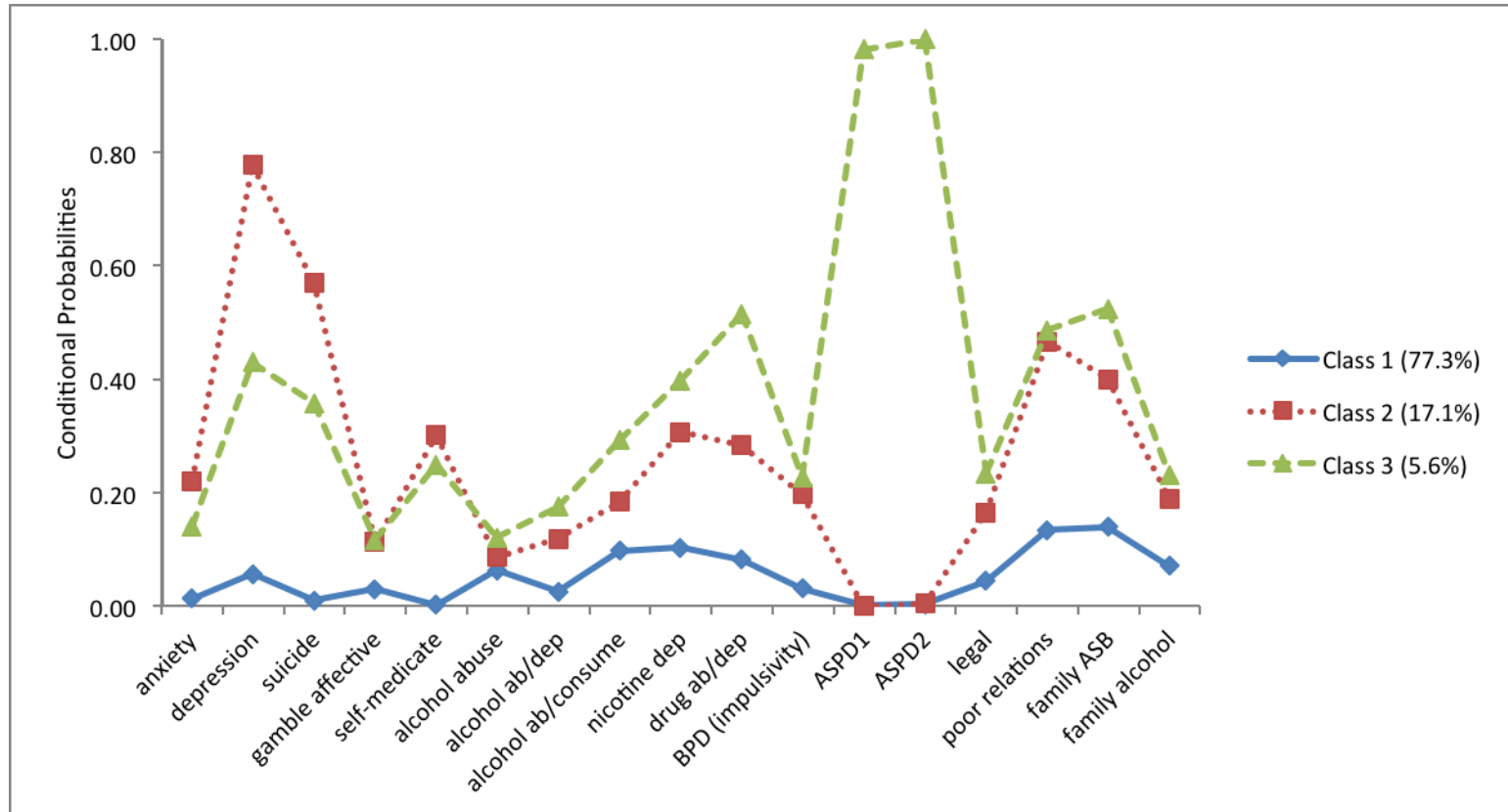[a]Behaviorally Conditioned

[b]Emotionally Vulnerable

[c]Antisocial Impulsivist

Figure 1

Profile of Gambler Characteristics (3 Class Model)

Post-hoc Analyses of LCA Derived Variables

The majority of the variables used in the LCA were successful in discriminating the three classes. For instance, when examining Figure 1, it is apparent that all three classes differ significantly on the *anxiety*, *depression*, *suicide*, and *drug ab/dep* variables. In addition, both antisocial personality disorder variables strongly differentiate Class 3 from the other two classes. However, a number of the variables used in the LCA did not discriminate the classes as effectively as the aforementioned variables. For instance, it was difficult to determine if the *alcohol abuse* variable differentiated the classes at all. Therefore, a number of post hoc analyses were conducted to examine how well a number of these variables discriminated classes; the variables selected for these analyses included *gamble affective, alcohol abuse, BPD impulsivity, and poor relations*. Omnibus chi-square analyses revealed that each of these variables was able to discriminate between classes significantly: *gamble affective* (χ^2 (2, N = 9289) = 276.61, p < 0.0001), *alcohol abuse* (χ^2 (2, N = 9300) = 29.67, p < 0.0001), *BPD impulsivity* (χ^2 (2, N = 9300) = 769.51, p < 0.0001), and *poor relations* (χ^2 (2, N = 9300) = 1134.93, p < 0.0001). Post-hoc chi-square analyses showed that the *alcohol abuse* variable discriminated Class 1 from Class 3 (χ^2 (1, N = 9300) = 24.63, p < 0.0001), Class 1 from Class 2 (χ^2 (1, N = 9300) = 7.96, p = 0.0048), and Class 2 from Class 3 (χ^2 (1, N = 9300) = 6.60, p = 0.0102). Post-hoc chi-square analyses also showed that the remaining three variables were only able to discriminate Class 1 from the other two classes (χ^2 (1, N = 9300) > 7.96, p < 0.01 in all cases).

Post-hoc Analyses Relating to Gender and Pathological Gambling

After selecting the three-class solution, each individual was assigned to his or her most likely class and additional between-class comparisons were performed on several gambler

characteristics with the aim of validating the class structure of gamblers in this sample. The results of these analyses are described below.

Gender. A chi-square test of independence was performed to further explore the associations between gender and class membership (see Table 4). Class membership was associated with gender, χ^2 (2, N = 9300) = 185.85, p < 0.0001. As expected, there were significantly more males than females in Class 3 (73.53% males versus 26.48% females), and significantly more females than males in Class 2 (58.84% females versus 41.16% males). Class 1 had slightly more males than females (males 54.68% versus 45.32%).

Table 4

Table 4.
Prevalence Estimates for Class Membership by Gender and Treatment Seeking Among All Gamblers (N = 9300)

Gambling Latent Groups

Demographics	Total	Class 1 (BC, *n* = 7186)	Class 2 (EV, *n* = 1589)	Class 3 (AI, *n* = 525)
Gender				
Female	4331 (46.57)	3257 (45.32)	935 (58.84)	139 (26.48)
Male	4969 (53.43)	3929 (54.68)	654 (41.16)	386 (73.52)
Treatment Seeking				
Yes	19 (0.21)	7 (0.10)	10 (0.63)	2 (0.38)
No	9281 (99.79)	7179 (99.90)	1579 (99.37)	523 (99.62)

Notes: All χ^2 analyses were significant at p < .0001. The χ^2 analysis examining treatment seeking did not meet the minimum expected cell frequency counts and therefore may not be valid.

Pathological Gambling. Chi square statistics showed a significant association between class membership and lifetime pathological gambling, χ^2 (2, N = 9300) = 139.48, p < 0.0001 (Table 5). Specifically, the proportion of lifetime pathological gamblers increased across classes. Class 1 had the smallest proportion of lifetime pathological gamblers (0.71%). In Class 2, 4.41% of gamblers met criteria for lifetime pathological gambling. Lastly, 6.67% of Class 3 gamblers were lifetime pathological gamblers. This finding indicates that gamblers in Class 2 and even more specifically Class 3 have a higher risk of becoming pathological gamblers than their Class 1 counterparts.

Table 5

Table 5.

Prevalence Estimates for Class Membership by Pathological Gambling Diagnosis Among All Gamblers (n = 9300)

Gambling Latent Groups

Pathological Gambling	Total	Class 1 (BC, n = 7186)	Class 2 (EV, n = 1589)	Class 3 (AS, n = 525)
Lifetime				
Yes	156 (1.68)	51 (0.71)	70 (4.41)	35 (6.67)
No	9144 (98.32)	7135 (99.29)	1519 (95.59)	490 (93.33)

Notes: All χ^2 analyses were significant at p < .0001.

Discussion

The aim of this study was to examine if gamblers from a nationally representative sample from the United States could be classified according to a number of the characteristics suggested by the Blaszczynski and Nower (2002) pathways model. Consistent with other studies within the subtyping literature (Blaszczynski & Nower, 2002; Bonnaire et al. 2007; Gonzalez-Ibanez, 1994; Gonzalez-Ibanez et al., 2003; Moran,1970; Stewart et al., 2008; Vachon & Bagby, 2009) my analysis supported a three-class solution that supports several aspects of the pathways model. For instance, Class 1 was characterized by a low probability of endorsing the majority of the variables being measured. Also, only a small percentage of gamblers in this class (0.71%) met criteria for pathological gambling. Both of these findings are consistent with those found in studies employing LCA to classify subtypes of gamblers (Carragher & McWilliams, 2011; Faregh & Derevensky, 2011; McBride et al., 2010; and Xian et al., 2008). In addition, I found that men were slightly more likely than women to be classified as Class 1 gamblers.

Class 2 gamblers were characterized by an increased probability of meeting diagnostic criteria for depression, generalized anxiety disorder, and suicidality. These gamblers were also characterized as being more likely to self-medicate than gamblers in both other classes. This class of gambler most resembled Moran (1970) and Zimmerman et al.'s (1985) neurotic gambler subtypes, as well as Blaszczynski and Nower's (2002) emotionally vulnerable subtype. Interestingly, although gambling to escape negative affect was successful in differentiating Class 1 from the other two classes, it failed to differentiate Class 2 from Class 3. This result was surprising as it did not support Blaszczynski and Nower's (2002) prediction that emotionally vulnerable gamblers would be more likely to endorse gambling to escape negative affect compared to other subtypes. An explanation for this finding might be that gambling primarily to

relieve aversive affective states is a characteristic more pronounced in treatment seeking problem or pathological gamblers and is less prominent in gamblers in general. If this is the case, gambling to escape aversive affective states may be a strong indicator that an individual is potentially more likely to develop gambling problems. Of course, another explanation might be that this one variable was not a sensitive enough measure of this characteristic. Future studies should take this finding into consideration. Longitudinal studies for instance could pinpoint at what point in a developmental pathway emotionally vulnerable gamblers start to report using gambling as a way to relieve aversive emotional states. It is also interesting to note that gamblers in this class were more likely than the other two classes to endorse self-medicating. These findings might indicate that self-medication with drugs and alcohol may be different than self-medicating with gambling. Future longitudinal research should examine when gamblers begin to self medicate and if this is related to gambling as a means to avoid aversive affect.

My prediction that a higher percentage of gamblers in Class 2 would meet criteria for pathological gambling compared to Class 1 was supported. This finding makes sense considering that Petry et al. (2005) found that 49.6% of pathological gamblers surveyed in the NESARC had a mood disorder and el-Guebaly et al. (2006) found that the risk of moderate/high severity gambling was 1.7 times higher in people with a mood or anxiety disorder compared to those with no disorder. In addition, in line with past research examining gender differences (Faregh and Derevenski, 2011; Ledgerwood & Petry, 2006; Martins et al., 2011; Turner et al., 2008), women were also over-represented in Class 2. These results are also in agreement with Steel and Blaszczynski's (1996) finding that a group of gamblers composed mainly of females showed high levels of psychological distress as indexed by high scores on measures of history of depression, psychological distress, and suicidality.

Class 3 gamblers were characterized by an extremely high probability of endorsing items measuring antisocial personality disorder (100.00%), and antisocial personality disorder with conduct disorder (98.48%). Gamblers in this *antisocial class* were more likely to endorse having legal problems compared to those in the other classes. Class 3 gamblers were also more likely to endorse having a family history of behavioral and alcohol problems. In addition, these gamblers were most likely to meet criteria for alcohol abuse and dependence, and drug abuse and dependence. All of these findings support Blaszczynski and Nower's (2002) characterization of the antisocial impulsivist gambler. About 74 % of Class 3 gamblers were men. Thus, it appears that antisocial gamblers are substantially more likely to be male than female. As predicted, compared to the other two classes, Class 3 had the highest proportion of lifetime pathological gamblers (6.67%). This finding mirrors a trend of increasing severity across classes found in other studies (e.g., Carragher & McWilliams, 2011; McBride et al., 2010; and Xian et al., 2008). Blaszczynski and Nower (2002) propose that antisocial gamblers are also more likely to be impulsive and demonstrate attention deficit than the emotionally vulnerable and behaviourally conditioned subtypes of gamblers. However, even though the borderline personality disorder measure used in this study as a proxy to measure impulsivity did differentiate Class 1 gamblers from the other two classes, it failed to differentiate Class 2 and Class 3 gamblers.

Blaszczynski and Nower (2002) note that clinical findings often demonstrate that impulsive gamblers tend to be more likely than other gamblers to display behavioral problems such as suicidality. This observation was not fully supported in the current study. Although Class 3 gamblers – the group most closely resembling the antisocial impulsivist subtype of gambler – were more likely to endorse suicidality than Class 1, this class had a lower probability of endorsing this characteristic than Class 2 gamblers. These results seem to indicate that although

suicidality is a major issue for the antisocial impulsivist type, it is even more probable in the

emotionally vulnerable type of gambler. Further research investigating suicidality in these

subtypes is therefore necessary. Blaszczynski and Nower (2002) also have characterized the

antisocial impulsivist subtype of gambler as being more likely than the other subtypes to have

poor interpersonal relationships. The results from this study support the idea that Class 2 and 3

gamblers are equally likely to endorse having strained interpersonal relationships, and more

likely to do so compared to Class 1 gamblers.

It is important to note that although these three classes are presented as distinct, gamblers

in each class may share some of the characteristics of the other classes. For example, although

Class 3 gamblers are mainly defined by their antisocial tendencies and family history of

antisocial behaviour, some gamblers in this Class may also be affected by depression and

anxiety.

To my knowledge this is the first study to demonstrate that gamblers in general (i.e.,

problem, pathological, and normal) from the United States can be classified into three distinct

groups that resemble those proposed by Blaszczynski and Nower (2002). This study is unique in

that the LCA used variables that attempted to represent a broader range of gambler

characteristics as outlined in the Blaszczynski and Nower (2002) pathways model, including co-

occurring psychiatric diagnosis. This is important because most LCA studies to date have mainly

used problem or pathological gambling diagnostic criteria in their LCAs (e.g., Carragher &

McWilliams, 2011; Martins et al., 2011; McBride et al., 2010; Xian et al, 2008). However, none

have derived latent classes including such factors as psychiatric diagnoses and family history of

antisocial behaviour. Although Martins et al. (2011) did include an item examining if gamblers

were under the care of a doctor for stress-related problems, this item does not clearly define the

nature of the problem or if the gambler received a diagnosis. In addition, Martins et al. (2011) also employed one item assessing self-reported perception of alcohol and drug problems; however, this item is also somewhat limited in that it did not contain information regarding a specific diagnosis.

The findings from this study provide support for many aspects of the Blaszczynski and Nower (2002) pathways model and also demonstrate that gamblers from the general population can be differentiated into distinct subtypes. These results are important because they demonstrate that all gamblers, not just those experiencing gambling related problems, could be understood to fall into distinct subtypes that resemble those proposed by Blaszczynski and Nower (2002). Since gamblers who fit into the emotionally vulnerable and antisocial impulsivist type classes have a higher likelihood of developing gambling problems, it might be advantageous to customize prevention strategies that address the underlying characteristics that may lead to gambling problems. In addition, this research may aid in the development of better diagnostic criteria for uncovering gambling pathologies. Currently, pathological gambling is conceptualized as a unitary construct in the DSM-IV-TR. This research supports the assertion that diagnostic tools need to be developed that take into consideration factors such as family history and co-occurring psychiatric disorders, not addressed in the current nosology. The current study also has provided further evidence that women are more likely to be classified as emotionally vulnerable gamblers and men as antisocial impulsivist. This highlights the importance of more research being conducted to further examine how gender influences gambling behavior. This knowledge can also help in the development of better diagnostic tools as well as prevention and treatment programs that consider issues related to gender. In addition, this research indicates that treatments may need to be tailored to address the unique underlying issues of each gambling

subtype so that the underlying issues that may be contributing to the gambling problems are addressed.

A number of limitations should be noted and taken into consideration when interpreting the findings of the current study. First, there are a number of limitations related to the data set that was used. As described in Carragher and McWilliams (2011), data from the NESARC were self-reported; as a result, gamblers' responses may have been vulnerable to memory and social desirability bias, which could have resulted in reporting errors such as under-reporting of gambling involvement. Another limitation is that the use of a screening question to limit the dataset to only gamblers who reported gambling five or more times in any one year of their life may limit the generalizability of this study. As Carragher and McWilliams (2011) point out, there may be individuals in the population who gambled less than this amount and still demonstrate characteristics of interest.

There are a number of limitations relating to the construct validity of the variables used in this LCA. First, impulsivity was not directly measured but inferred through a proxy measure, namely the diagnosis of borderline personality disorder. Although it is true that marked impulsivity is part of the diagnostic criteria for borderline personality disorder, individuals with this disorder may also demonstrate other symptomatology related to instability in interpersonal relationships, self-image, and affect. A diagnosis of ADHD would have provided a more suitable proxy measure of impulsivity and attention deficit, but unfortunately there were issues related to the validity of this variable in the NESARC and therefore it could not be used (J. Bolton, personal communication, June 4, 2012). An ideal situation would have been to use measures specifically designed to assess the constructs of interest (e.g., the Barratt Impulsiveness Scale version 11; Patton, Stanford, & Barratt, 1995). Unfortunately, this was not possible in a study

that involved secondary data analysis. In addition, the pathways model outlines a large number

of gambling characteristics that hypothetically differentiate gamblers and not all of these were

measured in the NESARC. Therefore, it is recommended that future subtyping studies attempt to

examine all characteristics proposed in the pathways model.

It is important to note that this study used data that were cross-sectional in nature and

therefore does not provide information about how, or if, class membership changes over time. It

is therefore recommended that longitudinal research be carried out investigating the temporal

stability of class membership over time.

Overall, this study provides empirical support that gamblers from a nationally

representative sample are best classified into three classes, which overlap well with those

proposed in Blaszczynski and Nower's (2002) pathways model. In addition, this study adds to a

growing body of research, which demonstrates that gamblers are not homogeneous and that they

can be differentiated by such factors as co-occurring psychiatric disorders and family history.

Future studies using longitudinal data are needed to investigate the temporal stability of

gambling subtypes.

References

Afifi, T. O., Cox, B. J., Martens, P. J., Sareen, J., Enns, M. W. (2010). Developing a population
health framework for studying problem gambling. *Canadian Journal of Community
Mental Health*, *30*(1), 61-77.

American Psychiatric Association (APA) (2000). *Diagnostic and Statistical Manual of Mental
Disorders- IV*. Washington, DC, American Psychiatric Association Press.

Bagby, R. M., Vachon, D. D., Bulmash, E. L., Toneatto, T., Quilty, L. C., & Costa, P. T. (2007).
Pathological gambling and the five-factor model of personality. *Personality and
Individual Differences*, *43*, 873-880.

Bauer, D. J., & Curran, P. J. (2003). Distributional assumptions of growth mixture models:
Implications for overextraction of latent trajectory classes. *Psychological Methods*, *8*,
338–363.

Blaszczynski, A., McConaghy, N., & Frankova, A. (1990). Boredom proneness in pathological
gambling. *Psychological Reports*, *67*, 35-42.

Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological
gambling. *Addiction*, *97*, 487−499.

Blaszczynski, A., Steel, Z., & McConaghy, N. (1997). Impulsivity in pathological gambling: The
antisocial impulsivist. *Addiction*, *92*, 75-87.

Boscardin, C. (2012) Profiling students for remediation using latent class analysis. *Advances in
Heath Sciences Education*, 17, 55-63.

Bonnaire, C., Varescon, I., & Bungerener, C. (2007). Sensation seeking in a French population of horse better gamblers: Comparison between pathological and regular, *Encephale, 33*(5), 798-804.

Bonnaire, C., Bungener, C., & Varescon, I. (2009). Subtypes of French pathological gamblers: Comparison of sensation seeking, alexithymia and depression scores. *Journal of Gambling Studies*, *25*, 455−471.

Carragher, N., & McWilliams, L. A. (2011). A latent class analysis of DSM-IV criteria for pathological gambling: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychiatry Research*, *187*, 185-192.

Carlton, P. L., & Manowitz, P. (1992). Behavioral restraint and symptoms of attention deficit disorder in alcoholics and pathological gamblers. *Neuropsychobiology*, *25*(1), 44–48.

Ciarrocchi, J. (1987). Severity of impairment in dually addicted gamblers. *Journal of Gambling Behavior*, *3*, 16-26.

Clark, D. (2006). Impulsivity as a mediator in the relationship between depression and problem gambling. *Personality and Individual Differences*, *40*, 5-15.

Cox, B. J., Kwong, J., Michaud, V., Enns, M. (2000). Problem and probable pathological gambling: Considerations from a community survey. *Canadian Journal of Psychiatry*, *45*, 548-553.

Cox, B. J., Yu, N., Afifi, T. O., Ladouceur, R. (2005). A national survey of gambling problems in Canada. *Canadian Journal of Psychiatry*, *50*(4), 213-217.

Cunningham-Williams, R. M. & Hong, S. I. (2007). A latent class analysis (LCA) of problem

gambling among a sample of community-recruited gamblers. *The Journal of Nervous and*

Mental Disease, *195*(11), 939-947.

Daghestani, A. N., Elenz, E., & Crayton, J. W. (1996). Pathological gambling in hospitalized

substance abusing vetrans. *Journal of Clinical Psychiatry*, *57* (8), 360-363.

el-Guebaly, N., Patten, S. B., Currie, S., Williams, J. V. A., Beck, C. A., Maxwell, C. J., et al.

(2006). Epidemiological associations between gambling behavior, substance use & mood

and anxiety disorders. Journal of Gambling Studies, 22, 275-287.

Faregh, N. & Derevensky, J. (2011). A comparative latent class analysis of endorsement profiles

of DSM-IV diagnostic criteria for problem gambling among adolescents from a

community and a treatment sample. *Addiction Research and Theory*, *19*(4), 323-333.

Gonzalez-Ibanez, A., Aymani, M. N., Jimenez, S., Domenech, J. M., Granero, R., & Lourido-

Ferreira, M. R. (2003). Assessment of pathological gamblers who use slot machines.

Psychological Reports, *93*, 707−716.

Graham, J. R., & Lowenfeld, B. H. (1986). Personality dimensions of the pathological gambler.

Journal of Gambling Behavior, *2*, 58-66.

Grant, B. F., & Dawson, D. A. (2006). Introduction to the National Epidemiologic Survey on

Alcohol and Related Conditions. Bethesda, MD: National Institute on Alcohol Abuse and

Alcoholism.

Grant, G. F., Dawson, D. A., & Hasin, D. S. (2001). The Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV Version. Bethesda, MD: National Institute on Alcohol Abuse and Alcoholism.

Grant, B. F., Stinson, F. S., Dawson, D. A., Chou, S. P., et al. (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry*, *61*, 807–816.

Gupta, R., Nower, L., Derevensky, J. L., & Blaszczynski, A. (2009). Problem gambling in adolescents: An examination of the pathways model. Retrieved from The Responsible Gambling Council website: http://www.responsiblegambling.org/articles/FINAL_REPORT_Pathways_FOR_POSTING_DEC_9_20093076a0f0f9d2af4%5B1%5D.pdf

Leblond, J., Ladouceur, R., & Blaszczynski, A. (2003). Which pathological gamblers will complete treatment? *British Journal of Clinical Psychology*, *42*, 205-209.

Legerwood, D. M., Alessi, S. M., Phoenix, N., & Petry, N. M. (2009). Behavioral assessment of impulsivity in pathological gamblers with and without substance use disorder histories versus healthy controls. *Drug and Alcohol Dependence*, *105*, 89-96.

Ledgerwood, D. M., & Petry, N. M. (2010). Subtyping pathological gamblers based on impulsivity, depression and anxiety. *Psychology of Addictive Behaviors*, *24*(4), 680-688.

Ledgerwood, D. M., & Petry, N. M. (2006). Psychological experience of gambling and subtypes of pathological gamblers. *Psychiatry Research*, *144*, 17−27.

Lesieur, H. R. (2001). Cluster analysis of types of inpatient pathological gamblers. *Dissertation Abstracts International*, 62B, 2065.

Lesieur, H. R., & Blume, S. B. (1991). When lady luck loses: Women and compulsive gambling. In N. Van Den Bergh (Ed.), Feminist perspectives on addictions (pp. 181−197). New York: Springer Publishing Co.

Lorr, M. (1983). *Cluster analysis for social scientists: Techniques for analyzing and simplifying complex blocks of data*. San Francisco, CA: Jossey-Bass Inc.

Martins, S. S., Ghandour, L. A., Storr, C. L. (2011). Gambling behavior subtypes among respondents with gambling-related problems in a population based sample. *Journal of Addictive Diseases*, *30*, 169-180.

McBride, O., Adamson, G., & Shevlin, M. (2010). A latent class analysis of DSM-IV pathological gambling criteria in a nationally representative British sample. *Psychiatry Research*, *178*, 401-407.

McCormick, R. A. (1987). Pathological Gambling: A parsimonious need state model. *Journal of Gambling Behavior*, *3*, 257-263.

Miller, M. A., & Westermeyer, J. (1996). Gambling in Minnesota. *American Journal of Psychiatry*, *153*(6), 845.

Milosevic, A., & Ledgerwood, D. M. (2010). The subtyping of pathological gambling: A comprehensive review. *Clinical Psychology Review*, *30*(8), 988-998.

Moran (1970). Varieties of pathological gambling. *The British Journal of Psychiatry*, *116*, 593-597.

Muthén, B. O. (2003). Statistical and substantive checking in growth mixture modeling: Comment on Bauer and Curran (2003). *Psychological Methods*, *8*, 369–377.

Muthén, L .K., & Muthén, B. O. (1998-2010). Mplus User's Guide, version 6. Muthén & Muthén, Los Angeles.

National Opinion Research Centre (NORC) (1999). *Gambling Impact and Behavior Study*. Chicago, University of Chicago.

National Research Council (1999). *Pathological Gambling: A Critical Review*. Washington, D.C.: National Academy Press.

Nower, L., & Blaszczynski, A. (2006). Impulsivity and pathological gambling: A descriptive model. *International Gambling Studies*, *6*, 61-75.

Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt impulsiveness scale. *Journal of Clinical Psychology,* 51, 768-774.Petry, N. M., & Arentano, C. (1999). Prevalence, assessment, and treatment of pathological gambling: a review. *Psychiatric Services*, *50*(8), 1021-1027.

Petry, N. M., Stinson, F. S., & Grant, B. F. (2005). Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *The Journal of Clinical Psychiatry*, *66*, 564−574.

Pietrzak, R. H. & Petry, N. M. (2005). Antisocial personality disorder is associated with increased severity of gambling, medial, drug, and psychiatric problems among treatment-seeking pathological gamblers, *Journal of Nervous and Mental Disease*, *181*, 107-112.

Rindskopf, D. (2003). Mixture or homogeneous? Comment on Bauer and Curran. *Psychological Methods*, *8*(3), 364-368.

Ruan, W.J., Goldstein, R.B., Chou, S.P. et al. (2008). The Alcohol Use Disorder and Associated Disabilities Interview Schedule-IV (AUDADIS-IV): Reliability of new psychiatric diagnostic modules and risk factors in a general population sample. *Drug and Alcohol Dependence*, *92*, 27-36.

Rugle, L. J., & Melamed, L. (1993). Neuropsychological assessment of attention problems in pathological gamblers. *Journal of Nervous and Mental Disease*, *181*(2), 107–112.

Shaffer, H. J., & Hall, M. N. (2001). Updating and refining prevalence estimates of disordered gambling behaviour in the United States and Canada. *Canadian Journal of Public Health*, *92*, 168–17.

Spunt, B., Dupont, I., Lesieur, H., Liberty, H. J., & Hunt, D. (1998). Pathological gambling and substance misuse: a review of the literature. *Substance Use and Misuse*, *33*(13), 2535-2560.

Specker, S. M., Carlson, G. A., Christenson, G. A., & Marcotte, M. (1995). Impulse control disorders and attention deficit disorder in pathological gamblers. *Annals of Clinical Psychiatry*, *7*(4), 175–179.

Steel, Z., & Blaszczynski, A. (1996). The factorial structure of pathological gambling. *Journal of Gambling Studies, 12*, 3−20.

Stewart, S. H., & Zack, M. (2008). Development and psychometric evaluation of a three-dimensional Gambling Motives Questionnaire. *Addiction*, *103*, 1110−1117.

Stewart, S. H., Zack, M., Collins, P., Klein, R. M., & Fragopoulos, F. (2008). Subtyping

  pathological gamblers on the basis of affective motivations for gambling: Relations to

  gambling problems, drinking problems, and affective motivations for drinking.

  Psychology of Addictive Behaviors, *22*, 257−268.

Turner, N. E., Jain, U., Spence, W., & Zangeneh, M. (2008). Pathways to pathological gambling:

  Component analysis of variables related to pathological gambling. *International*

  Gambling Studies, *8*, 281−298.

Turner, N., & Littman-Sharp, N. (2006). *Inventory of gambling situations users guide.*

  Toronto, Ontario, Canada: Centre for Addictions and Mental Health.

Vachon, D. D., & Bagby, R. M. (2009). Pathological gambling subtypes. *Psychological*

  Assessment, *21*, 608−615.

Vitaro, F., Arseneault, L., & Tremblay, R. E. (1999). Impulsivity predicts problem gambling in

  low SES adolescent males. *Addiction*, *94*, 565-575.

Vitaro, F., Ferland, F., Jacques, C., & Ladouceur, R. (1998). Gambling, substance use, and

  impulsivity during adolescence. *Psychology of Addictive Behaviors*, *12*, 185-194.

Walker, M. B., & Dickerson, M. G. (1996). The prevalence of problem and pathological

  gambling: a critical analysis. *Journal of Gambling Studies*, *12*(2), 233-249.

Xian, H., Shah, K. R., Potenza, M. N., Volberg, R., Chantarujikapong, S., True, W. R., . . . Eisen,

  S. A. (2008). A latent class analysis of DSM-III-R pathological gambling criteria in

  middle-aged men: Association with psychiatric disorders. *Journal of Addiction Medicine*,

  2(2), 85-95.

Zimmerman, M. A., Meeland, T., & Krug, S. E. (1985). Measurement and structure of

pathological gambling behavior. *Journal of Personality Assessment*, *49*, 76−81.

Appendix A

Section 12 – BETTING			
(SHOW FLASHCARD 27)			
Statement O ➤ Now I'd like to ask you a few questions about gambling. By gambling I mean playing cards for money, betting on the horses or dogs or sports games, playing the stock or commodities market, buying lottery tickets or playing bingo or KENO or gambling at a casino, including playing the slot machines.			

1. Have you ever gambled at least 5 times in any one year of your life?	1 ☐ Yes 2 ☐ No - *SKIP to Section 13, page 126*		
2a. The next few questions are about experiences that people have had with gambling. As I read each experience, please tell me if it has EVER happened to you. In your ENTIRE LIFE did you EVER . . . *(PAUSE)* *(Repeat phrase frequently)*	**b.** Did this happen in the last 12 months?	**c.** Did this happen before 12 months ago, that is, before last *(Month one year ago)*?	
(1) Gamble to get out of a bad mood -- like feeling nervous, sad or down?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(2) Gamble to forget your problems?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(3) More than once try to quit or cut down on your gambling, but found you couldn't do it?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(4) Find that you had to increase the amount of money you would gamble to keep it exciting?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(5) Spend a lot of time gambling, planning your bets or studying the odds?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(6) Spend a lot of time thinking about ways to get money together so you could gamble?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(7) Spend a lot of time thinking about the times when you won or lost?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No
(8) Have job or school trouble because of your gambling -- like missing too much work, being demoted at work, losing your job or dropping out of school?	1 ☐ Yes ——→ 2 ☐ No - *Go to next experience*	1 ☐ Yes ——→ 2 ☐ No - *Mark Yes in column c*	1 ☐ Yes 2 ☐ No