2015

THE LEISURE, LIFESTYLE, & LIFECYCLE PROJECT (LLLP):

A LONGITUDINAL STUDY OF GAMBLING IN ALBERTA

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Final Report for the:

LEISURE·LIFESTYLE & LIFECYCLE PROJECT

ALBERTA GAMBLING RESEARCH INSTITUTE

Citation

el-Guebaly, N., Casey, D. M., Currie, S. R., Hodgins, D. C., Schopflocher, D. P., Smith, G. J., & Williams, R. J. (2015). *The Leisure, Lifestyle, & Lifecycle Project (LLLP): A Longitudinal Study of Gambling in Alberta.* Final Report for the Alberta Gambling Research Institute. February 2015.

Acknowledgements

Longitudinal studies require a significant investment of time and resources. We want to acknowledge the foresight of the Alberta Gambling Research Institute (AGRI) in allocating funding for this project. The AGRI board has been exceedingly understanding and patient with various delays in the project and this report. We started the project in 2006, and taken approximately 8 years to produce a five-year longitudinal study. Where does the time go? We are also grateful that AGRI is funding a further assessment wave with these participants, which is further value-added for the project.

Over the course of the LLLP, a number of individuals have worked as project coordinators, research assistants, data analysts, and volunteers. These include: Kristy Kowatch, Rodney Steadman, Ashley McInnes, Annik Mossiere, Jeanne Williams, Dina Lavorato, Audra McEwen, Stephanie Tilleman, Aneta Filiciak, Nicola Lawrence, Trevor Dorey, and Mark Pickup. As well, we would like to thank the many research assistants that facilitated data collection at wave one of the study. We thank you for your attention to detail and commitment to collecting a unique and invaluable dataset.

Rob Wood from the University of Lethbridge provided a sociological perspective in the earlier phases of the project and Daniela Lobo and James Kennedy from the University of Toronto organized the genetic component, with Nicole King, Natalie Freeman, and Sajid Shaikh facilitating the collection and analysis of the genetic samples. Constructive external reviews were provided by Brian Castellani, Mike Dixon, and Ken Winters.

Finally, we most appreciate the dedication of our participants. We fully recognize that the assessments that we have requested you to complete are far from stimulating. Your input will hopefully serve to minimize gambling-related harm in the future.

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EXECUTIVE SUMMARY

The Leisure, Lifestyle, and Lifecycle Project (LLLP) is a five-year prospective longitudinal study designed to collect data on the factors influencing change in gambling and problem gambling behavior over time. A sample of 1808 participants from four locations representing the diversity of the province of Alberta (Edmonton, Calgary, Lethbridge area, and Grand Prairie area) were recruited primarily through random digit dialing. In order to assess the development of gambling problems over the lifespan, five critical age ranges were targeted: 13-15, 18-20, 23-25, 43-45 and 63-65 year-olds. Individuals with relatively heavy involvement with gambling were over sampled. A broad array of psychosocial variables was assessed at baseline via telephone, face-to-face and computer self-completion interviews. The sample was weighted to match the population of Alberta according to age, gender, geographic location and the over sampling procedure. The three follow-up interviews of the cohort were completed by paper- or Internet-based surveys. Retention in the fourth and final assessment was 76.2% for the adult cohorts, 71.8% for the adolescent cohort, and 75.1% for the combined cohort.

Three primary questions directed this project:

1. What are the normal patterns of continuity and discontinuity in gambling and problem gambling behaviour?
2. What biopsychosocial variables and behaviour patterns are most predictive of current and future problem gambling?
3. What etiological model of problem gambling is best supported by the longitudinal findings?

This report provides analyses of the *adult sample* and focuses primarily on the first two of the primary research questions above - specifically, on identifying variables that are robust predictors of future problem gambling onset, the stability of gambling problems over time, and the development of a multivariate model that illustrates the interaction of gambling behaviour and problem gambling over time. A tentative etiological model is also presented to address the last research question. The LLLP sample problem gambler prevalence at wave 1 was 4.7% (weighted prevalence 3.2%).

A similar longitudinal study was conducted during the same time period in Ontario, namely the Quinte Longitudinal Study. A set of parallel analyses was conducted on the QLS dataset to identify findings that were robustly supported in both studies. The collective findings of the

LLLP and QLS studies represent the most comprehensive longitudinal analysis of gambling and problem gambling currently in the literature.

Factors Associated with Concurrent Gambling Problems

Factors associated with concurrent gambling problems across both the LLLP and QLS were largely consistent with previous cross-sectional research. As expected, problem gamblers generally showed more frequent involvement and greater expenditure in most forms of gambling, as well as all aggregate measures of gambling involvement (number of formats, aggregate frequency, aggregate expenditure, and aggregate time spent). They also were more likely to report an early big win in their gambling history as well as family exposure to gambling and/or problem gambling while growing up. Finally, they were more likely to have gambling fallacies and more likely to indicate that they gamble to escape or distract from negative feelings, and to win money.

Demographically, the only characteristic robustly associated with concurrent problem gambling was being non-Caucasian. Unlike previous research, male gender, younger age, and lower income were not consistent correlates.

Problem gambling was robustly associated with several personality traits (neuroticism, depression, vulnerability, impulsivity, lower agreeableness, and lower conscientiousness). It was also robustly associated with poorer physical health, and most mental health disorders. There was a consistent association with substance use and abuse in QLS, but not LLLP.

Factors Predicting First Onset of Gambling Problems

Whereas the analyses of factors that are concurrently associated with problem gambling serve to replicate previous research conducted with cross sectional designs, the analyses of predictors of future onset of gambling problems capitalize on the unique features of longitudinal designs. Generally, variables indicating frequent and more intensive involvement in gambling, were as a set, predictive of future problems in both the LLLP and QLS. In addition, indicators of development of future problems included gambling to escape, dissociating while gambling, and endorsing gambling cognitive fallacies. Reporting stressful life events was also a robust predictor.

Whereas a large number of variables were found to be associated with gambling problems concurrently, relatively fewer were predictive of first onset of problems. However, these robust predictors are modifiable risk factors. Efforts to reduce the amount that people gamble may be the most effective way of preventing problem gambling.

Stability of Problem Gambling

The analytic approach taken to determine stability and change in problem gambling status involved accounting for measurement imprecision in the instruments used to assess problem

gambling. Of individuals who met the cut-off for problem gambling sometime during the study, roughly half were problem gamblers in only a single time period. One year thus represents the modal duration of problem gambling, with two years being the second most common duration. Chronic problem gambling is a less common pattern. Only a minority of problem gamblers were problem gamblers in three, four, or five consecutive time periods. Risk of chronic problem gambling increased with each consecutive year of problem gambling status.

Approximately 80% of problem gamblers will have at least one year of remission (i.e., did not meet criteria for problem gambling) in a five-year period. Of those that do recover, only about one-third are observed to relapse, although the maximum time period to observe relapse was only the subsequent three years following a recovery year. Longer-term relapse rates are unknown, but are likely significantly higher. Probability of relapse escalates with increased prior duration of problem gambling and with increased time. The relapse rate observed is lower than the rate seen in treatment samples where the majority of treatment participants lapse at some point in the post-treatment period.

More severe forms of problem gambling have similar patterns of episode duration, chronicity, recovery, and relapse compared with less severe forms when the definition of stable is that the person remains in the severe or 'pathological' category. However, when recovery is more conservatively defined as not evidencing *either* problem or pathological gambling, then more severe gambling problems show a more chronic and stable course than less severe problems.

Multivariate Models of Gambling and Problem Gambling Severity

The results of multivariate modeling indicate that from a broad population perspective gambling and problem gambling are relatively stable over time. Stability is found not only for overall gambling involvement, but also for specific aspects of gambling such as amount spent, number of types of gambling engaged in, and frequency of gambling.

These results at first glance seem inconsistent with the analysis of stability in gambling problems among people with gambling problems as defined categorically, which showed a great deal of recovery and relapse as well as a smaller group of chronic problems. These results are not, however, inconsistent. The multivariate models focused on the entire range of gambling and problem gambling and not solely on the small group exceeding the cut-off on a gambling disorder measure sometime during the study time period. Overall, general stability at the population level does not preclude less stability among this extreme group.

Longitudinally, participants who experienced both positive (improvements in relationship and family functioning and happiness) and negative changes (increase in illegal activities and stressful life events) in one time period increased their gambling in the subsequent period. This suggests that people gamble to enhance positive feelings as well as escape from negative ones.

In contrast, participants who experienced solely negative changes increased problem gambling. Participants who experienced improvements in community involvement and in family showed decreases in problem gambling in the subsequent period.

The multivariate modeling confirmed that the risk factors associated with relatively higher gambling involvement differ from risk factors that directly affected gambling disorders. Generally, the size of relationships between predictive variables and gambling behaviour and problems was small, which suggests that there is no variable that is overwhelmingly predictive. Rather, many variables contribute a small but significant effect. In both samples, being less intelligent and less religious, having greater excitement-seeking tendencies (essentially greater sensation-seeking) and having grown up gambling with parents and having friends who gamble were factors associated with more gambling involvement, but not directly related with a greater likelihood of gambling problems. Being male was also predictive of greater gambling in both samples; however, males were more likely to have gambling problems in the LLLP, but not the QLS. Gambling to escape and experiencing an early "big win or big loss" were directly associated with both increased gambling and increased problem gambling in both samples.

One of the strongest predictors of problem gambling was greater impulsivity. Impulsivity is emerging as a particularly consistent factor in gambling disorders. Understanding which facets of impulsivity are etiologically linked to gambling involvement and gambling problems is an important future direction for the field.

An additional important finding of the modeling analysis is that a variety of mental health indicators predict problem gambling: a mental health formative indicator, largely comprised of internalizing disorder indicators (e.g., depression, anxiety, obsessive compulsive traits), did not influence gambling involvement, but did influence gambling problems. Individuals with more of these struggles were not more likely to gamble, but were more likely to develop gambling problems.

The pattern of results for externalizing disorders, such as antisocial personality disorder, and substance abuse was more variable. Antisocial personality disorder traits were associated with greater gambling involvement in both samples but greater gambling problems in only the LLLP.

Drug abuse was associated with greater gambling problems in both samples, but not gambling involvement. Alcohol use disorder was unrelated to gambling involvement in either sample but negatively related to problem gambling in the QLS. The QLS revealed an association between tobacco use and gambling involvement (not problems) and the LLLP found the opposite relationship.

The negative impact of childhood trauma on the development of gambling problems is confirmed in this longitudinal analysis, which is consistent with research that has looked at biological-based effects of childhood trauma on a range of adult mental and physical health outcomes.

The results of the multivariate analyses conducted for this report complements the analysis reported in the QLS report. Together, these results are summarized in a tentative etiological model displayed in Figure 13.

Conclusions

The LLLP and QLS provide the most comprehensive longitudinal profile of gambling and problem gambling currently available. This report provides analyses focusing on the stability of gambling and problem gambling and variables etiologically related to change in gambling and problem gambling. The opportunity to conduct parallel analyses across two large data sets is invaluable and the consistency of the findings across studies conducted in two provinces as well as the consistency with previous cross-sectional and longitudinal research is remarkable. In summary, the results identified a number of robust predictors of gambling and problem gambling including both fixed and modifiable factors. Fixed factors include gender, ethnicity, intelligence and arguably income and impulsivity. Modifiable factors include mental and substance use disorders, gambling involvement and proximity. Although some factors predicted both gambling involvement and gambling problems (e.g., gender), some factors were more predictive of only gambling (e.g., excitement-seeking) and others more predictive of only gambling problems (e.g., mental health problems). Taken together these findings provide a solid basis for designing prevention and intervention programs.

The results also shed light on the question of stability of gambling problems. At a broad population level, there is considerable stability in people's overall involvement in gambling and problems they experience. However, at the individual level, there is a considerable amount of transition. These findings underscore the importance of looking at gambling problems at both the population and individual levels. Investigations at the population level inform the creation of focused interventions aimed at reducing overall gambling problems. Investigations concerning how individuals experience change in their gambling habits over time, and the characteristics that lead to such change, can inform interventions targeted at helping people make smooth and long term transitions away from problematic gambling.

INTRODUCTION

There has been a dramatic worldwide expansion of legalized gambling since the late 1980s. The overall social and economic costs and benefits of this expansion are mixed (Williams, Rehm & Stevens, 2011). However, what is clear is that one of the primary negative impacts of widely available gambling opportunities is the development of problem gambling in a minority of people. Various terms have been used to describe disordered gambling, including 'compulsive gambling', 'addictive gambling', 'problem gambling', 'pathological gambling' and most recently 'disordered gambling'. The term used in the present document is '**problem gambling'**. The definition of problem gambling put forward by Neal, Delfabbro, and O'Neil (2005) captures the essential elements of this phenomenon common to almost all definitions: *"Problem Gambling is characterized by difficulties in limiting money and/or time spent on gambling which leads to adverse consequences for the gambler, others, or for the community."* Essentially, a problem gambler is someone with a pattern of excessive gambling; impaired control over their gambling behaviour; significant negative consequences deriving from this impaired control; and persistence in the activity despite these negative consequences. Problem gambling is assumed to have varying degrees of severity, ranging from mild, to moderate, to severe. The term 'pathological gambling' is synonymous with the most severe forms of problem gambling.

A considerable amount of effort is currently being put into the development of strategies to prevent problem gambling. Unfortunately, it is fair to say that the majority of these initiatives have been ineffectual (Williams, West & Simpson, 2012). This situation is partly due to the fact that most of these educational and policy initiatives have been put in place by government and industry because they 'seemed like good ideas' and/or were being used in other jurisdictions, rather than having demonstrated scientific efficacy, or being derived from a good understanding of effective prevention practices. However, it is also due to the fact that there is no comprehensive and well established etiological model of problem gambling to guide these efforts. Knowing how and where to effectively intervene hinges on having research that clearly identifies the variables that are etiologically involved in problem gambling, their temporal sequence, and causal connections. This is accomplished through longitudinal cohort studies, which is the focus of the present investigation.

The Leisure, Lifestyle, Lifecycle Project (LLLP) is the largest investigator-led research project funded by the Alberta Gambling Research Institute (AGRI). It is also the first longitudinal investigation of recreational and problem gambling funded by AGRI. When the study was conceived, there was relatively little empirical data on the progression of gambling habits across multiple time points. Much of the knowledge on the risk factors for problem gambling has been derived from cross-sectional and retrospective studies of individuals already identified as problem gamblers. However, prevention and early identification of problem gambling efforts will be better informed by a scientifically rigorous longitudinal study examining the natural progression of gambling in the general population. Since the LLLP started, other large scale longitudinal studies of gambling have emerged (Billi, Stone, Marden & Yeung, 2014; Romild, Volberg & Abbott, 2014). Some have reached a similar state of closure as the LLLP and others are still collecting data.

Conceptual Models Used in Longitudinal Studies of Gambling

The conceptual frameworks that guide most longitudinal studies for problem gambling are eclectic. This is mainly due to the paucity of theories addressing the etiology of problem gambling. In fact, most longitudinal studies are largely atheoretical or hypothesis generating. Such studies have provided the means to advance theories of etiology rather than confirm existing theories.

In addition, longitudinal studies typically attempt to answer several research questions about etiology, trajectories, and the long-term consequences of problem gambling. Two broad categories of questions concerning problem gambling have interested researchers in the field (Barnes, Welte, Hoffman, & Dintcheff, 2002): what are the major causal influences on the development of problem gambling? and what are the trajectories of recreational and problem gambling behaviour? Within each question category, there is typically one or more implicit theoretical frameworks guiding the specific methods employed and research questions asked.

Causal Influences on the Development of Problem Gambling

Cross-sectional studies have identified many correlates of problem gambling, but because correlation does not equal causation, longitudinal research is used to identify and clarify the true temporal sequence of events. The key risk factors for problem gambling have been summarized in three comprehensive reviews (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009a; Raylu & Oei, 2002; Toneatto & Nguyen, 2007). The bulk of cross-sectional and retrospective research has focused on individual characteristics that place people at an elevated risk for developing a gambling problem. For example, male gender, younger age, ethnic minority status, and psychiatric comorbidity are commonly cited risk factors for problem gambling. Also relevant are environmental risk factors such as proximity to gambling venues and certain game characteristics such as high speed of play. Risk factors are not mutually exclusive; the combination of influences is what determines whether a specific individual develops a gambling problem. For example, impulsive, sensation-seeking males would be at elevated risk to develop a gambling problem when living in an environment with access to electronic gaming machines, whereas males with the same psychological profile living in an environment where access to such games is limited are less likely to develop a gambling problem.

Theoretical models of causality implicitly guide most longitudinal studies; however, the specific theory being tested is often not clearly articulated or identified. Winters and colleagues (1995) have been following a cohort of individuals from adolescence to young adulthood in Minnesota. One of their hypotheses was that the risk factors for problem gambling are not dissimilar from the risk factors for other addictive behaviours (Winters, Stinchfield, Botzet, & Anderson, 2002). Shared risk factors include male gender, history of parental involvement in the addictive behaviour, personal involvement in other addictive behaviours, poor academic achievement, and antisocial behaviours. Similarly, reaching the legal age to gamble coincides with an increase in gambling and parallels the increase in youth drinking observed when adolescents reach the

legal age to drink. Jacobs and colleagues (1989) were the first researchers to suggest that adolescent gambling would increase as laws changed and more forms of gambling became legal.

Certain personality traits have also been identified as risk factors for addictive behaviours. For example, Slutske and colleagues (2005) found that negative emotionality at an early age is predictive of problem gambling. Negative emotionality is also predictive of problem drinking and drug use; furthermore, Vitaro and colleagues (2004) found that both self-rated and teacher-rated impulsivity predict a progression to problematic gambling behaviours in adolescent boys.

Trajectories of Gambling and Problem Gambling

The other category of questions that longitudinal studies attempt to answer relates to the natural progression of gambling behaviour in various age cohorts. Specific questions posed by researchers include:

1. Does early onset of non-problem gambling behaviour predict the later development of at-risk or problem gambling behaviour?
2. What is the progression of gambling behaviour from adolescence to young adulthood?
3. Do distinct gambling trajectories exist in cohorts when defined by age and sex?
4. What is the natural course of problem gamblers over time?
5. What is the overall temporal stability of gambling and problem gambling behaviour?
6. How do changes in laws, policies, and the availability of gambling influence the course of both non-problem and problem gambling behaviours?

Some longitudinal studies have also estimated the incidence and prevalence of problem gambling in the population over time. The estimates produced are difficult to generalize to the entire population because of the relatively small sample sizes used in longitudinal studies and the non-random nature of many samples (e.g., males, students, or twins only).

Similar to questions about causal influences, the specific theoretical model of the natural progression of problem gambling is often not clearly stated. Slutske (2006) provided an excellent overview of the theoretical underpinnings of studies on the natural trajectories of problem gambling. Some widely held assumptions about the progression of problem gambling as tested in longitudinal research are:

1. Youth who start gambling at an early age are more likely to become problem gamblers.
2. Problem gambling is preceded by at-risk gambling and at-risk gambling is preceded by low-risk or non-problem gambling (i.e., the notion that problem gambling develops in a predictable sequence).
3. The progression to high-risk games, like electronic gaming machines (EGM) and casinos, is preceded by involvement in low risk games (i.e., the notion that playing the lottery may be a “gateway” activity to more severe gambling).

Based on the literature there is reasonable support for assumptions two and three. Problem gambling is typically preceded by at-risk gambling although the time of progression is highly variable across individuals. There is some support for the notion of a "gateway" to problem gambling, but it may not be a specific game type. The youth studies of Winters and colleagues (1995) revealed that early participation in any legal form of gambling, including lottery play, leads to later problem gambling. Recent research suggests that certain symptoms, feelings of guilt, and chasing losses for example, may be relatively early warning signs of problem gambling (Miller, Currie, Hodgins, & Casey, 2013).

Support for the first assumption that early onset of gambling leads to later problem gambling is mixed. Winters and colleagues (2002) found that early gambling involvement predicted later at-risk gambling, but not problem gambling. Vitaro and colleagues (2004) sought to identify specific groups of adolescents within the same age cohort who could be differentiated on the basis of their trajectory of gambling. The authors concluded that not all adolescents who gambled at an early age (age 11) were at risk for problem gambling. They identified a distinct group of boys who were distinguishable from other children on measures of impulsiveness, risk-taking, and anxiety and for whom early onset of gambling behaviour was predictive of later problem gambling. They identified another group with a similar psychological profile, but this group showed a later onset of gambling (age 13 or later). The psychological features of these groups were a stronger predictor of later problem gambling than age of onset of gambling.

An important limitation of longitudinal studies is the control researchers have over studying the "natural" aspects of problem gambling behaviour over time. Longitudinal studies are challenged to account for the influence of prevention initiatives and treatment availability, both of which can vary over time. For example, during the period of the LLLP data collection the province of Alberta stepped up its prevention efforts for problem gambling (see Appendix A for a detailed background on gambling in Alberta during the LLLP study time period). Electronic gaming machines (EGMs) were equipped with new features designed to limit playing time and information centres on problem gambling were put into most casinos. Sometimes a significant change in the gambling environment, such as the building of a new casino or legalization of a previously illicit form of gambling, can work to the researcher's advantage by creating opportunity for natural experiments in the field. Assuming other external influences on gambling remain stable, and the period of assessment is kept short to avoid maturation effects, it is possible to measure the impact of such an environmental change at a population level.

Summary of Findings from the Longitudinal Studies on Gambling

Longitudinal studies of gambling behaviour fall into two broad categories: studies specifically designed to identify the risk factors and natural course of problem gambling ('purpose-built' longitudinal studies); and studies that follow a cohort of individuals to examine the risk factors and course of multiple mental health concerns including problem gambling as one of their measures of interest ('all-purpose' longitudinal studies). Findings from purpose-built studies provide the most compelling evidence of risk factors and trajectories of gambling because the sampling methods, measures, and analyses are specifically tailored to gambling.

Notwithstanding, studies in each category have produced important findings on risk factors common to the etiology of problem gambling and other addictive behaviours.

A systematic review of the literature revealed 27 peer-reviewed longitudinal studies of gambling, where 21 contained analyses of at least one predictor of gambling behaviour. The remaining studies collected data on gambling, but not as a dependent variable. In the 21 relevant studies, researchers investigated predictors of problem gambling, change in gambling behaviour over time, and remission of problem gambling (see Table 1 for a detailed listing of all the longitudinal studies in gambling listed in order of chronology). Studies which investigated predictors of problem gambling are labelled 'subsequent predictors' in Table 1. These studies assessed gambling data in a time period subsequent to the time of data collection of measures of social, psychological, or biological factors hypothesized to be related to gambling behaviour. Studies investigating subsequent predictors are differentiated from those investigating correlates of gambling behaviour, which measure gambling behaviour and social, psychological, or biological factors in the same wave of data collection. The method of analysis known as 'trajectories' refers to studies which included an analysis of individuals' change in gambling behaviour and level of problem gambling severity over time.

Predictors of Change in Gambling Behaviour

A number of studies have examined the impact of psychosocial variables on subsequent gambling, including the impact of recent and past gambling behaviour, reaching legal age to gamble, substance use, psychological and social factors, and proximity to gambling venues on problem gambling development. LaBrie and colleagues (2008) tracked the gambling behaviour of users of an Internet gambling site. Results showed that the majority of people quickly reduced their gambling participation after joining the site, possibly because the novelty of Internet gambling had diminished within a short time or because people were joining simply to collect the bonus money allocated to new players (LaPlante et al., 2008). There were, however, heavily involved gamblers who maintained high levels of play. In particular, gamblers involved in live-action betting were more likely to demonstrate sustained and frequent participation. Over time, significant differences emerged between the typical online gambler and heavy online gamblers. Fifty percent of users played once every two weeks, betting an average of 196 Euros each day played. Heavy bettors made up of 5% of the users and played every five days, betting an average of 4700 Euros each day played. The authors suggest that time spent gambling be considered in future investigations of problem gambling.

Past-year gambling may be related to subsequent gambling behaviour. A longitudinal investigation of elders in Pennsylvania asked participants whether they had left home to gamble in the past year. The authors found that past year gambling was predictive of future gambling (Vander Bilt et al., 2004). Similarly, being classified as a problem gambler in the past is a strong predictor of current problem gambling (Abbott, Williams, & Volberg, 2004; Winters et al., 2002).

Delfabbro, Winefield, and Anderson (2009) investigated the gambling patterns of a sample of students transitioning from adolescence to adulthood. Results showed high variability in gambling patterns at the individual level, with only 25% of those who gambled in the first wave continuing to gamble each year. Results also showed that a link between adolescent and adult gambling behaviour differed by game type, with youth preferring games of skill more likely to continue gambling into adulthood. Overall, associations between adolescent and adult gambling behaviour were weak although these associations were stronger between later adolescence and adulthood than early adolescence and adulthood.

Studies have investigated the influence of reaching the legal age to gamble on gambling behaviour. Winters, Stinchfield, and Kim (1995) examined the impact of a new state lottery and reaching the legal age to gamble and found that overall rates of gambling (including involvement and problem gambling status) did not change, but lottery and casino machine preference increased, while informal gambling such as personal bets decreased. A study of college students in Missouri also found that participants tended to shift from informal gambling to slots and casino gambling upon reaching the legal age to gamble (Goudriaan, Grekin, & Sher, 2007).

Substance use may also be a predictor of gambling behaviour. In the study of elders in Pennsylvania discussed earlier, researchers found past-year alcohol use predicted future gambling (Vander Bilt et al., 2004). In a study of youth living in New York, researchers found that after controlling for other socioeconomic and demographic variables, alcohol misuse in males predicted high or increasing rates of gambling (Barnes et al., 2002). For females, alcohol misuse predicted increasing gambling rates only when combined with other factors including impulsivity or low parental monitoring.

Psychosocial factors may be important in predicting change in gambling behaviour over time. Vitaro, Ladouceur, and Bujold (1996) found that, compared to non-gamblers, 13 year old gamblers had lower teacher ratings of anxiety and withdrawal at ages 10 and 11. In another study of youth, teacher-rated impulsivity in kindergarten was related to involvement in gambling in sixth grade, even after accounting for confounding factors including parental gambling (Pagani, Derevensky, & Japel 2009). In a study of first-year students at a large mid-western American university, Cyders and Smith (2008) assessed the relationships between gambling behaviour and lack of planning, lack of perseverance, negative urgency, positive urgency, and sensation-seeking. They found that only positive urgency predicted increased gambling behaviour, although other measures of rash action had concurrent relationships.

Jacques, Ladouceur, and Ferland (2000) investigated the relationship between gambling behaviour and proximity to gambling venues. A random sample of residents in an area where a casino was planned to open were compared to residents in an area that had no casino opening during the study. One year after the initial sample (and 11 months after the casino opening), the group near the new casino showed a significant increase in casino gambling, maximum amount of money lost gambling in one day, and reports of knowing a person who developed a gambling problem in the past year (Jacques et al., 2000). Most trends were not maintained at

follow-up two and four years after the initial sample, although reluctance to see a new casino open remained stable over time (Jacques & Ladouceur, 2006).

Bio-psychosocial Predictors of Problem Gambling

Whereas the above section reviewed research identifying predictors of gambling behaviour, this section reviews predictors of gambling problems. The most potent predictors of problem gambling are male gender; particular type of gambling (e.g., electronic gambling machines); and psychosocial factors such as, substance use, and childhood and parental influence (Winters et al., 1995; Winters et al., 2002). These risk factors are consistent with findings from cross-sectional and retrospective studies of gamblers. Younger age, a risk factor identified in most cross-sectional studies, has not emerged as a robust predictor of future problem gambling in longitudinal gambling research. Slutske (2006) reviewed the complex relationship between age and problem gambling prevalence found in longitudinal studies and concluded the previous cross-sectional findings were heavily influenced by cohort effects. In two US-based longitudinal studies (National Gambling Impact Study Commission, 1999; Grant et al., 2004) the prevalence of problem gambling showed no significant variation in participants followed from adolescence to young adulthood. Slutske (2006) concluded that other risk factors (e.g., personality traits, extent of gambling involvement) are stronger predictors than developmental changes. However, the knowledge base related to age as an influence is still limited by: the relatively short period of time participants are followed in longitudinal research; the small number of cohort participants across all age groups in studies (particularly persons over 30 years old); and the low prevalence of pathological gambling when defined using the DSM-IV criteria (American Psychiatric Association, 2000).

Extent of gambling behaviour is an important predictor of problem gambling. Using in-vivo data from an Internet gambling site, Braverman and Shaffer (2012) applied cluster analysis to identify high-risk online gamblers. Playing characteristics associated with high-risk gamblers included frequent and intensive betting combined with variable and increasing bet size. In the same sample, LaBrie and Shaffer (2011) modeled betting behaviour of gamblers who closed their account due to gambling-related problems (73% of high-risk gamblers) compared to those who cited other reasons. Those who cited gambling-related problems tended to bet larger dollar amounts more frequently and bet more intensely shortly after joining the site (LaBrie & Shaffer, 2011).

Table 1: Longitudinal Studies of Gambling

Study	Time span (years)	No. of Times	Age category	Gender	Sample Size	Recruitment technique	Data gathering technique	Retention	Method of analysis	Country	Gambling measures	Primary outcome constructs
Winters (1995; 2002; 2005)	8	3	W1: 15-18 W3: 22-25	Males & Females	W1: 702 W3: 305	RDD	Telephone interview	W2: 75.8% W3: U	Subsequent predictors Correlates Trajectories	U.S.A.	SOGS-RA & SOGS Parental gambling	Gambling
Vitaro (1996)	3	3	10-13	Males	441	Recruited from schools	Self-reports administered in groups	U	Subsequent predictors Correlates	Canada	Gambling Involvement (Frequency, Type)	Gambling
Montreal Longitudinal & Experimental Study: **Dussault (2011)** **Vitaro (1997; 1999; 2001; 2004)** **Wanner (2006; 2009)**	12	10	11-16 16-23	Males	W1: 1034, 1037, 1161, 1162 Age 23: 502	87% of kindergarten boys in 53 schools	Face-to-face interview	Age 11-16: 903/1037 = 87.1% Age 16/17: 717/1034 = 69.3% Age 23: 502/1034 = 48.4% Dussault (valid data on at least 1 measure): 1004/1162 = 86.4%	Subsequent predictors Correlates Trajectories	Canada	SOGS-RA & SOGS	Antisocial behaviour development
New Zealand Gaming Survey: **Abbott (1999; 2004)**	7	3	18+	Males & Females	1999-1: 4053 1999-2: 217 1998: 143	RDD	Telephone & Face-to-face interviews	U	Subsequent predictors Trajectories	New Zealand	SOGS-R	Gambling
Barnes (1999; 2002; 2005)	7	6	W1: 13-16 W6: 18-22	Males & Females	Sample 1: W1: 699 W5:522 W5/6: 488 Sample 2: W1: 625 W3: 565	RDD	Face-to-face interview	Sample 1: W3:92% W5/6: 69.8% Sample 2: 90.4%	Subsequent predictors Correlates Trajectories	U.S.A.	Gambling Involvement (Frequency, Type)	Alcohol

Study	Time span (years)	No. of Times	Age category	Gender	Sample Size	Recruitment technique	Data gathering technique	Retention	Method of analysis	Country	Gambling measures	Primary outcome constructs
Jacques (2000; 2006)	5	4	18+	Male & Female	Sample 1: W1:810 W2:457 Sample 2: W1:798 W2: 423	RDD	Telephone interview	Sample 1: W2: 56.4% W3: 42.5% W4: 25.1% Sample 2: W2: 53.0% W3: 42.4% W4: 28.4%	Subsequent predictors	Canada	SOGS French Version	Gambling
Shaffer (2002)	2	3	W1: M=37.40	Males & Females	6067	Volunteer workers from 6 casinos	Self-report questionnaire	All waves 19.4%	Subsequent predictors Correlates Trajectories	U.S.A.	SOGS	Gambling
Slutske (2003a)	11	4	W1: 18-19 W4: 28-29	Males & Females	468	Freshmen with a relative with alcoholism history	Telephone **or** Face-to-face interviews	W4: 96.8% W5: 93.6% W6: 84.0%	Trajectories	U.S.A.	DSM-III & DSM-IIIR/IV	Alcohol
Wiebe (2003a; 2003b; 2001)	1	2	18+	Males & Females	448	Stratified random sample	Telephone interview	U	Subsequent predictors Correlates Trajectories	Canada	CPGI	Gambling
DeFuentes-Merillas (2004)	2	2	18+	Males & Females	201	Sample of scratch card buyers	Structured interviews & self-report questionnaire	75.6%	Prevalence Incidence	The Nether-lands	SOGS	Gambling
Hodgins (2004a)	1	4 or weekly contact	19+	Males & Females	101	Volunteer participants	Face-to-face & telephone interviews	4-wave participants: W2: 71.3% W3: 70.3% W4: 79.2%	Subsequent predictors	Canada	SOGS	Gambling
Vander Bilt (2004)	15	6	W1: 65+ W4: 71-97	Males & Females	W1: 1681 W4: 1016	Random & Volunteer participants	Unknown	U	Subsequent predictors Correlates	U.S.A.	Whether participants left home to gamble	Mobility of elders
Dunedin Multi-disciplinary Health & Development Survey: Slutske (2005)	29	4	W1:3 W2 18 W3: 21 W4 32	Males & Females	W1: 1037	Births in Dunedin between Apr 1, 1972 & Mar 31, 1973	Face-to-face interview	W2: 90.5% W3: 90.5% W4: 92.5%	Subsequent predictors	New Zealand	Modified SOGS	Health and Behaviour of a complete birth cohort

Study	Time span (years)	No. of Times	Age category	Gender	Sample Size	Recruitment technique	Data gathering technique	Retention	Method of analysis	Country	Gambling measures	Primary outcome constructs
National Epidemiologic Survey on Alcohol & Related Conditions (NESARC): Desai (2007)	3	2	40+	Male & Female	25,485	Random sampling using the Census 2000/2001 Supplement Survey	Self-report questionnaire	U	Correlates	U.S.A.	Gambling Problem Severity	Alcohol
Braverman & Shaffer (2012); LaBrie (2007; 2008; 2011); LaPlante (2008; 2009); Nelson (2008); Xuan (2009)	2	Daily data	18+	Male & Female	47,603	Individuals opened account - Internet betting service provider between Feb. 1 to 27, 2005	In vivo data and web-based survey	N/A (in vivo data)	Internet gambling behaviour over time	Data collected in 85 countries Study based in U.S.A.	Fixed-odds betting & Live-action betting, Gambling involvement (frequency & activities)	Gambling
Vietnam Era Twin Registry: Scherrer (2007) Xian (2007)	11	2	W1 M=43	Male	1675	Twins born between 1939-1955 – both served active military duty	Telephone interview	U	Subsequent predictors	U.S.A.	DSM-III-R	Long-term health effects of service in Vietnam
Cyders (2008)	1	3	18-32	Male & Female	418	First-year students at a large mid-western university	Self-report questionnaire	293/418 = 79% after W3	Subsequent predictors Correlates	U.S.A.	Gambling behaviour	Gambling
Leisure, Lifestyle, Lifecycle Project el-Guebaly (2008)	5	4	W1 13-15, 18-20, 23-25, 43-45, & 63-65	Male & Female	W1: 1808 W2: 1495 W3: 1316 W4: 1343	RDD	Telephone & Face-to-face interviews	W4: 75.1% Adolescents: 72.0% Adults: 76.1%	Subsequent predictors Correlates	Canada	CPGI, CIDI Fisher DSM-IV-MR-J Attitudes & Fallacies	Gambling
Johns Hopkins Center for Prevention & Early Intervention Cohort 3: Lee (2011) Martins (2008)	14	14	Childhood to late adolescence	Male & Female	Lee 618 Martins 452	Recruited from 9 urban primary schools in Baltimore	Self-report questionnaires and teacher/ parent ratings	2004, 2006 or 2007 Follow-up 92% 2004 Follow-up 76%	Subsequent predictors Correlates	U.S.A.	SOGS-RA	Academic achievement & aggression
Delfabbro (2009)	4	4	15-19	Male & Female	578	Students in Year 10 at 25 schools in South Australia	Self-report questionnaires	After W4: 46.6%	Subsequent predictors Trajectories	Australia	Gambling participation (frequency & activities)	Youth – demographics psychological well-being & behaviours

Study	Time span (years)	No. of Times	Age category	Gender	Sample Size	Recruitment technique	Data gathering technique	Retention	Method of analysis	Country	Gambling measures	Primary outcome constructs
Intensive Multivariate Prospective Alcohol College Transitions Study (IMPACTS 2009): Goudriaan (2008; 2009)	4	8	W1: 17.5 – 19.5	Male & Female	3720 Gambling data: 3073	Participants from a longitudinal study of college student health	Self-report questionnaire	After W4: 73.2%	Subsequent predictors Correlates Trajectories	U.S.A.	Gambling involvement Self-identified problem gambling Iowa Gambling Task (IGT)	Alcohol
Montreal Longitudinal Preschool Study in Canada – 1999 cohort: Pagani (2009)	6	2	W1: M=5.5	Male	163	1999 Kindergarten cohort of Montreal Longitudinal Preschool Study in Canada	Self-report questionnaires & teacher ratings	U	Subsequent Predictors	Canada	Gambling participation (frequency & activities)	
The Australian Twin Study of Gambling (OZ-GAM; 2009): Slutske (2009)	7.8	2	32-43	Male & Female	4,764	Recruited from the Australian Twin Registry Cohort II (ATR)	Structured telephone interview & mailed self-report questionnaire	U	Prevalence	Australia	NODS, SOGS, Gambling participation (frequency, activities, expenditure, quantity)	Gambling
National Longitudinal Study of Adolescent Health: Beaver (2010) Fiegelman (2006)	7	3	Adolescent	Male & Female	Beaver 602 twin sets Feigel-man 13,298 (298 gamblers)	Participants from a longitudinal study of adolescent health	In-home surveys with computer-assisted software for privacy	Full sample: After W3: 15197/20745 = 73.3%	Subsequent predictors	U.S.A	Problem gambling questions, gambling participation (activities)	Adolescent physical and mental health
Gambling follow-up of the Detroit City-Wide Needs Assessment of Older Adults: Martin (2011)	2	2	60+	Male & Female	247	Urban elders who had participated in a city-wide survey; oversampled those who answered that they had gone to a casino "monthly or more"	Self-report questionnaire	U	Correlates	U.S.A.	Gambling participation (frequency), attitudes, reasons for gambling	Gambling

Study	Time span (years)	No. of Times	Age category	Gender	Sample Size	Recruitment technique	Data gathering technique	Retention	Method of analysis	Country	Gambling measures	Primary outcome constructs
Wohl (2011)	1	2	17-46 M = 19.94	Male & Female	379	University students screened for gambling problems; oversampled those reporting at least one gambling problems	Self-report questionnaire	26.1%	Correlates	Canada	DSM-IV, stage of change of gambling behaviour	Gambling
Problem Gambling - Pacific Islands Families Longitudinal Study: Abbott (2012)	11+	7+	Birth – Age 11 and their parents	Male & Female		Recruited at birth if at least one parent was a NZ Permanent Resident of Pacific ethnicity	Structured interviews		Subsequent predictors	New Zealand	Parents: Gambling participation PGSI, SOGS-R, Children: participation	Gambling
Victorian Gambling Study: Billi (2014)	3	4	General Population (18+?)	Male & Female	W1: 15000 W2: 5003 W3: 5620 W4: 3700	RDD	Self-report questionnaires	U	Subsequent predictors Incidence Trajectories	Australia	PGSI, NODS-Clip2, Gambling Readiness to Change	Gambling
Quebec Gambling Study: Kairouz (2012)	3	4	General Population (18+?)	Male & Female	W1: 11,888 W2: 179 W3: 184 W4: 137	Population Survey + request for follow-up		U	Subsequent predictors Trajectories	Canada	Gambling patterns, PGSI, use of gambling help services	Gambling
Swedish Longitudinal Gambling Study (SWELOGS): Romild (2014)	7	7	W1: 16-84 W2: 17-85	Male & Female	W1: ~8,200 W2: 6,021	National register of total population; Sample stratifijcation based on age, gender and likelihood of having gambling problems	Telephone interviews and questionnaires		Prevalence Incidence Trajectories Correlates (peer-reviewed)	Sweden	SOGS, PGSI, FORS	Gambling

Study	Time span (years)	No. of Times	Age category	Gender	Sample Size	Recruitment technique	Data gathering technique	Retention	Method of analysis	Country	Gambling measures	Primary outcome constructs
National Longitudinal Study of Gambling Behaviour (NLSGB 2012): Ross (2013)	15 month	6	M = 38.2	Males and Females	W1: 298 W2: 291 W3: 281 W4: 270 W5: 258 W6: 248	National Urban Prevalence Study of Gambling Behaviour 3000 participants randomly selected from the 4 major metropolitan areas) plus newspaper ad recruitment	In-person surveys, Diary intervention: weekly telephone interviews	83.2%	Correlates Trajectories	South Africa	PGSI, Gambling participation (activities, expenditure)	Gambling

Note: U indicates retention rate is unknown. Retention rate refers to the number of completed interviews divided by the number of eligible interviews, although individual studies have complied with this standard to varying degrees (for detailed information see CASRO, 1982; AAPOR, 2011; Williams & Volberg, 2012).

Some studies found prior at-risk gambling, prior problem gambling, and early onset gambling to be associated with subsequent at-risk or problem gambling (Abbott et al., 2004; Abbott & Volberg, 1991; Scherrer et al., 2007; Wiebe et al., 2003a; Winters et al., 2002). In contrast, Wanner and colleagues (2009) found that although adolescent gambling problems were related to gambling participation in young adulthood, gambling participation in adolescence did not predict gambling problems in young adulthood.

Game preference is another predictor of subsequent gambling problems. Abbott et al. (1999; 2004) found that a preference for racetrack betting in 1991 was one of the strongest predictors of problem gambling in 1998 for New Zealand adults. A study of children attending urban schools in Baltimore (Martins, Storr, Ialongo, & Chilcoat, 2008), a comparison of males and females found that male gamblers preferred strategic games, gambled more frequently and had more gambling-related problems than female gamblers. LaBrie and colleagues (2007) followed gambling behaviour on an Internet betting service provider and found that the sample had moderate levels of gambling involvement, suggesting that Internet gambling does not necessarily encourage high involvement in gambling.

Two recent studies have found EGM play to be associated with subsequent problem gambling (Billi et al., 2014; Romild et al., 2014). These studies validate mounting cross-sectional and descriptive evidence over the past two decades, thus implicating electronic gambling machines (EGMs) as being a dangerous gambling format for frequent players (Doughney, 2007; Smith & Campbell, 2007; Thomas, Sullivan, & Allen, 2009). The empirical substantiation of the association between frequent EGM play and an elevated risk for becoming a problem gambler is largely uncontested by academics, but downplayed by government policy makers, machine manufacturers, and the gambling industry as a whole (Livingstone & Woolley, 2007; Borrell, 2006). The case against frequent and intense EGM play has found its most robust expression in Dow Schull's (2012) comprehensive work *Addiction by Design.* Following nearly two decades of investigation that encompassed observations of and interviews with EGM addicts, discussions with EGM designers and manufacturers, dialogue with addiction therapists, and exchanges with gambling industry executives, Dow Schull (2012) concluded that:

> Machine gambling is a potentially inexhaustible activity whose only sure end is the depletion of gambler funds. The operational logic of the machine is programmed in such a way as to keep the gambler seated until that end—the point of "extinction," as some gaming executives call it—is reached (180).

Dow Schull's thesis is that purveyors of machine gambling aim to keep players on the devices for as long as possible, knowing that the longer one plays the higher the probability of losing (58). Addicted gamblers, known to be unhappy with their life circumstances, play EGMs not so much to win, but to numb themselves; in essence, to forget (at least for a while) the day-to-day troubles they face. EGM addicts seeking to continue in this state of numbness, typically play until the venue closes or their funds are exhausted.

An oft-cited study of Australian EGM players (Dickerson, Haw, & Shepherd, 2003) determined that even regular players lose control over spending and frequency of venue visits and this is highly correlated with number of hours a week spent playing EGMs. Despite the fact that most participants used active and planned strategies to control their EGM play, about half reported still losing control on some occasions. This finding led Dickerson et al. (2003) to conclude that impaired control and subsequent problem development are "natural consequences" of regular high-frequency machine gambling involvement, and not just the behavior of a small minority of addicted gamblers. In support of the regular EGM play leads to gambling problems thesis is a survey of frequent (at least once a week) slot players in Ontario. Problem Gambling Severity Index (PGSI) scores from a sample of 849 participants showed 39% to be at low risk for gambling problems, 38.9% were at moderate risk, and 22.1% qualified as being at high risk (MacLaren, Harrigan, & Dixon, 2012). In other words, every participant in the survey had some degree of risk for problem gambling.

Regular EGM play increases the likelihood of harm in the form of health, emotional, and financial problems; and at higher frequencies of play, EGM gambling is no longer considered a 'safe' product (Australian Productivity Commission, 2010). The Australian Medical Association (2013) took a similar position on EGM gambling; calling it the most harmful gambling offering, one that accounts for between 70 and 80 per cent of problem gamblers.

Longitudinal studies of gambling have examined a range of other social and psychological factors in relation to problem gambling. For example, lower education was associated with increasing gambling problems in a study by Scherrer and colleagues (2007). In a multidisciplinary study from New Zealand, Slutske and colleagues (2012) found that under-controlled temperament at age 3 was associated with problem gambling at ages 21 and 32 even after considering childhood IQ and socioeconomic status. In the Baltimore child study discussed earlier, both male and female adolescent gamblers had higher levels of impulsivity and hyperactivity in childhood as compared to the overall sample (Martins et al., 2008). Male adolescent gamblers were more likely to have high teacher-rated externalizing behaviours in childhood in comparison to female adolescent gamblers, whereas female adolescent gamblers were more likely to report anxious and depressive feelings (Martins et al., 2008).

The relationship between impulsivity, depressive symptoms, other mental health disorders, and gambling problems remains unclear. Lee, Storr, Ialongo, and Martins (2011) found no association between impulsivity in early adolescence and problem gambling in late adolescence, although there was a small association between early adolescent depressive symptoms and problem gambling in late adolescence. Vitaro and Areseneault (1999) found a relationship between impulsivity during early adolescence and gambling status in late adolescence after controlling for other predictors of gambling behaviour including early gambling behaviour, socio-demographic variables, aggressiveness, and anxiety. Dussault and colleagues (2011) found impulsivity at age 14 to be related to both depressive symptoms and gambling problems at age 17. The same study also found gambling problems at age 17 related to increased depressive symptoms at age 23 and depressive symptoms at age 17 related to increased gambling at age

23. The authors suggest that while impulsivity precedes gambling problems and depressive symptoms, symptoms of the two disorders may escalate due to mutual influence.

Wiebe and colleagues (2003a) investigated the relationships between problem gambling and social and psychological factors such as depression, distress, loneliness, life events, and low social support. Loneliness, distress, and low social support were all related to increased problem gambling between the first two times of data collection. When examining distress, loneliness, life events, and low social support together, the authors found emotional distress to be the only significant variable in predicting increases in problem gambling. A study of twins who served active military duty found that depression was associated with problem gambling ten years later (Scherrer et al., 2007).

Other psychological factors related to subsequent problem gambling include post-traumatic stress disorder, conduct disorder, and antisocial personality disorder. Contrary to the findings above, Shaffer and Hall (2002) examined casino employees over three years and found that depression and dissatisfaction with one's personal life were related to decreasing problem gambling; although, only 3% of changes in gambling were accounted for by these variables. A study of Internet gambling in Sweden found that mental health and social support measured in 2008 were not related to incidence of problem gambling in 2009 (Svensson & Romild, 2011). The current research demonstrates the complexity of the relationships between social and psychological factors and the development of gambling problems and illustrates the need for further investigation.

The relationship between problem gambling and substance use has been examined in several studies and also reveals mixed results. Winters and colleagues (2002) found substance abuse to be a risk factor for both at-risk and problem gambling. Using random samples in New Zealand, Abbott and colleagues (1999; 2004) found one of the strongest predictors of problem gambling in 1998 was hazardous drinking in 1991. In the study of twins who served active military duty discussed earlier, nicotine dependence and drug dependence were associated with subsequent problem gambling; however, alcohol dependence was not associated with problem gambling (Scherrer et al., 2007). Svensson and Romild (2011) also found alcohol and smoking were not related to the incidence of problem gambling in 2009. Wanner and colleagues (2009) examined cross-lagged links among gambling, substance use, and delinquency from adolescence to age 23 and found adolescent substance use to be unrelated to gambling at age 23. Vitaro and colleagues' (2001) data was consistent with a "general problem behaviour syndrome" rather than mutual influence between gambling, substance use, and delinquency. Although cross sectional relationships among gambling, substance use, and delinquency were strong, longitudinally (ages 16 to 17) these behaviours seem to be influenced more by other risk factors including impulsivity, low parental supervision, and deviant friends.

Winters and colleagues (2002) found risk factors for problem gambling to be similar to those associated with substance abuse and problem behaviour syndrome in adolescence; the risk factors were prior gambling behaviour, male gender, delinquency, substance abuse, early onset, and poorer school performance. Based on results from a longitudinal study in Dunedin, New

Zealand, Slutske and colleagues (2005) also argue that personality traits of problem gamblers are similar to those with other addictive disorders and include higher negative emotionality, lower constraint, higher risk-taking behaviour, and impulsivity.

Wanner and colleagues (2006) conducted a cluster analysis to investigate correlates between teacher-rated personality and self-reported parenting, and antisocial behaviour (including gambling, alcohol, and marijuana use) which resulted in two groups: those with adult problems and those without adult problems. The cluster without adult problems was associated with low involvement or late onset of gambling/alcohol problems; the cluster with 'subsequent adult problems' was associated with early initiation and involvement in problem behaviours (gambling, alcohol, or marijuana). The causes of the relationships between substance use and development of gambling problems remain unclear. Several studies have investigated the links between childhood and parenting and problem gambling later in life. Winters and colleagues (2002) found that poorer school performance and parental history of gambling were related to problem gambling development. Vitaro and colleagues (2001) found that low parental supervision predicted problem gambling among other deviant behaviours.

Stability of Gambling Behaviour and Problem Gambling Over Time

Longitudinal research has shown both gambling behaviour and problem gambling to vary considerably over time (Slutske, 2006). The larger studies conducted in Montreal, Minnesota, and Missouri indicate that gambling behaviour can appear stable in a cohort of individuals at the mean level (i.e., prevalence of any gambling and prevalence of regular gambling); however, there exists moderate individual and intra-individual variation over time. This is particularly evident for problem gambling. The stability (test-retest reliability) of the problem gambling scores for the measures used in the Minnesota and Missouri studies ranged from 0.2 to 0.8 (average = 0.5) with increasingly lower coefficients as the time between testing increased. Moreover, the proportion classified as problem gamblers showed little stability across study cycles. In the Missouri study, only one of eleven individuals identified at the first cycle as a problem gambler was still classified as a problem gambler at the third cycle seven years later. Similar findings were reported in the Minnesota study and New Zealand national prevalence survey (Abbott et al., 1999). A key limitation that impacts these estimates of stability is the low rates of problem gambling found in longitudinal studies to date.

Predictors of remission and problem gambling relapse can also provide insight into the etiology of problem gambling. One study examined predictors of relapse in individuals who had recently quit gambling (Hodgins & el-Guebaly, 2004). Participants tended to think about winning or needing money prior to relapse, with moods equally likely to be positive or negative. In addition, individuals with mood disorders took more time to achieve stable abstinence, while those attending treatment for gambling problems took less time (Hodgins, Peden, & Cassidy, 2005). The authors also found that the age of onset for substance use disorders was earlier than for gambling disorders; however, those with alcohol disorders took less time to achieve stable abstinence from gambling.

Implications for the LLLP

Results from longitudinal studies reveal a consistent set of risk factors that appear to predict future problem gambling. These include male gender, gambling behaviour itself, preference for EGMs, substance abuse, impulsivity, and mental health concerns. There is less consistency regarding the type of mental health problems that make one vulnerable to problem gambling; rather it appears that any emotional health problem (e.g., depression, anxiety, generalized distress) increase one's risk. Another set of factors could be labelled probable risk factors but additional research is needed, these include: other personality traits (hyperactivity and antisocial behaviour in particular), early onset of gambling, parental gambling, and poor school performance. Similar to prior research, the LLLP did not set out to test a specific theory of the etiology of gambling. The LLLP relied on the research conducted prior to its launch for direction on the variables that should be included for longitudinal study, notably early life experience with gambling (personally and within the family context), preference for EGMs, personality, and mental health. The LLLP also included variables that had yet to be tested as predictors including intelligence, genetic profile, and gambling fallacies. Figure 1 displays the conceptual model used to determine the constructs included in the LLLP (el-Guebaly et al., 2008). The broad domains of the model reflect the existing research as well as domains assumed important in biopsychosocial models of substance abuse and mental health disorder etiology. With this exploratory approach the goal was to be as broad as logically feasible.

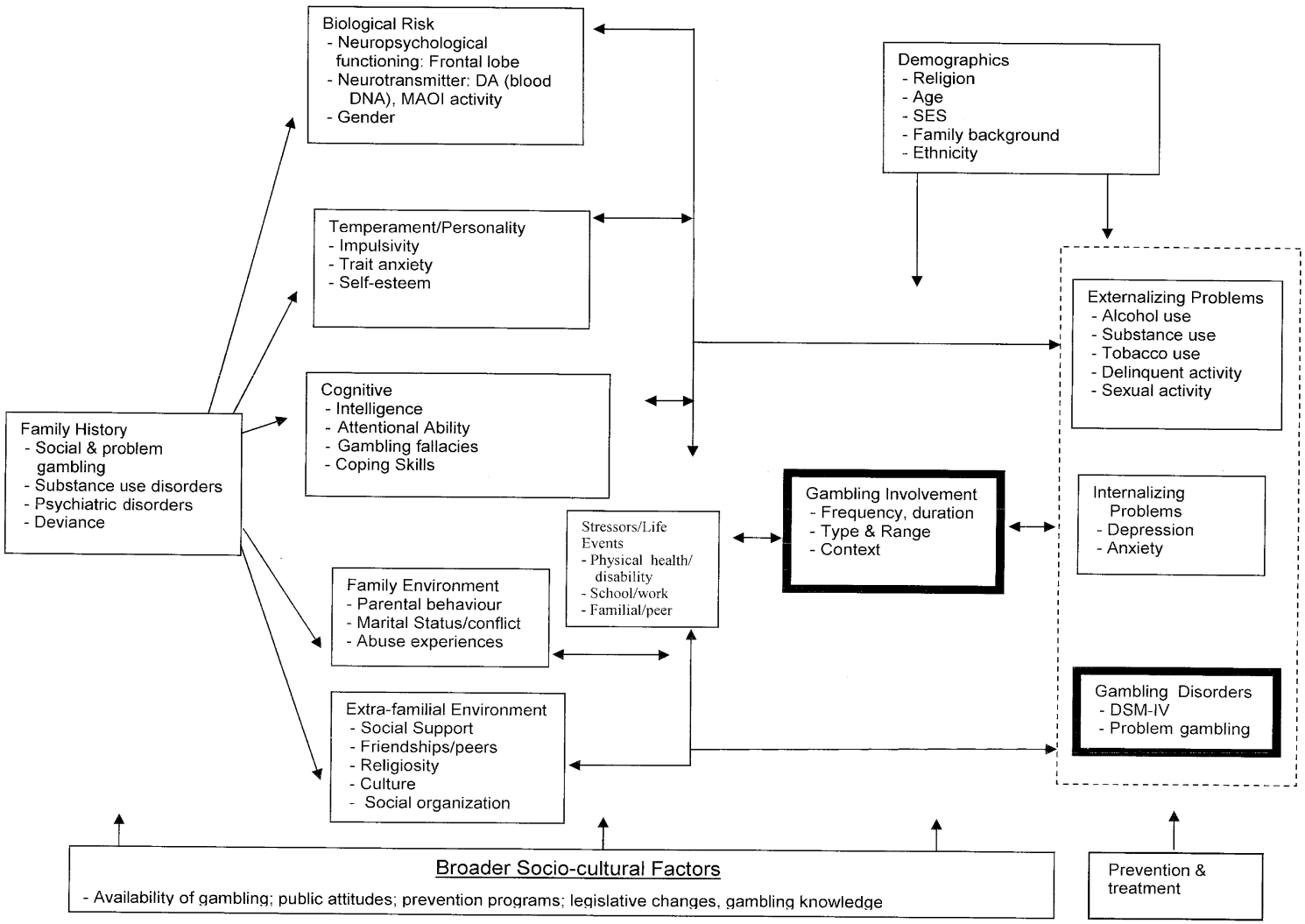


Figure 1: Conceptual Model of the Constructs Included in the LLLP

Objectives of the Current Research

At the launch of the present study in 2006, there were more than 200 studies of gambling prevalence, but few studies of gambling onset and even fewer studies of the determinants and course of gambling and problem gambling. The LLLP was initiated in response to this gap in knowledge.

The LLLP is a 5-year prospective longitudinal study designed to collect data on the factors influencing change in gambling and problem gambling over time. Based on the literature review, it was concluded that a significant contribution to gambling research would be achieved by examining three primary research questions:

1. What are the normal patterns of continuity and discontinuity in gambling and problem gambling behaviour?

2. What biopsychosocial variables and behaviour patterns are most predictive of current and future gambling and problem gambling?

3. What etiological model of problem gambling is best supported by the longitudinal findings?

The present report provides analyses of the adult sample and focuses primarily on the first two research questions. At the end of this report a preliminary etiological model is also presented that emerges from these findings and addresses the third research question. Prior, more circumscribed analyses of the LLLP data set have already been conducted (see Appendix E). Further analyses of the LLLP data set will be undertaken by the current authors in future publications.

METHOD

Type of Design

A longitudinal multiple cohort study was deemed to be the optimal research design to answer the research questions posed. Longitudinal data provide an opportunity to investigate variations over time *within* individuals as well as variations *between* individuals, whereas cross-sectional surveys allow only the study of variations between individuals. One opportunity presented with the use of longitudinal data is the ability to assess changes in individual development by comparing the same participants at different times. Only in this way can age of onset and termination of a problem behaviour, as well as changes in its manifestation, be determined. A second advantage is the capacity to identify mediating and moderating factors by demonstrating changes in one factor that are followed by changes in another. Without examining factors over time, it is not possible to determine the direction of influence. Additionally, longitudinal data allows researchers to study 'escape' from adverse environmental circumstances or events and to evaluate the factors fostering resilience to adversity; and to investigate how far later functioning can be predicted by earlier functioning or events (Verhulst & Koot, 1991; Rutter, 1981). Longitudinal data allows the investigator to determine not only whether one variable is associated with another, but whether it precedes the other in time; a necessary property for establishing causality.

Following different age cohorts simultaneously ('multiple cohort strategy') has several advantages (Farrington, 1991; Bell, 1953). The period of funding is shorter and results can be produced more quickly with less concern for out of date theories, instruments or policy issues. In addition, there are fewer problems ensuring continuity in the research organization. The shorter follow-up period reduces problems with cumulative effects of testing and cumulative attrition. Following-up several cohorts (rather than one) increases confidence in the generalizability of the results. Finally, a longitudinal multiple cohort design has the potential to study aging effects independently of period and cohort effects, but only if there is substantial overlap between the follow-up ages of different cohorts.

In summary, a longitudinal multiple cohort design was the design used for the LLLP. This multiple cohort strategy, with multiple age groups over time, was used to ensure that representative results were obtained. Surveying the same individuals at multiple time points allows the research team to assess changes that occur within individuals over time. Nevertheless, longitudinal data is still subject to the effects of aging (i.e., changes that occur with age) and period effects (i.e., influences from a particular time period) (el-Guebaly et al., 2008). Therefore, assessing different age ranges is necessary to limit the period and aging effects, although cross-sectional designs (following multiple age groups at once) are also faced with cohort effects (el-Guebaly et al., 2008). Cohort effects are differences between individuals that can be accounted for by the age-group they belong to. Accordingly, to obtain the richness of information sought, it was important to use a multiple cohort longitudinal research design that considers all of these factors.

How Information Was Collected

The science of assessing sensitive behaviours such as gambling is a complex undertaking. How the information is collected influences participant response rates, participant retention, and the validity of self-report data (i.e., the initial willingness to participate will be influenced by the perceived inconvenience involved). For example, a lengthy face-to-face interview results in lower response rates than short interviews administrated by telephone. Conversely, a short interview collects less information than a longer one and telephone interviewing does not allow for some types of psychometric testing (e.g., intelligence).

One advantage of face-to-face interviewing is that it may enhance subject engagement, which is an important factor in reducing subsequent attrition (Del Boca & Noll, 2000). At the same time, greater engagement may result in biasing of self-report due to social desirability. Participants' responses to questions are often shaped by their perception of how positively or negatively they think others (particularly the interviewer) are evaluating their behaviour (Del Boca & Noll, 2000). Although 'social desirability bias' is present in all social scientific research, it can be minimized with self-administered (as opposed to researcher administered) data collection techniques. Studies seeking information on sensitive issues report higher response rates and more accurate responses using this method of data collection (Aquilino, 1997; McAllister & Makkai, 1991; Schaeffer, 2000; Supple, Aquilino, & Wright, 1999; Tourangeau & Smith, 1996; van der Zouwen & de Leeuw, 1990). Computerized self-assessment reportedly produces some of the most valid results among adolescents (Supple et al., 1999).

To minimize costs while maximizing validity, the LLLP data were collected using the following techniques: a telephone screening procedure (Wave 1 only); a face-to-face interview (to decrease drop-out; Wave 1 only); computer-based surveys (Wave 1 only); paper-based surveys (small sample of adults at Wave 2, 3, and 4); and Internet-based surveys (Wave 2, 3, and 4). These formats were chosen to maximize completion rates and minimize costs.

Sampling and Recruitment

A five-year prospective study capturing three age groups (adolescents, adults, and seniors) of both genders was employed. In order to assess the development of gambling problems over the lifespan, five critical age ranges were followed: 13-15, 18-20, 23-25, 43-45, and 63-65 year-olds. The reasoning for these particular ages was as follows: the youngest age group, 13-15 year-olds, was chosen at Wave 1 as they are just being introduced to gambling and undergoing developmental changes; the next age group, 18-20 year-olds, are individuals who have just reached the age of majority in Alberta, and thus more likely to engage in frequent gambling; family and leisure activities are life changes that face the third age range (23-25 year-olds); mid-adulthood (43-45) is a time of higher disposable income, when most individuals have addressed many of life's tasks and must educate the next generation about acceptable activities; and finally, the retirement age (63-65) is a population that is often neglected in gambling studies research. In addition, the younger age cohorts allowed a full assessment of the 13-30 age range; a critical period of development while the two older age cohorts allow comparisons of different

age groups. From the cohorts above, it was assumed that a five-year 'real-time' strategy would allow a seamless assessment from age 13 to 30 (the normative years in leisure activity), as well as comparisons with mid-adult and senior groups.

In the LLLP, the primary dependent variables were gambling behaviours and gambling disorders. Gambling behaviours are common in the general population with more than 73% of adult Albertans gambling at least once on an annual basis (Williams, Belanger, & Arthur, 2011). However, the prevalence of gambling disorders is much lower. In 2008–2009 the past year prevalence of problem gambling in Alberta was estimated to be in the 2% to 3% range (Williams et al., 2011). Based upon prior research (Loeber & Farrington, 1994; 1995), our sampling strategy was to over sample individuals who were at-risk of developing gambling problems in the short- or long-term. Essentially, two samples were recruited: a general sample and a sample of individuals who were conceptualized as at-risk gamblers on the basis of relatively heavy gambling involvement. Table 2 presents the demographic information over the four waves of data collection (details outlined in el-Guebaly et al., 2008).

Table 2: Demographic Overview of LLLP Sample by Wave

	Wave 1 (N=1808)		Wave 2 (N=1495)		Wave 3 (N=1316)		Wave 4 (N=1343)	
	n	%	n	%	n	%	n	%
Gender								
Male	837	46.3	664	44.4	563	42.8	574	42.7
Female	971	53.7	831	55.6	753	57.2	769	57.3
Age								
13-15	436	24.1	350	23.4	312	23.7	313	23.3
18-20	315	17.4	245	16.4	198	15.0	204	15.2
23-25	341	18.9	263	17.6	238	18.1	244	18.2
43-45	402	22.2	353	23.6	312	23.7	322	24.0
63-65	314	17.4	284	19.0	256	19.5	260	19.4
Location								
Calgary	754	41.7	652	43.6	565	42.9	574	42.7
Edmonton	536	29.6	455	30.4	402	30.5	410	30.5
Grande Prairie	224	12.4	167	11.2	156	11.9	152	11.3
Lethbridge	294	16.3	221	14.8	193	14.7	207	15.4
Attending School							(N=1341)	
No	1039	57.5	903	60.4	892	67.8	988	73.7
Yes	769	42.5	592	39.6	423	32.2	353	26.3
Employment Status							(N=1340)	
Not Currently Employed	746	41.3	533	35.7	445	33.8	434	32.4
Part-Time	430	23.8	408	27.3	339	25.8	311	23.2
Full-Time	631	34.9	554	37.1	531	40.4	595	44.4

Education							(N=1274)	
< High School	549	30.4	411	27.5	235	17.9	108	8.5
Complete High School	279	15.4	138	9.2	181	13.8	200	15.7
Some Tech/Com College	203	11.2	130	8.7	123	9.4	110	8.6
Complete Com College	225	12.5	258	17.3	219	16.7	249	19.5
Some University	236	13.1	221	14.8	199	14.9	273	21.4
Bachelor's Degree	225	12.5	240	16.1	262	19.9	212	16.6
Professional Degree	90	5.0	97	6.5	98	7.5	122	9.6
Marital Status (Adults Only)							(N=1314[1])	
Single/Never Married	570	41.6	413	36.1	314	31.4	614	46.7
Married	516	37.7	477	41.7	458	45.8	460	35.0
Common-Law	127	9.3	112	9.8	105	10.5	116	8.8
Separated/Divorced	123	9.0	111	9.7	95	9.5	95	7.1
Widowed	33	2.4	32	2.8	29	2.9	29	2.2
Household Income (ADULTS)							(N=1030)	
Less than $20,000	97	7.8	87	7.7	69	6.9	77	7.5
$20,000 TO $29,999	78	6.3	71	6.2	63	6.3	58	5.6
$30,000 TO $39,999	94	7.6	102	9.0	70	7.0	81	7.9
$40,000 TO $49,999	105	8.5	94	8.3	85	8.5	83	8.1
$50,000 TO $59,999	110	8.9	90	7.9	90	9.0	104	10.1
$60,000 TO $69,999	216[2]	17.4	105	9.2	82	8.2	88	8.5
$70,000 TO $79,999	--	--	108	9.5	71	7.1	79	7.7
$80,000 TO $89,999	541[3]	43.6	80	7.0	80	8.0	65	6.3
$90,000 TO $99,999	--	--	62	5.5	72	7.2	67	6.5
More than $100,000	--	--	338	29.7	322	32.2	328	31.8
Household Income (ADOL)[4]							(N=304)	
Less than $20,000	12	.6	6	1.8	5	1.8	19	6.3
$20,000 TO $29,999	8	.4	8	2.3	4	1.4	11	3.6
$30,000 TO $39,999	16	.9	11	3.2	7	2.5	16	5.3
$40,000 TO $49,999	23	1.3	14	4.1	7	2.5	14	4.6
$50,000 TO $59,999	31	1.7	24	7.0	8	2.8	25	8.2
$60,000 TO $69,999	77[2]	4.3	26	7.6	20	7.1	34	11.2
$70,000 TO $79,999	--	--	30	8.8	24	8.5	18	5.9
$80,000 TO $89,999	269[3]	14.9	28	8.2	23	8.2	29	9.5
$90,000 TO $99,999	--	--	28	8.2	19	6.7	16	5.3
More than $100,000	--	--	166	48.7	165	58.5	122	40.1

Note: The sample sizes and proportions displayed in the Wave 2, 3, and 4 columns represent the number from the original Time 1 sample grouping that remain at each time point. Unweighted proportions are displayed.

The original aim was to recruit 200 individuals from each age cohort from a general population (n=1000) and 200 high-risk individuals who scored above the 70th percentile for gambling

[1] Adults and Adolescents

[2] $60,000 to $79,999

[3] $80,000 or greater

[4] Household income for adolescents as provided by parents of the adolescents at Wave 1, 2, & 3; at Wave 4 adolescents provided household income

expenditure and frequency (n=1000) using random digit dialing (RDD). Telephone sampling proved to be an inefficient and costly way to recruit the high-risk sample. Therefore, at Wave 1, four supplemental recruitment techniques were attempted: a media release asking for study volunteers; in cases where gambling venues (casino, bingo hall, or establishment with a VLT machine) agreed, posters were placed to advertise the study; advertisements were placed in local papers to facilitate recruitment; and a "snowball" e-mail was sent to individuals who had already participated in the study asking them to tell their friends about the study. Ultimately, only 33 of the total 1808 participants at Wave 1 were recruited using these supplemental techniques (1.8%).

A total of 524 high-risk individuals was sampled and the total number of participants in each age cohort ranged from 314 (age 63-65) to 436 (age 13-15) (Table 2). Participants from Calgary accounted for 41.7% of the sample, followed by 29.6% from Edmonton, and 28.7% from the cities and surrounding areas of Grande Prairie and Lethbridge. Age, sex, and geography specific population projections for July 1, 2006 were available for Alberta (Health Surveillance and Environmental Health Branch Alberta Health and Wellness, 2007). These projections were based upon population counts through 2005 for Albertans insured under the Alberta Health Care Insurance Plan, a universal health care plan with virtually complete coverage of Albertans. The geographic regions for which counts were available corresponded closely to the geographies for the current project. The weighting process consisted of the combination of three weighting factors: an age-sex-geography factor derived from these projections, an adjustment based upon the number of individuals in the same age-sex grouping residing in the household as derived from the survey information, and a factor to account for the oversampling of at-risk gamblers. This last factor was derived by first, determining the age-sex-geography based count of the at-risk gamblers in the general population sample, and second, dividing the weight of all at-risk gamblers in each age-sex-geography grouping of the total sample into that count. Bootstrap weights (Yeo, Mantel, & Liu, 1999) were generated to facilitate analysis of the data within this complex survey design. Bootstrap weighting based on age, sex and geography ensured that the sample was representative of the population of all four regions and for the five age ranges. Refer to el-Guebaly et al. (2008) for a more detailed description of the sampling, recruitment, and weighting. The prevalence of problems gambling (PGSI 5+) was 4.7% of the adult sample or 3.2% of the weighted sample.

Procedures and Survey Administration

The LLLP was initiated in 2006 and the start-up date for data collection for Wave 1 was staggered between the four locations, over nine months, between February 2006 and October 2006. Initial contact with the majority of potential participants was completed using RDD. If the individual stayed on the line, they were asked questions from the initial screener. Computer-aided telephone interviewing (CATI) technology was used to collect the data for the initial screener and telephone interview (Freeman, 1983).

The screener at Wave 1 had specific inclusion criteria for individuals to participate in the study. That is, the individual had to be a resident of the geographic target area, be in one of the five

age cohorts, and have been a resident of Alberta for a minimum of three months. There were also specific criteria for those 524 participants in the at-risk group. An individual's inclusion in this at-risk group was based on their answers to the frequency of gambling and amount of gambling questions from the cohort screener. Based on results for gambling expenditure and frequency, cutoffs for the 70th percentile were established for each of the age cohorts and gender. The cut-off for adults (18-20, 23-25, 43-45, & 63-65 year olds) was spending more than $10 (absolute value) on gambling in a typical month or gambling at least twice a month. The cut-off for adolescents (13-15) was spending any amount on gambling in a typical month **or** those that gambled at least once in the previous year. A statistical analysis was completed to determine whether there were any significant differences in demographics between the group that met the amount cutoff, frequency cutoff, or both cutoffs. The analysis indicated that there were no significant differences between these groups (el-Guebaly et al., 2008).

At Wave 1, eligible respondents completed the telephone interview, and at the end, a time was booked for the individual to complete a computer-based survey and face-to-face interview. The computer-based survey and face-to-face interview took place at one of the four geographic locations. Participants completed the computer-based survey independently. Research assistants completed the face-to-face part of interview; which consisted of the Life Events Questionnaire, Wechsler Abbreviated Scale of Intelligence (WASI), and the computer-based version of the Wisconsin Card Sorting Test (WCST). The same procedures were used for adolescents, with parents completing the computer-based survey while their child was completing the face-to-face portion of the interview with a research assistant. On average, the computer-based survey and face-to-face interview combined took 3 hours to complete for adults and 2.25 hours for adolescents. When completed, participants were paid $75 to cover expenses incurred as a result of their participation.

For all subsequent waves of data collection (Waves 2, 3, & 4), the vast majority of participants completed an Internet-based survey, with a small group of adult participants electing to complete a paper version, with 133 adult participants (133/1145 = 11.62%) completing the paper survey at Wave 2, 100 adult participants (100/1004 = 9.96%) completing the paper survey at Wave 3, and 99 adult participants (99/1030 = 9.61%) completing the paper survey at Wave 4. Wave 2 data collection occurred between November 2007 and July 2008. Wave 3 data was primarily collected between July 2009 and May 2010. Finally, Wave 4 data was collected between February 2011 and October 2011. Data collection time intervals lasted between 9 and 10 months, with the time between the end of one time period of data collection and the start of the next varying between 9 and 13 months. Median elapsed times between data collection cycles 1 to 2, 2 to 3, and 3 to 4 were 567 days (18.90 months), 649 days (21.63 months), and 518 days (17.27 months) respectively. The number of days (649) between the midpoint for Wave 2 and the midpoint for Wave 3 was slightly longer than the midpoints between Wave 1 and 2 and for Wave 3 and 4. There was a delay in receiving ethics approval for Wave 3 of the study, which led to a late start of data collection at Wave 3, thus causing most of the increase in time between data collection at Waves 2 and 3.

In general, attrition in longitudinal gambling research is most common among individuals who typically display a gambling disorder: single males, younger, with minority group status, and substance use patterns (Claus, Kindleberger, & Dugan, 2002; Collins, Ellickson, Hays, & McCaffrey, 2000; Morrisson et al., 1997). Thus it was imperative that incentives be provided for participant's to complete the lengthy surveys. In addition to financial incentives ($75 for initial interview, $45 for years 2 and 3, and $75 for the final interview), detailed tracking was developed with multiple collaterals; as well, researcher persistence and frequent re-engagement were used to minimize attrition rates. At Wave 1, following the telephone screening procedure, a face-to-face interview was conducted in order to decrease drop-out. Subsequent data collection waves were conducted through either an Internet-based or paper-based format according to participant preference. These formats were chosen to increase completion rates and limit expenses.

Participants and Response Rate at Wave 1

At Wave 1, there were more participants in the 13-15 (n = 436), and 43-45 (n=403), year age ranges and fewer 18-20 (n = 315), 23-25 (n = 341), and 63-65 (n = 313) year olds than originally intended (Table 2). Furthermore, slightly more females (53.7%) than males (46.3%) completed the initial wave. Overall, 1,808 participants were recruited at Wave 1. In order to examine potential bias, the group of 1,808 participants who completed the entire study at Wave 1 (both telephone and face-to-face interviews) was compared with those individuals who completed only the telephone interview but did not complete the face-to-face interview. This analysis showed there were no significant differences in the demographic characteristics for the telephone only participants (n=654) compared to the 1,808 participants that completed the entire study at Wave 1.

We also compared the individuals within the general population recruitment who met the criteria for being considered at-risk and the individuals who were recruited specifically for the at-risk sample group (i.e., based on gambling expenditure and frequency cutoffs for the 70th percentile for each of the age cohorts and both genders). The marital status, education, and current employment distributions for the adult at-risk group in the general population (n=387) did not differ from those of the adult at-risk population. Overall response rate to our solicitation to participate was 5.4% (CASRO, 1982). Refer to el-Guebaly et al. (2008) for a more detailed discussion of the response rate and a comparison of how the full participants compared to the group who only completed the telephone survey portion.

Participants in Genetic Sub-study

The conceptual model for the study identified genetic factors as potentially etiologically important, albeit challenging to collect in a large sample cohort study. Instead of incorporating this domain into the main study, at Wave 2, individuals were invited to participate in a genetic sub-study. Participants were asked to visit a laboratory and provide a blood sample. Blood was drawn by venipuncture and the date and time of collection recorded. Samples were shipped to the Centre for Addiction and Mental Health (CAMH) in Ontario (at ambient temperature) within

five days. At Wave 3, an advancement in technology allowed willing participants to provide saliva instead of blood samples. Participants were required to refrain from eating, drinking, smoking, or chewing gum for a minimum of thirty minutes before providing the saliva sample. Participants collected the sample themselves, and provided with a pre-paid envelope, sent the sample to the Centre for Addiction and Mental Health (CAMH). A total of 679 participants participated in the genetic sub-study. Both blood collection at Wave 2 and saliva collection at Wave 3 had kit return rates of 68% of those who agreed to participate. At Wave 2, 414 blood samples were obtained from the 608 blood draw kits sent. At Wave 3, 388 saliva kits were sent and 265 saliva samples were returned. The genetic sub-sample is distinct from the results for the adult participants described here; consequently, it was thought to be more appropriate to summarize these results in a separate report. As well, colleagues at the University of Toronto and CAMH (Dr. Jim Kennedy & Dr. Daniela Lobo) will continue to develop further research manuscripts based on the genetic sub-sample.

Adolescent Sub-sample

The results described in this report are limited to an examination of the gambling behaviour of the adult sample (i.e., >18 at Wave 1). Results for the adolescent participants (13-15 at Wave 1) and the genetic study will be discussed in additional reports and manuscripts. The results for the adolescents are not described here since the trajectory of their gambling is distinctly different than the adult participants. As well, many of the questions and instruments used for the adolescent participants were different than those used for the adult sample (e.g., the gambling questions).

Retention

Twenty individuals passed away during the course of the study. After removing these individuals, 75.1% (1343/1788) of the remaining participants completed Wave 4. In terms of the adult cohort, 76.2% of adults completed Wave 4 and 68.4% of adults completed all four assessments. A total of 71.8% of adolescents completed Wave 4 and 59.6% completed all four assessments. Table 3 presents detailed information about completion rates for adult participants (similar information is provided for the adolescent sample in Appendix C). Ineligible participants are defined as participants recruited at Wave 1 that either subsequently died or became medically incapacitated (i.e., no longer had the capacity or ability to gamble). Eligible participants are defined as individuals recruited at Wave 1 minus those deemed to be ineligible. Finally, retention rate is the number of individuals who completed the survey in that wave period divided by the number of eligible participants.

Table 3: Pattern of Adult Retention in LLLP

	Survey Completions (A)	Ineligible Participants (Cumulative) (B)	Eligible Participants (C) (1372 - B)	Retention Rate (A/C) x 100
Wave 1	1372	-	1372	100.0
Wave 2	1145	2	1370	83.6
Wave 3	1004	14	1358	73.9
Wave 4	1030	20	1352	**76.2**
Survey Completion Pattern		**Number**	**%**	**Cumulative %**
Survey 1 only		180	13.1	13.1
Surveys 1 and 2 only		129	9.4	22.5
Surveys 1 and 3 only		4	0.3	22.8
Surveys 1 and 4 only		10	0.7	23.5
Surveys 1, 2 and 3 only		29	2.1	25.6
Surveys 1, 2 and 4 only		49	3.6	29.2
Surveys 1, 3 and 4 only		33	2.4	31.6
All surveys: 1, 2, 3, 4		938	**68.4**	100.0

Differential Drop Out

An analysis also identified differences between adults who completed all four waves and those that dropped out or had sporadic completion rates (the adolescent cohort was excluded from this analysis). Variables examined were: gender, age category, location, education, employment, income, marital status, whether recruited from the high-risk group or the general population, and PGSI score. A logistic regression found the following variables to be independently associated with a statistically significantly increased probability of attrition (listed from highest Wald statistic to lowest): age categories 18-20 and 23-25, less education, male, having a score of 5 or more on the PGSI, and a resident of Grande Prairie or Lethbridge rather than Calgary or Edmonton. Overall, however, the relationships are small, and the total variance accounted for was only 9.8% (Nagelkerke *R* square).

Measures

Instruments were chosen to ensure that they were the most reliable, valid, and efficient measures available within the area being assessed. Also, an examination of existing omnibus instruments was conducted for comparison purposes. Although instruments were selected for the number of age cohorts they could be used for (ideally assessing all age cohorts), a few instruments were not normed or developed for use with adolescent populations, and therefore, appropriate adolescent measures were used in place of the adult measures (Table 4). Additionally, it was not necessary to administer all instruments at wave, and in an effort to

minimize participant time commitment, some instruments were only administered once (see Table 4 and Table 5). Some instruments were developed specifically for the current study. These included measures of attitudes regarding gambling, gambling fallacies, life events, activity participation (video games, television, Internet, etc.), and some demographics. The final list of instruments thought to maximize the ability to measure a comprehensive list of constructs perceived to be related to gambling behaviour and optimize the time of administration (i.e., keep the interviews as short as possible) is shown in Table 4 and Table 5.

Measures of problem gambling severity included the Problem Gambling Severity Index (PGSI) for adults and Fisher DSM-IV-J-MR for adolescents. Within the Canadian Problem Gambling Index (CPGI), nine items (Q8-17) comprise a sub-scale known as the Problem Gambling Severity Index. The PGSI distinguishes four gambler sub-types, namely: non-problem (PGSI = 0), low risk (PGSI = 1-2), moderate risk (PGSI =3-7), and problem gambler (PGSI = 8-27). The non-problem group is further divided into gamblers and non-gamblers, as these types are known to display different characteristics. The CPGI has been used in 55 problem gambling prevalence surveys worldwide, and is the dominant instrument in Canada (Williams, Volberg, & Stevens, 2012). Using a sample of over 25,000 gamblers including the LLLP, Currie, Hodgins, and Casey (2012) conducted validity and reliability analyses and revised the categorization cutoffs. The authors rescored the low risk (PGSI = 1-4) and moderate risk (PGSI = 5-7) categories to improve the scale. Williams and Volberg (2010, 2014) also found that a 5+ score on the PGSI provides a better demarcation of clinically assessed problem gambling. Consequently, for all the analyses in the present study, participants are categorized into nongamblers (no past year gambling); nonproblem gamblers (PGSI score of 0); at risk gamblers (PGSI score of 1 – 4); and problem gamblers (PGSI score of 5 or higher). It is important to note that in a few analyses a PGSI score of 8 or higher is used to denote severe problem gambling.

Because the PGSI has not been normed for adolescents, the Fisher DSM-IV-J-MR was the primary instrument used for this cohort. This latter instrument consists of 12-items that assess nine of the ten diagnostic criteria for adult problem gambling (CPGI in adults; DSM-IV-MR-J in adolescents; Fisher, 2000). A more detailed description of all the measures employed at Waves 1, 2, 3, and 4, for both adolescents and adult participants, can be found in Appendix B.

Table 4: Adolescent Measures for LLLP at Waves 1, 2, 3, and 4

Instrument/Measure	Construct	Wave 1	Wave 2	Wave 3	Wave 4
Gambling					
Canadian Problem Gambling Index	Gambling History/Motivation/Past Year	Yes	Yes	Yes	Yes
Fisher DSM-IV-MR-J	Problem/Pathological Gambling	Yes	Yes	Yes	Yes
Gambling Attitudes Questionnaire	Attitudes	Yes	Yes	Yes	Yes
Gambling Fallacies Measure	Fallacies	Yes	Yes	Yes	Yes
Devaluation Discrimination Questionnaire – Short Form	Stigma	-	Yes	Yes	-
Mental Health/Personality/Stressors/Coping					
Child Behaviour Checklist	Psychopathology/Temperament/Personality	Yes	Yes	Yes	Yes
Life Events Questionnaire (LEQ)	Stressors	Yes	-	-	-
Stressors (Shortened Version of LEQ)	Stressors	-	Yes	Yes	Yes[1]
Coping Inventory for Stressful Situations	Coping	-	Yes	Yes	Yes
Health					
SF-10 Children Health Survey (Parents)	Physical Health	Yes	Yes	Yes	-
Statistics Canada Questions (2 Q)	Physical Health	Yes	-	-	-
Medication Questions[2]	Health	Yes	-	Yes	Yes
Personal Wellbeing Index – Adult	Physical & Mental Health	-	-	Yes	Yes
Eating Disorder Examination Questionnaire	Eating Disorders	-	-	Yes	-
Substance Use/Risky Behaviour					
Canadian Community Health Survey	Substance Use	Yes	Yes	Yes	Yes[3]
Reckless Behaviour Questionnaire	Risky Behaviour	-	Yes	Yes	Yes
Family					
Childhood Trauma Questionnaire	History of Abuse/Childhood Trauma	Yes	Yes	Yes	-
Adverse Childhood Experience	Hist. of Abuse. Adverse Childhood Exp.	-	-	Yes	-
Family Environment Scale	General Functioning	Yes	Yes	Yes	Yes
Parental Monitoring	Parental Monitoring (Parents/Adolescents)	-	Yes	Yes	-
Societal					
Lubben Social Network Scale	Social Network	Yes	Yes	Yes	Yes
Loneliness & Social Dissatisfaction	Social Support- Loneliness & Social Diss.	-	-	Yes	Yes
Rohrbaugh Jessor Religiosity Scale	Religiosity	Yes	-	Yes	Yes
Buckner Neighborhood Cohesion Scale (2 Q)	Neighborhood Cohesion	Yes	Yes	Yes	Yes
York Ethnicity Scale	Ethnicity Scale	Yes	-	Yes	-
Cognitive					
Wechsler Abbreviated Scale of Intelligence	Intelligence/Cognitive	Yes	-	-	-
Wisconsin Card Sorting Test-64 Computer Version	Executive Functioning/Cognitive	Yes	-	-	-

Instrument/Measure	Construct	Wave 1	Wave 2	Wave 3	Wave 4
Activity Participation					
Video, TV, Computer, etc.	Activity Participation	-	Yes	Yes	Yes
Demographics					
Age, Gender, Birthday, Education, Occupation, Income, Ethnicity	Demographics (Parents/Adolescents)	Yes	Yes	Yes	Yes[4]
Time 4 – Ethnicity	Demographics (Adolescents Only)	Yes	Yes	Yes	-
Time 4 – Ask Adolescents Income Questions (5 Q)[5]	Demographics (Adolescents Only)	Yes	Yes	Yes	Yes
Time 4 – Ask Sexual Orientation	Demographics	-	-	-	Yes
Time 4 – Ask Family of Origin	Demographics	-	-	-	Yes
Other					
Gambling & Drinking Questions (increased since during 18)	Gambling & Drinking	-	-	Yes	Yes

[1] Added items related to the transition to adulthood.

[2] At Wave 4, dropped question "how long have you been taking it?

[3] Youth smoking questions dropped for Wave 4 (4 questions)

[4] Ethnicity not asked at Wave 4

[5] Household income for adolescents as provided by parents of the adolescents at Wave 1, 2, & 3; at Wave 4 adolescent's household income

Table 5: Adult Measures for LLLP at Waves 1, 2, 3, and 4

Instrument/Measure	Construct	Wave 1	Wave 2	Wave 3	Wave 4
Gambling					
Canadian Problem Gambling Index	Gambling History/Motivation/Yr	Yes	Yes	Yes	Yes
Problem Gambling Severity Index (PGSI)	Problem Gambling	Yes	Yes	Yes	Yes
CPGI – Who do you gamble with? (13 Q)	Who Gamble With	Yes	Yes	Yes	Yes
CPGI – What is the main reason you gamble? (13 Q)	Reason for Gambling	Yes	Yes	Yes	Yes
CPGI – Extra Internet gambling questions (65 Q)	Internet Gambling	-	Yes	Yes	-
Composite International Diagnostic Inventory – Gambling Module	Problem/Pathological Gambling	Yes	Yes	Yes	Yes
Gambling Attitudes Questionnaire	Attitudes	Yes	Yes	Yes	Yes
Gambling Fallacies Measure	Fallacies	Yes	Yes	Yes	Yes
Devaluation Discrimination Questionnaire – Short Form	Stigma	-	Yes	Yes	-
Gambling Behaviour, Treatment, & Family History	Gambling	Yes	Yes	Yes	Yes
Sydney & Laval University Gambling Screen	Problem Gambling	Yes	-	-	-
Mental Health/Personality/Stressors/Coping					
Composite International Diagnostic Inventory – Short Form	Psychopathology	Yes	-	Yes	Yes
Personality Assessment Inventory	Personality	Yes	Yes	-	Yes
NEO Personality Inventory	Temperament/Personality	Yes	-	-	-
Life Events Questionnaire (LEQ)	Stressors	Yes	-	-	-
Stressors (Shortened Version of LEQ)	Stressors	-	Yes	Yes	Yes
Coping Inventory for Stressful Situations	Coping	-	Yes	Yes	Yes
Adult ADHD Self-Report Scale	ADHD	-	-	Yes	-
Health					
SF-8 Health Survey	Physical Health	Yes	Yes	Yes	Yes
Statistics Canada Questions (2 Q)	Physical Health	Yes	-	-	-
Medication Questions[1]	General Health	Yes	-	Yes	Yes
Personal Wellbeing Index – Adult	Physical & Mental Health	-	-	Yes	Yes
Eating Disorder Examination Questionnaire	Eating Disorders	-	-	Yes	-
Substance Use					
Canadian Community Health Survey	Substance Use	Yes	Yes	Yes	Yes
National Comorbidity Study of Treatment & Family History	Treatment for Substance Use	Yes	-	-	-
Family					
Childhood Trauma Questionnaire	History Abuse/Childhood Trauma	Yes	Yes	Yes	-
Adverse Childhood Experience	Hist. Abuse. Adverse Exp.	-	-	Yes	-
Family Environment Scale	General Functioning	Yes	Yes	Yes	Yes
Kansas Marital Satisfaction Scale	Marital Functioning/Satisfaction	Yes	Yes	Yes	Yes

Instrument/Measure	Construct	Wave 1	Wave 2	Wave 3	Wave 4
Societal					
Lubben Social Network Scale	Social Network	Yes	Yes	Yes	Yes
Rohrbaugh Jessor Religiosity Scale	Religiosity	Yes	-	Yes	Yes
Buckner Neighborhood Cohesion Scale (2 Q)	Neighborhood Cohesion	Yes	Yes	Yes	Yes
York Ethnicity Scale	Ethnicity Scale	Yes	-	Yes	-
Cognitive					
Wechsler Abbreviated Scale of Intelligence	Intelligence/Cognitive	Yes	-	-	-
Wisconsin Card Sorting Test-64 Computer Version	Executive Functioning/Cognitive	Yes	-	-	-
Activity Participation					
Video, TV, Computer, etc.	Activity Participation			Yes	Yes
Demographics					
Age, Gender, Birthdate, Education, Occupation, Income, Ethnicity	Demographics	Yes	Yes	Yes	Yes[2]
Time 4 – Ask Sexual Orientation	Demographics	-	-	-	Yes
Time 4 – Ask Family of Origin	Demographics	-	-	-	Yes

[1] At Time 4, dropped question "how long have you been taking it?"

[2] Ethnicity not asked at Wave 4

Coordinated Analysis of the LLLP and QLS Datasets

The generalizability of any one study is always limited to some extent by the sample characteristics and methodology of that study. An opportunity for enhancing the generalizability and scientific value of the LLLP presented itself when a second large scale Canadian longitudinal study of gambling (i.e., the Quinte Longitudinal Study (QLS), Williams et al., 2015) was awarded to a team of researchers in 2006 that included two of the members of the LLLP research team (i.e., Williams & Schopflocher). Partly as a consequence of this overlapping team membership, many of the important methodological features of these two projects were either identical or very similar.

The methodological similarities between the studies include the following:

- Began in 2006 and ended in 2011.
- Had a primary (LLLP) or exclusive (QLS) focus on Canadian adults.
- Employed large sample sizes (LLLP = 1,372 adults + 436 adolescents; QLS = 4,121), with over selection of people at risk for becoming problem gamblers (comprising 29% of the LLLP sample and 26% of the QLS sample).
- Conducted extremely comprehensive self-administered assessments of all variables of etiological relevance to gambling and problem gambling (no other longitudinal studies of gambling have employed assessments that are as comprehensive as the ones used in LLLP and QLS). For most constructs assessed, the actual questions and/or psychometric instruments were the same in both studies.
- Used identical or very similar questions to assess past year gambling behaviour (i.e., expenditure and frequency of participation on the same identified types of gambling).
- Used overlapping measures of problem gambling (the PGSI with a 5+ demarcation for problem gambling was used in both studies; although the Problem and Pathological Gambling Measure (PPGM) (Williams and Volberg, 2010; 2014) was the primary instrument in QLS).
- Had strong retention rates (LLLP = 76.2% for the adult cohort; QLS = 93.9%).

There were a few important methodological differences between the studies:

- QLS had a smaller geographic area (70 kilometer radius around city of Belleville, Ontario), whereas LLLP recruited participants from four sites intended to approximate the demography of Alberta (cities of Calgary, Edmonton, Lethbridge, and Grande Prairie, as well as the rural areas surrounding Lethbridge ('rural south') and Grande Prairie ('rural north')).
- The LLLP only recruited people who were in one of five circumscribed age ranges (13-15; 18-20; 23-25; 43-45; & 63-65), whereas all adults 18 and older were eligible to participate in the QLS. As a consequence, the average age of the QLS cohort (46.5) was older than the LLLP adult cohort (37.9).
- The LLLP had four assessments 17-22 months apart using a 9-10 month assessment window, whereas QLS had five assessments 12 months apart using a five month assessment window.
- There were considerably more legal gambling opportunities available to the Alberta sample versus the QLS sample. For example, Alberta allows video lottery terminals (VLTs) in bars

and lounges, while Ontario does not. Also there are 24 casinos in Alberta as opposed to 11 in Ontario, none of which are close to the Belleville area.

Because of the large number of methodological similarities between LLLP and QLS, and because of the desire of both research teams to produce the most robust scientific conclusions possible, a decision was made to use similar analytic approaches for both the LLLP and QLS datasets and to try and replicate findings from one dataset to the other. Thus, the results and discussion sections of the present LLLP Final Report (el-Guebaly et al., 2015) and QLS Final Report (Williams et al., 2015) are similar in most respects. More specifically, the conclusions pertaining to the stability of gambling and problem gambling are identical, although the approaches differ somewhat. Furthermore, the approach, results, and conclusions regarding the univariate predictors and correlates of problem gambling are virtually identical. Where the two reports diverge are in the analyses predicting future problem gambling where the QLS focuses on problem gambling status as the dependent variable and uses the Problem and Pathological Gambling Measure (PPGM) (Williams & Volberg, 2014), whereas LLLP focuses on problem gambling symptomatology and uses PGSI scores. The QLS analyses also focus exclusively on predictors, whereas the LLLP analyses identify both predictors and correlates. The LLLP uses structural equation modeling and evaluates subsets of variables on gambling and problem gambling whereas the QLS uses logistic regression and evaluates all variables simultaneously. Several other methodological differences exist. These different approaches are reflective of the fact that there are many different approaches that can be legitimately applied to the data. Nonetheless, the large majority of variables implicated in predicting future problem gambling in the LLLP Final Report were also identified as important predictors in the QLS Final Report. This is reflected in the fact that the final conceptual model is identical in both reports.

General Analytic Approach

This report describes three major analyses of the adult LLLP (and QLS) datasets. The first set of analyses examines the univariate correlates and predictors of subsequent problem gambling. The second set of analyses examines the stability of problem gambling status over time among individuals who had that status sometime during their participation. Movement in and out of problem gambling status was conservatively measured accounting for measurement error in the assessment instruments. The third set of analyses focuses on multivariate modeling of predictors of gambling and problem gambling using a series of structural equation models. The relationship between gambling involvement and problem gambling symptoms was modeled first and then potential predictors (e.g., background variables, personality, & mental health) were added as covariates.

RESULTS

Univariate Correlates and First Onset Predictors of Problem Gambling

Appendix C contains the detailed descriptive and univariate results of the LLLP study. There are two sets of tables. Table C3 provides the profile of non-gamblers, non-problem gamblers (PGSI 1-4), and PGSI 5+ problem gamblers for each of the independent variables as a function of data collection wave. In addition to the values for each wave, *average values across the waves* are also presented. These averages were created by weighting each year's data as a function of sample size. When data were not available for all waves the weighting was adjusted accordingly. These average values were then subject to statistical testing. A *z* test of proportions was applied to categorical variables to determine whether the average proportion for the non-problem gambler group differed significantly from the average proportion for the problem gambler group. An independent group t-test was used in an analogous manner for the continuous variables. Significant differences between the two groups are denoted by grey shading. Variables not assessed or not available are denoted by '—'.[4]

In any given assessment, problem gamblers fall into one of three groups: people who became problem gamblers for the first time; problem gamblers who are continuing their problem gambling from the previous assessment; and relapsed problem gamblers. The univariate results in Table C4 focus on the first group. Table C4 presents the prior year independent variable profiles of participants who became PGSI 5+ problem gamblers for the first time in the next assessment ('became PG for 1st time' group) compared to the prior year profile of people who remained non-problem gamblers ('stayed non-PG' group). Thus, significant differences between the two groups identifies which variables are *predictive* of first onset problem gambling. The 'became PG' group consists of participants who did not meet criteria for PGSI 5+ problem gambling in any previous year; i.e., they became problem gamblers for the first time during the study. Problem gamblers who unambiguously reported a lifetime history of problem gambling were also excluded from this group, as were problem gamblers missing prior year data, and problem gamblers who were problem gamblers in any previous assessment. The 'stayed non-PG' group consists of everyone who was a non-gambler, non-problem gambler (PGSI = 0), or at-risk gambler (PGSI = 1 - 4) in the prior assessment and continued to be either a non-gambler, non-problem gambler, or at-risk Gambler in the next assessment.

Here again, in addition to data for the four individual assessments, the *average profile* across the waves has been created by weighting each year's data as a function of sample size. These average values across the waves were then subject to statistical testing. A *z* test of proportions was used for categorical variables to determine whether the average proportion for the *became problem gamblers group* differed significantly from the *stayed non-problem gamblers*

[4] Because there is some degree of movement between gambling category membership over time, the *averaged groups* are not totally independent (a requirement of these statistical tests). Thus, statistical significance must be regarded with some caution.

group ($p < .05$, 2 tail test). A t-test was used in an analogous manner for the continuous variables. Significant differences are denoted by grey shading.

These tables serve two purposes. The first is to provide comprehensive documentation of the descriptive results of this study. The second, the more important purpose is to identify variables that are robustly correlated with and/or predictive of subsequent problem gambling and that should be the focus of our multivariate analyses. With approximately 130 independent variables available for analysis there was a need to reduce the number of variables to be used in our structural equation modeling. A summary of these findings of the univariate analyses is provided in Table 6. For comparison purposes, the findings from the QLS are also presented. This table shows that although there are many concurrent and prospective predictors of problem gambling that emerged from the univariate analyses, the number that are both robust (significant at $p < .01$ levels) and cross-validated (significant in both the LLLP and QLS studies) is smaller. The strongest concurrent predictors of problem gambling are: frequency of EGM, casino games and games of skill; frequency of any gambling when all forms are collapsed; number of different game types played; total expenditure on all forms of gambling, and; number of stressful events in the past year. The strongest prospective predictors of problem gambling (variables that predict problem gambling at a future time point) are: a large single day loss; frequency of any gambling when all forms are collapsed (and frequency of certain individual games such as lottery, Bingo, and EGMs); number of different game types played; total expenditure on all forms of gambling (and expenditure on certain individual games); gambling to escape; gambling to win money; gambling fallacies; higher NEO-R scores on neuroticism, depression, vulnerability, impulsivity; number of stressful events in the past year; presence of major depression or an anxiety disorder; smoker; antisocial traits; lower intelligence, and; lower marital support. By far the largest number of concurrent and prospective predictors of problem gambling emerged in the category of variables assessing amount of gambling involvement. These variables were further examined in the multivariate testing described in the subsequent sections.

Table 6: Univariate First Onset Predictors and Correlates of Problem Gambling in LLLP and QLS

	LLLP Predictor	QLS Predictor	LLLP Correlate	QLS Correlate
DEMOGRAPHICS				
Male				
Younger Age			*	
Immigrant				
Non-Caucasian		*	*	**
Adopted				
Lower Educational Attainment		*		*
Marital Status (separated or not married)				**
Employment Status (on leave or on strike)				**
Household Income				
Household Debt				
Location		--		--
PHYSICAL HEALTH				
Physical disability			*	
Lower physical health rating			**	**
Taking prescription medication				

		LLLP Predictor	QLS Predictor	LLLP Correlate	QLS Correlate
GAMBLING					
	Gambling Attitudes (less positive)				**
LIFETIME GAMBLING	Age first gambled				
	Frequency of gambling prior to 19	--		--	
	Big win prior to 19 (QLS); Big win when 1st started gambling (LLLP)	**		**	
	Big loss prior to 19 (QLS); Big loss when 1st started gambling (LLLP)			**	
	Big win and big loss prior to 19	--		--	**
	Parents or sibs regular gamblers when person growing up (QLS); Parents or sibs do/did gamble regularly (LLLP)	**		**	*
	Parents or sibs gambled with person when growing up (QLS); (parents only in LLLP)			*	*
	Parents or sibs problem gamblers when person growing up (QLS); Parents or sibs are/were problem gamblers (LLLP)		*	**	**
	Largest single day loss ever			**	**
	Largest single day win ever	--		--	
	Lifetime net win/loss	--		--	**
PAST YEAR GAMBLING	Lottery ticket frequency		**	**	**
	Raffle ticket frequency		--		--
	Instant win ticket frequency	*	**	**	**
	Bingo frequency	*	**	**	**
	EGM frequency	**	**	**	**
	Casino table game frequency	**	**	**	**
	Private games for $ (QLS); Social games of skill (QLS)	**	**	**	**
	Sports betting frequency		*	**	**
	Horse or dog racing frequency			**	**
	High risk stock frequency		*		**
	Out-of-province casino frequency		--		--
	FREQUENCY OF ALL FORMS COMBINED	**	**	**	**
	Gambled on Internet		**	*	**
	TOTAL NUMBER OF GAMBLING TYPES	**	**	**	**
	Lottery ticket expenditure				**
	Raffle ticket expenditure		--		--
	Instant win ticket expenditure	**		*	**
	Bingo expenditure			*	**
	EGM expenditure	*		**	**
	Casino table game expenditure	*			**
	Social games of skill expenditure				**
	Sports betting expenditure		**	**	**
	Horse or dog racing expenditure			**	**
	High risk stock expenditure	**		**	
	Out-of-province casino expenditure	**	--		--
	EXPENDITURE ON ALL TYPES COMBINED	**	**	**	**
	Largest single day loss		**		**
	Largest single day win	--	**	--	**
	TOTAL TIME SPENT GAMBLING	**	--	**	--
	Membership in gambling rewards program	--	**	--	**
GAMBLING MOTIVATION	Excitement/entertainment/fun			**	
	To win money	*		**	**
	Escape/distraction (QLS); dissociation while gambling (LLLP)	**	*	**	**

		LLLP Predictor	QLS Predictor	LLLP Correlate	QLS Correlate
	To socialize				
	To support worthy causes	--		--	*
	To feel good about self	--		--	**
	Other motivation	--		--	
GAMBLING CONTEXT (past year)	Gambling alone rather than with friends	--	**	--	**
	Drink alcohol when gambling (QLS); Alcohol/drugs when gambling (LLLP)			**	
	Use tobacco when gambling	--	*	--	**
	Use [street] drugs when gambling (QLS); Alcohol/drugs when gambling (LLLP)			**	**
	Higher frequency of ATM use in gambling venues	--	**	--	**
GAMBLING SOCIAL EXPOSURE	# close friends/family regular gamblers (friends only in LLLP)		**		**
	# of close friends and family with gambling problems	--	*	--	**
	Other adults in household with gambling problems	--		--	**
GAMBLING EXPOSURE	Opportunities to gamble at workplace or school				
	Had prevention/awareness campaign at work or school	--		--	
	Gambling Fallacies	**	*	**	**
GAMBLING AVAILABILITY	Driving time (minutes) to nearest EGM venue	--		--	*
	Distance (km) to nearest EGM venue				
	Participant estimate of distance to nearest EGM venue	--	**	--	*
	Casino/racino density		--		--
PERSONALITY					
	Neuroticism (higher)			**	**
	Depression (higher)			**	**
	Vulnerability (higher)			**	**
	Impulsivity (higher)		*	**	**
	Extraversion				
	Excitement-seeking (higher)			*	
	Openness				
	Agreeableness (lower)			*	**
	Conscientiousness (lower)			*	**
STRESS					
	Number of stressful life events in past year	**	**	**	**
WELL BEING	Stress level (higher)			**	**
	Happiness level (lower)			**	**
	Life satisfaction (lower)			**	**
	Personal Wellness Index (lower)			**	**
	Abused as a child			**	
	Other past trauma that still impacts today	--		--	*
VALUES					
Most important in life	Money	--		--	**
	Power	--		--	*
	Fame	--		--	
	Friendships	--		--	**
	None of the above	--	*	--	
	Wealth indicates success	--	**	--	**
MENTAL HEALTH					
MENTAL DISORDERS	Post-Traumatic Stress	--		--	**
	Major Depressive Disorder		**	**	**
	Suicidal Ideation		--	**	--
	Mania				

		LLLP Predictor	QLS Predictor	LLLP Correlate	QLS Correlate
	Generalized Anxiety Disorder			**	**
	Panic Attacks &/or Agoraphobia				**
	Social Phobia		--	*	--
	Specific Phobias		--	**	--
	Somatic Complaints		--	**	--
	Paranoid Ideation	**	--	**	--
	Borderline Features		--	**	--
	Aggression		--	**	--
	Obsessive Compulsive Disorder			**	**
	Eating Disorder			**	
	Schizophrenic or Delusional			*	
	Attention Deficit Hyperactivity		--	**	--
	ANY MENTAL HEALTH PROBLEM	--	**	--	**
SUBSTANCE USE, ABUSE, AND DEPENDENCE	Tobacco user		*	**	**
	Alcohol use (QLS); Level of alcohol use (LLLP)				*
	Illicit Drug use				**
	≥ Weekly use of tobacco, alcohol, illicit drugs or nonmedical use of licit drugs	--		--	
	Substance abuse or dependence (QLS); Drug dependence (LLLP)		**	*	**
	Behavioural Addiction	--	*	--	**
LIFETIME MENTAL HEALTH (prior to past 12 months)	Lifetime history of addiction to drugs/alcohol	--		--	**
	Lifetime history of behavioural addiction	--		--	**
	Parents/siblings have history of addiction	--		--	
	Lifetime history of mental health problems	--		--	**
	Parents/siblings have history of mental health problems	--		--	*
SOCIAL FUNCTIONING					
	Heterosexual				
SOCIAL FUNCTIONING AND SUPPORT	Marital Satisfaction (lower)				**
	Social Support (lower)			**	**
	Family Functioning (lower)				**
	Community quality & involvement (lower)				**
RELIGION	Religious Affiliation				
	Religiosity				
RECREATIONAL ACTIVITIES	Gambling is 1 of 5 favourite leisure activities	--	**	--	**
	Gambling is favourite leisure activity	--		--	**
OCCUPATIONAL FUNCTIONING	Job stress	--		--	*
	Job satisfaction	--		--	
ILLEGAL BEHAVIOUR AND ANTISOCIALITY	Number of Illegal activities in lifetime			**	
	Number of Illegal activities in past year	--		--	**
	Antisociality			**	**
COGNITIVE FUNCTIONING					
	Lower Intelligence			**	**
	Wisconsin Card Sorting Test		--	**	--
Note: * *p* < .05 (2 tail); ** *p* < .01 (2 tail); -- not measured					

Stability of Problem Gambling Over Time

Measurement Error

In order to assess the stability of problem gambling over time, it is important to factor in measurement error. Unlike many clinical diagnoses (e.g., diabetes, cancer) there is no biological test for problem gambling. Rather assessment is based on a person's perception of their behaviour and mental state over the past year, and assigning a problem gambling designation is based on this perception. However, the accuracy of this perception is compromised by many factors, including incomplete recall, recency bias, self-deception, mood state, social desirability, the short period of time participants are given to answer the questions, and genuine uncertainty about whether they meet the criteria.

The one month test-retest reliability of the assessment instrument (i.e., PGSI) provides evidence pertaining to measurement error. Because the PGSI is asking about behaviour in the past year, there should be little difference in self-report after one month. However, as seen in Table 7, considerable one month variability exists as assessed by Pearson *r* and Cramer *V* statistics.

Table 7: One Month Test-Retest Reliability of the Canadian Problem Gambling Index

Total Score	*r* = .78	Canada in 2001; n = 417; (Ferris & Wynne, 2001)
	r = .75	Canada in 2006/7; n = 328; (Williams & Wood, 2007)
Traditional 5 Categories	*r* = .61	Canada in 2006/7; n = 328; (Williams & Wood, 2007)
2 Categories (0 - 4; 5+)	*V* = .54	Canada in 2006/7; n = 328; (Williams & Wood, 2007)

In recognition of the measurement error inherent in self-report instruments, the Reliable Change Index (RCI) was developed (Jacobson & Truax, 1991). The RCI is the difference in the person's score over two time periods divided by the standard error of difference between the two test scores. This index assesses whether an observed change score is larger than might be expected due to measurement instability:

$$RCI = \frac{x_1 - x_2}{\sqrt{2(SD_1\sqrt{1 - r_{xx}})^2}}$$

RCI scores provide a measure of the change in *standardized units.* Thus, a RCI of 1.96 or larger is needed for statistical significance at $p < .05$.

The above table demonstrated that PGSI total scores have an average test-retest reliability of .765. In the LLLP, the average standard deviation of PGSI scores over the four waves in the present study is 2.15. Hence, a raw score increase of **three or more** at the subsequent time period is what is required for a statistically significant change at the individual participant level.

Visual Depiction of Problem Gambling Stability

Figure 2 illustrates the stability of problem gambling over the four waves of the study using a dichotomous score of five or more on the PGSI to designate problem gambling and any other score to designate non-problem gambling, and a raw score change of three or more to represent a statistically significant change. This chart is restricted to just the 57 individuals who scored five or higher on the PGSI at any point during the study and completed all four surveys. Each row represents an individual, with grey shading designating problem gambling and white designating non-problem gambling.

In addition to the 57 participants who scored as problem gamblers at some point during the study and completed all four waves, there were 37 participants who scored as problem gamblers at some point but missed one or more assessment periods (11 missed one assessment; 7 missed two assessments; 19 missed three assessments).

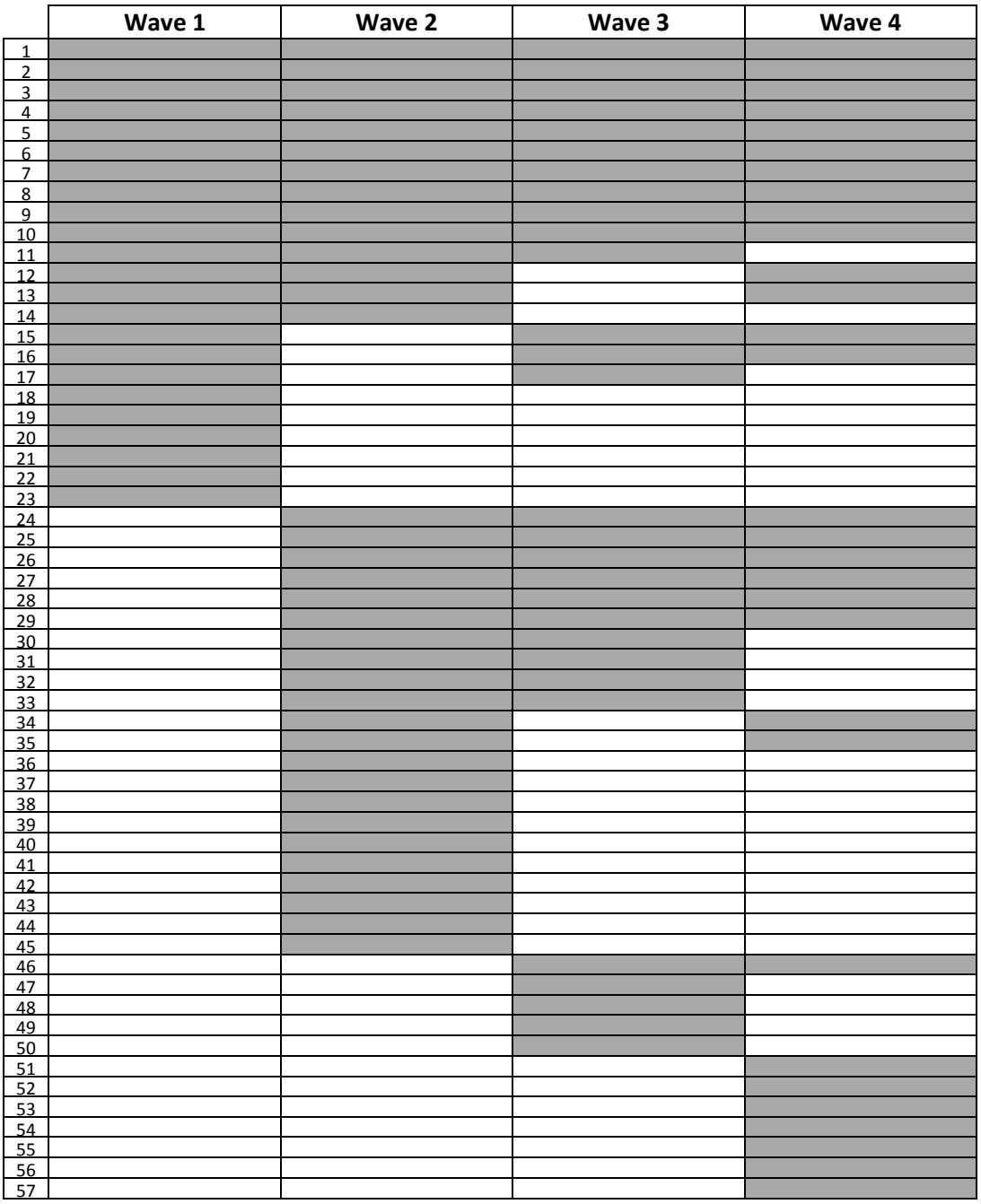


Figure 2: Stability of Problem Gambling in the Four Waves of the LLLP Study (*n*=57)

It is possible that more severe forms of problem gambling might show a different pattern of stability compared to less severe forms. Figure 3 illustrates the stability of severe problem gambling in the four waves of the study using a dichotomous score of eight or more on the PGSI to designate severe problem gambling and any other score to designate non-problem gambling, and a raw score change of three or more to represent a statistically significant change. This chart is restricted to the 21 individuals who scored eight or higher on the PGSI at any point during the study and completed all four surveys. Each row represents an individual, with dark

grey shading designating severe PGSI 8+ problem gambling, light grey shading designating PGSI 5+ problem gambling, and white designating non-problem and non-pathological gambling.

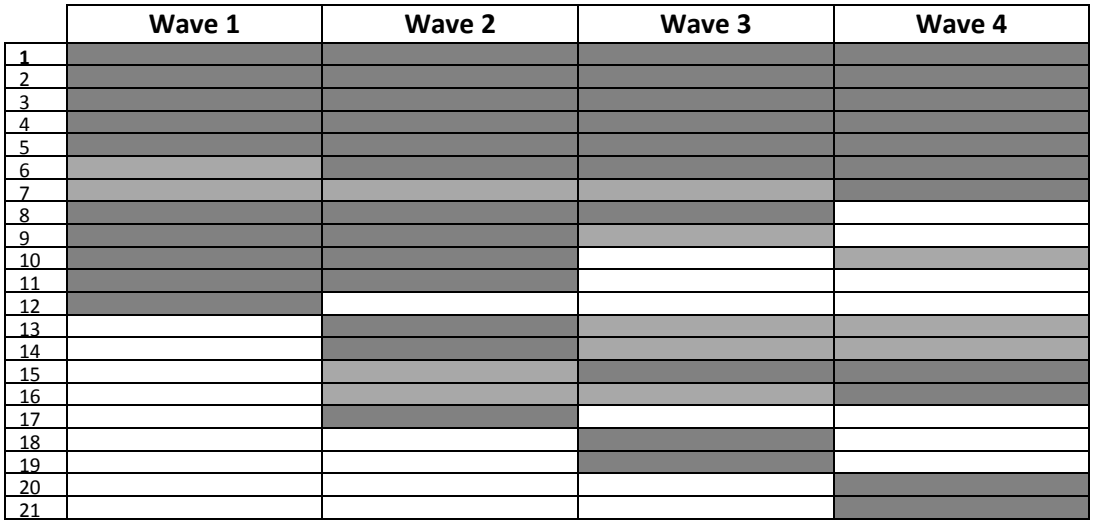


Figure 3: Stability of Severe Problem Gambling (PGSI 8+) During Course of LLLP (*n* = 21)

In addition to the 21 people who were PGSI 8+ severe problem gamblers at some point during the study and completed all four waves, there were 13 people who were severe problem gamblers at some point but missed one or more wave (three missed one wave; four missed two waves; six missed three waves).

Quantification of Problem Gambling Stability

Table 8 quantifies the stability of PGSI 5+ problem gambling as seen in Figure 2. Table 9 quantifies the stability of PGSI 8+ severe problem gambling as seen in Figure 3. For context, the same quantification metrics are applied to the QLS data.

Table 8: Stability of PGSI 5+ Problem Gambling (PG) in the LLLP and QLS Studies (complete data only)

	LLLP		QLS	
	n/N	%	n/N	%
PGs who are PGs in 1 time period	27/57	**47.4%**	105/226	**46.5%**
PGs who are PGs in 2 time periods	9/57	**15.8%**	43/226	**19.0%**
PGs who are PGs in 3 time periods	11/57	**19.3%**	24/226	**10.6%**
PGs who are PGs in 4 time periods	10/57	**17.5%**	23/226	**10.2%**
PGs who are PGs in 2 or more consecutive years	27/57	**47.4%**	109/226	**48.2%**
PGs who are PGs in exactly 2 consecutive years	10/57	**17.5%**	44/226	**19.5%**
PGs who are PGs in exactly 3 consecutive years	7/57	**12.3%**	22/226	**9.7%**
PGs who are PGs in exactly 4 consecutive years	10/57	**17.5%**	12/226	**5.3%**
PGs who are PGs in all 5 consecutive years	--	--	31/226	**13.7%**
PGs who have at least 1 year of recovery	33/50	**66.0%**	166/213	**77.9%**
After 2 consecutive years PG, % who recover in the next year	7/24	**29.2%**	32/97	**31.6%**
After 3 consecutive years PG, % who recover in the next year	1/11	**9.1%**	12/55	**21.8%**
After 4 consecutive years PG, % who recover in the next year	--	--	8/40	**20.0%**
After recovery from PG, % who relapse in the year following the recovery year	7/24	**29.2%**	25/143	**17.5%**
After recovery from PG, % who relapse within 2 years following the recovery year	3/9	**33.3%**	24/110	**21.8%**
After recovery from PG, % who relapse within 3 years following the recovery year	--	--	19/68	**28.0%**
4 alternating PG to non-PG status's within 4 years	3/57	**5.3%**	10/226	**4.4%**
4 alternating PG to non-PG status's within 5 years	--	--	16/226	**7.1%**

Table 9: Stability of Problem Gambling (PGSI 5+ or PGSI 8+) Among Participants Receiving a Designation of Severe Problem Gambling (PGSI 8+) (PPG) at Some Point During the LLLP and QLS Studies (complete data only)

	LLLP		QLS	
	n/N	%	n/N	%
PPGs who are PG or PPGs in 1 time period	6/21	**28.6%**	22/84	**26.2%**
PPGs who are PG or PPGs in 2 time periods	1/21	**4.8%**	15/84	**17.9%**
PPGs who are PG or PPGs in 3 time periods	7/21	**33.3%**	10/84	**11.9%**
PPGs who are PG or PPGs in 4 time periods	7/21	**33.3%**	15/84	**17.9%**
PPGs who are PG or PPGs in 2 or more consecutive years	14/21	**66.7%**	59/84	**70.2%**
PPGs who are PG or PPGs in exactly 2 consecutive years	2/21	**9.5%**	19/84	**22.6%**
PPGs who are PG or PPGs in exactly 3 consecutive years	5/21	**23.8%**	11/84	**13.1%**
PPGs who are PG or PPGs in exactly 4 consecutive years	7/21	**33.3%**	7/84	**8.3%**
PPGs who are PG or PPGs in all 5 consecutive years	--	--	22/84	**26.2%**
PPGs who have at least 1 year of recovery from PG or PPG	8/19	**42.1%**	50/81	**61.7%**
After 2 consecutive years PG or PPG, % who recover in the next year	2/15	**13.3%**	16/56	**28.6%**
After 3 consecutive years PG or PPG, % who recover in the next year	2/9	**22.2%**	3/33	**9.1%**
After 4 consecutive years PG or PPG, % who recover in the next year	--	--	5/29	**17.2%**
After recovery from PG or PPG, % who relapse in the year following the recovery year	1/4	**25.0%**	12/42	**28.6%**
After recovery from PG or PPG, % who relapse within 2 years following the recovery year	0/1	**0%**	13/33	**39.4%**
After recovery from PG or PPG, % who relapse within 3 years following the recovery year	--	--	8/16	**50.0%**
4 alternating PG or PPG to non-PG status's within 4 years	0/21	**0%**	2/84	**2.4%**
4 alternating PG or PPG to non-PG status's within 5 years	--	--	5/84	**6.0%**

Structural Analyses of Gambling Behaviour and Problem Gambling Scores

The analyses in the previous section focused on the stability of the problem and severe problem gambling categories over time. The analyses in the present section focus on the stability of gambling behaviour, problem gambling scores, and the inter-relationship between gambling behaviour, problem gambling scores, and other independent variables.

The sequence of analytic steps was as follows:

1. Creation of a composite measure of gambling behaviour and demonstrating that this composite measure had the same structure in each data set (LLLP and QLS) as well as in each successive wave of each study.
2. Examining the stability of this composite measure of gambling behaviour over time in both data sets.
3. Examining the stability of PGSI scores over time in both data sets.
4. Examining the relationship between overall gambling behaviour and PGSI scores at each wave and whether these relationships were similar over time.
5. Examining the relationship and influence of other independent variables on gambling behaviour and problem gambling scores both cross-sectionally and over time.

All of these analyses employed the entire sample of individuals available at each wave, regardless of whether these participants were gamblers or not, and whether they scored in the problem gambling range or not. While it may be the case that the causal mechanisms that operate to produce a problem gambler may differ from the mechanisms that operate to increase problem gambling symptoms; however, it is also plausible that the same mechanisms are at work.

The models were developed and refined on the QLS data first, and then applied to the LLLP data for replication, as the QLS had: a) a larger sample (3,656 complete cases versus 938 adult complete cases for LLLP); b) more time periods (five versus four for LLLP) with shorter and less variable inter-assessment intervals; c) a higher retention rate; d) a potentially more homogeneous population, as they were recruited from a more geographically circumscribed area; e) a full range of ages rather than the discontinuous age ranges of the LLLP study; and e) complete data on gambling behaviour, whereas lottery expenditure data was inadvertently not collected in Wave 1 of LLLP.

Structure and Stability of Gambling Behaviour Over Time

The general analytic approach involved conducting a series of confirmatory factor analysis models and longitudinal structural equation models. An introduction to these analyses is contained in Appendix D. Major results are summarized in the text for each of the analytic steps for readers unfamiliar with structural equation modeling.

A factor measuring overall level of gambling behaviour (‘Gamb’) was created for this investigation comprising equally weighted scores on total amount spent on gambling in the past

year ('spend'); number of types of gambling activities engaged in in the past year ('types'); and frequency of gambling in the past year ('freq'). Structural equation modeling was then used to determine whether this gambling behaviour factor had the same relationship to its three observed variables in each assessment period as well as in both the QLS and LLLP data sets. If so, this then allowed the examination of the stability of level of overall gambling behaviour from one time period to the next.

Figure 4 shows the results of this analysis for the QLS. The model fits quite well, with the root-mean-square error of approximation (RMSEA) = 0.059, indicating that it offers a statistically cogent explanation of the relationship between variables and factors. Good model fit also implies that the relationship between the three measures of gambling participation and the Gamb factor is similar in each time period. As can be seen, the loadings of spend (-.79), types (-.80), and frequency (-.71) on Gamb are quite high. That said, additional latent factors of 'spend', 'types', and 'freq' were created to account for the fact that each of these observed variables also contribute some unique variance.

As can be seen, there is a strong correlation (.89) from Gamb at one time period to the next time period. What this indicates is that: a) gambling behaviour is highly stable from one time period to the next; and b) the level of gambling behaviour in one time period strongly influences the level of gambling behaviour in the next time period.

This model was re-tested on the LLLP data, with the results displayed in Figure 5. The model fit was not quite as good, which may be due to the fact that in the first LLLP assessment the amount of money spent gambling on the most common form of gambling (lotteries) was inadvertently not collected only at Wave 1. Nonetheless, the same general findings were obtained in terms of the Gamb factor having a similar relationship to gambling expenditure, frequency, and number of gambling types engaged in across time periods, and there being a strong correlation between level of overall gambling in one time period to the next (.78) (i.e., the slightly lower correlation compared to the .89 observed in QLS may be due to the longer 17-22 month inter-assessment interval in LLLP).

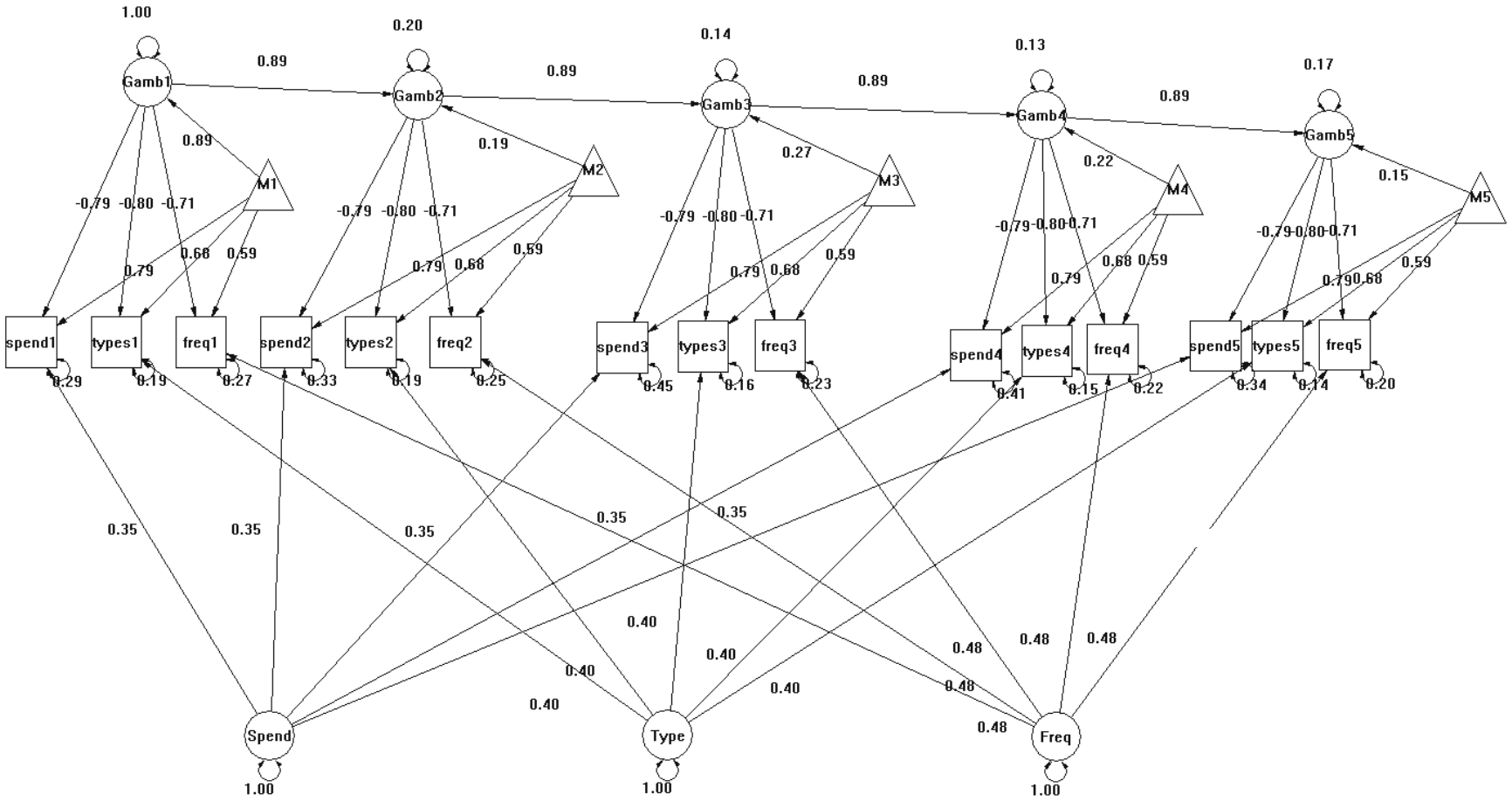


Figure 4: Structural Equation Modeling of Gambling Behaviour Over Five Waves of QLS

Squares represent the observed variables of gambling expenditure (spend); number of types of gambling engaged in (types); and frequency of gambling (freq).
Circles represent the underlying latent factors (e.g., Gamb) that the observed variables are believed to be manifestations of.
Triangles represent mean levels of the Gamb factor at each time period.
Numerical values are the standardized loadings/correlations between factors/variables (the Gamb correlation between time periods has been constrained to be equal).
Circular arrows represent unique variability.

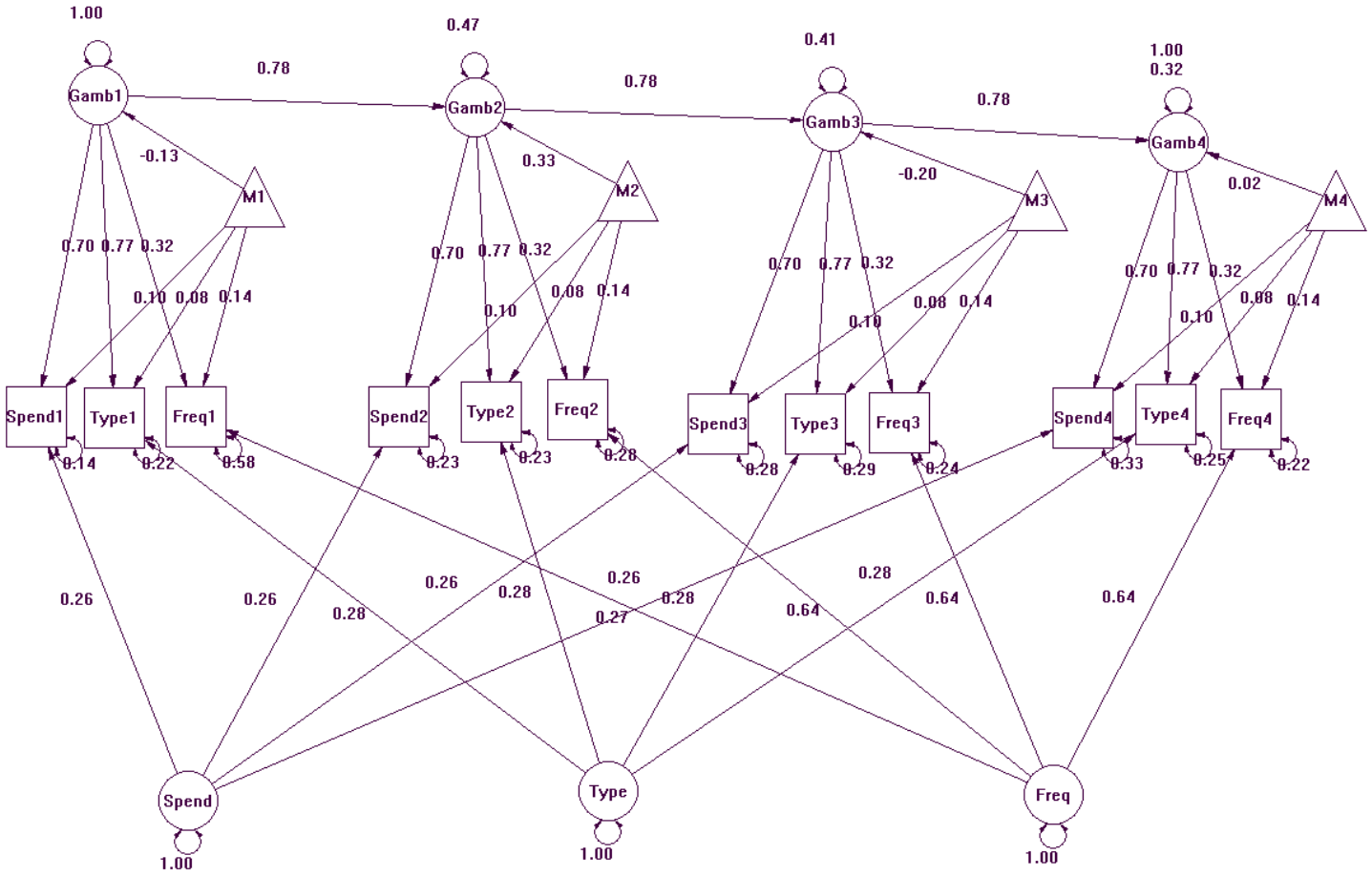


Figure 5: Structural Equation Modeling of Gambling Behaviour Over Four Waves of LLLP

Squares represent the observed variables of gambling expenditure (spend); number of types of gambling engaged in (types); and frequency of gambling (freq).
Circles represent the underlying latent factors (e.g., Gamb) that the observed variables are believed to be manifestations of.
Triangles represent mean levels of the Gamb factor at each time period.
Numerical values are the standardized loadings/correlations between factors/variables (the Gamb correlation between time periods has been constrained to be equal).
Circular arrows represent unique variability.

Stability of Problem Gambling Scores Over Time

Structural equation modeling was also applied to PGSI scores for both the QLS and LLLP data sets to determine whether problem gambling scores were also stable across time.

Following the approach used in the previous analysis, a latent CPGI factor was created comprising equally weighted scores on 3 observed variables: the score from a random set of three questions from the 9-item CPGI ('p1'); the score from a second random set of three CPGI questions ('p2'); and the score from a third random set of CPGI questions ('p3'). Structural equation modeling was then used to determine whether this latent CPGI factor had the same relationship to its observed variables in each assessment period as well as in each data set (QLS and LLLP). If so, this then allowed the examination of the stability of overall CPGI scores from one time period to the next.

Figure 6 shows the results of this analysis for the QLS. The model fits quite well, with the root-mean-square error of approximation (RMSEA) = 0.059, indicating that it offers a statistically cogent explanation of the relationship between variables and factors. Good model fit implies that the CPGI factor also has a similar relationship to its three observed variables at each time period. As can be seen, the loadings of p1 (.65), p2 (.57), and p3 (.36) on CPGI are reasonably high. As occurred in the previous analysis, additional latent factors of 'Parcel1', 'Parcel2', and 'Parcel3' needed to be created to account for the unique contribution of these observed variables.

As can be seen, the high correlation of CPGI scores between time periods (.79) indicates that: a) CPGI scores are fairly stable from one time period to the next; and b) CPGI scores in one time period strongly influence CPGI scores in the next time period.

This model was re-tested on the LLLP data with the results displayed in Figure 7. The model fit was equally good and the same general findings were obtained in terms of the CPGI factor expressing itself similarly across time periods and there being a strong correlation of CPGI scores from one time period to the next (.77).

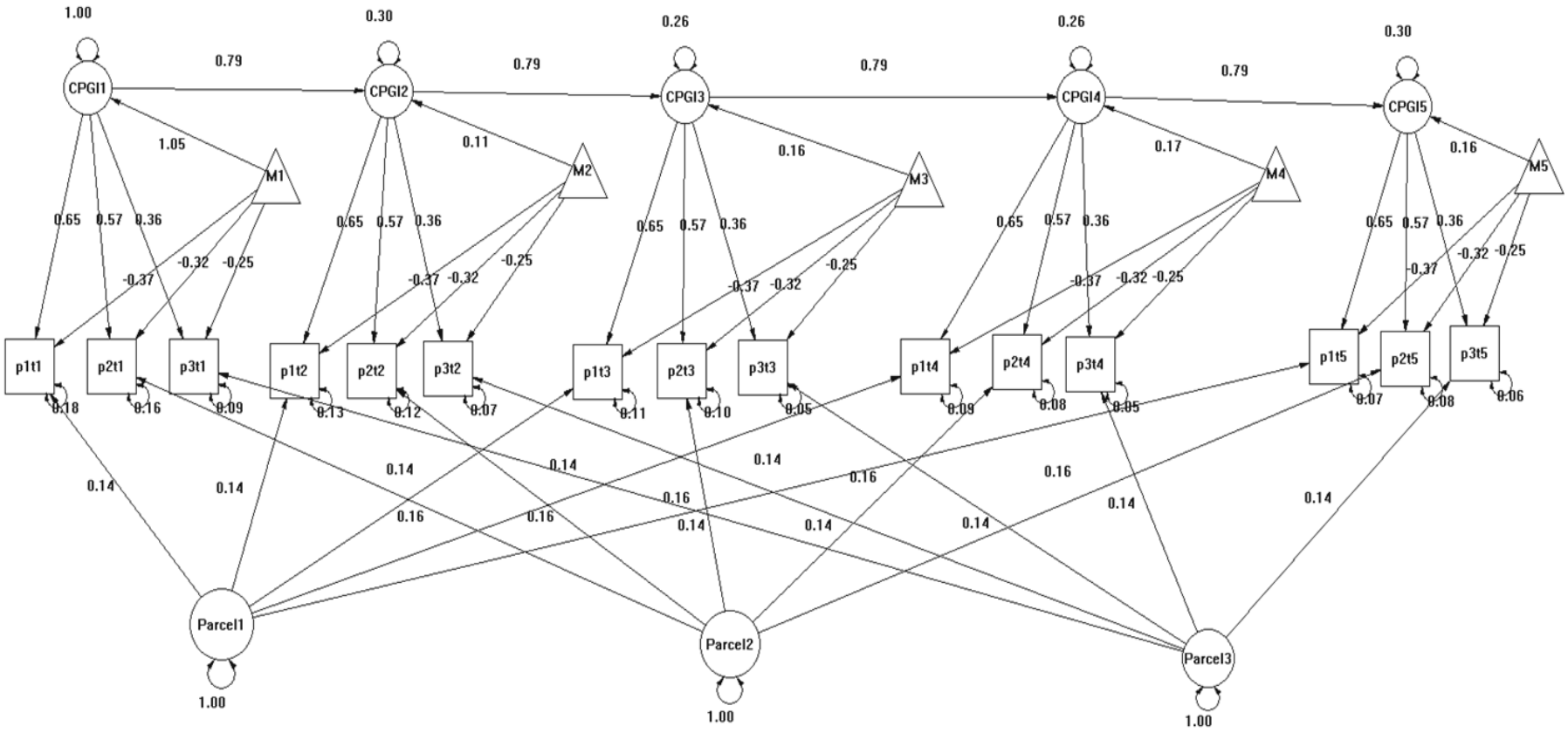


Figure 6: Structural Equation Modeling of Problem Gambling Scores Over Five Waves of QLS

Squares represent the observed variables of CPGI subset 1 (p1); CPGI subset 2 (p2); and CPGI subset 3 (p3).
Circles represent the underlying latent factors (e.g., CPGI) that the observed variables are manifestations of.
Triangles represent mean levels of the CPGI factor at each time period.
Numerical values are the standardized loadings/correlations between factors/variables (the CPGI correlation between time periods has been constrained to be equal).
Circular arrows represent unique variability.

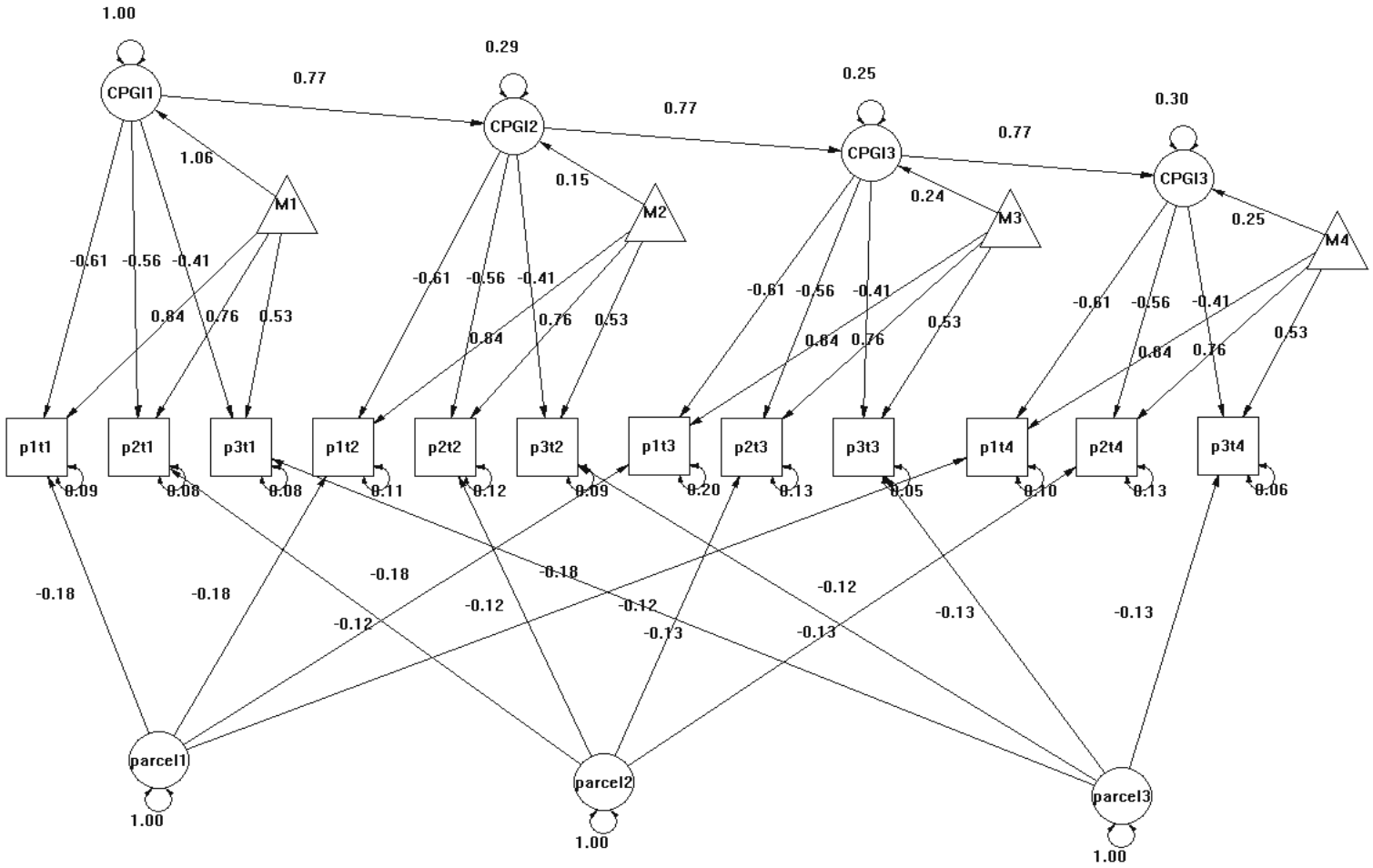


Figure 7: Structural Equation Modeling of Problem Gambling Scores Over Four Waves of LLLP

Squares represent the observed variables of CPGI subset 1 (p1); CPGI subset 2 (p2); and CPGI subset 3 (p3).
Circles represent the underlying latent factors (e.g., CPGI) of which the observed variables are manifestations; Triangles represent mean levels of the Gamb factor at each time period; Numerical values are the standardized loadings/correlations between factors/variables (the CPGI correlation between time periods has been constrained to be equal); Circular arrows represent unique variability..

Relationship Between Gambling Behaviour and Problem Gambling

The proposed relationship between gambling behaviour and problem gambling is outlined in Figure 8. Essentially what this figure shows is gambling behaviour to be an underlying latent factor which the observed variables of gambling expenditure; number of types of gambling engaged in; and frequency of gambling are believed to be manifestations of in addition to the unique variance of each of these three measures of gambling behaviour.

The level of gambling behaviour factor is postulated to have a direct influence on level of the underlying latent factor of problem gambling, which the observed PSGI scores of the CPGI are a manifestation of.

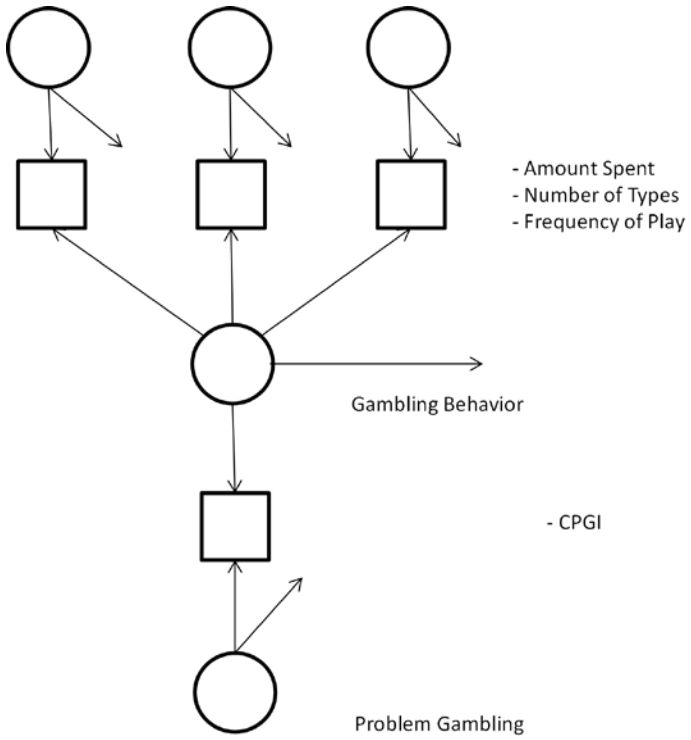


Figure 8: Relationship Between Gambling Behaviour and Problem Gambling

Figure 9 shows this model applied to the QLS data over five waves and Figure 10 shows this model applied to the LLLP data over four waves. This later model differs from the one shown in Figure 8 because there was limited evidence that there was a uniqueness trait underlying the amount spent at each point in time for the LLLP, which may be due to the anomaly previously noted for the Wave 1 LLLP data.

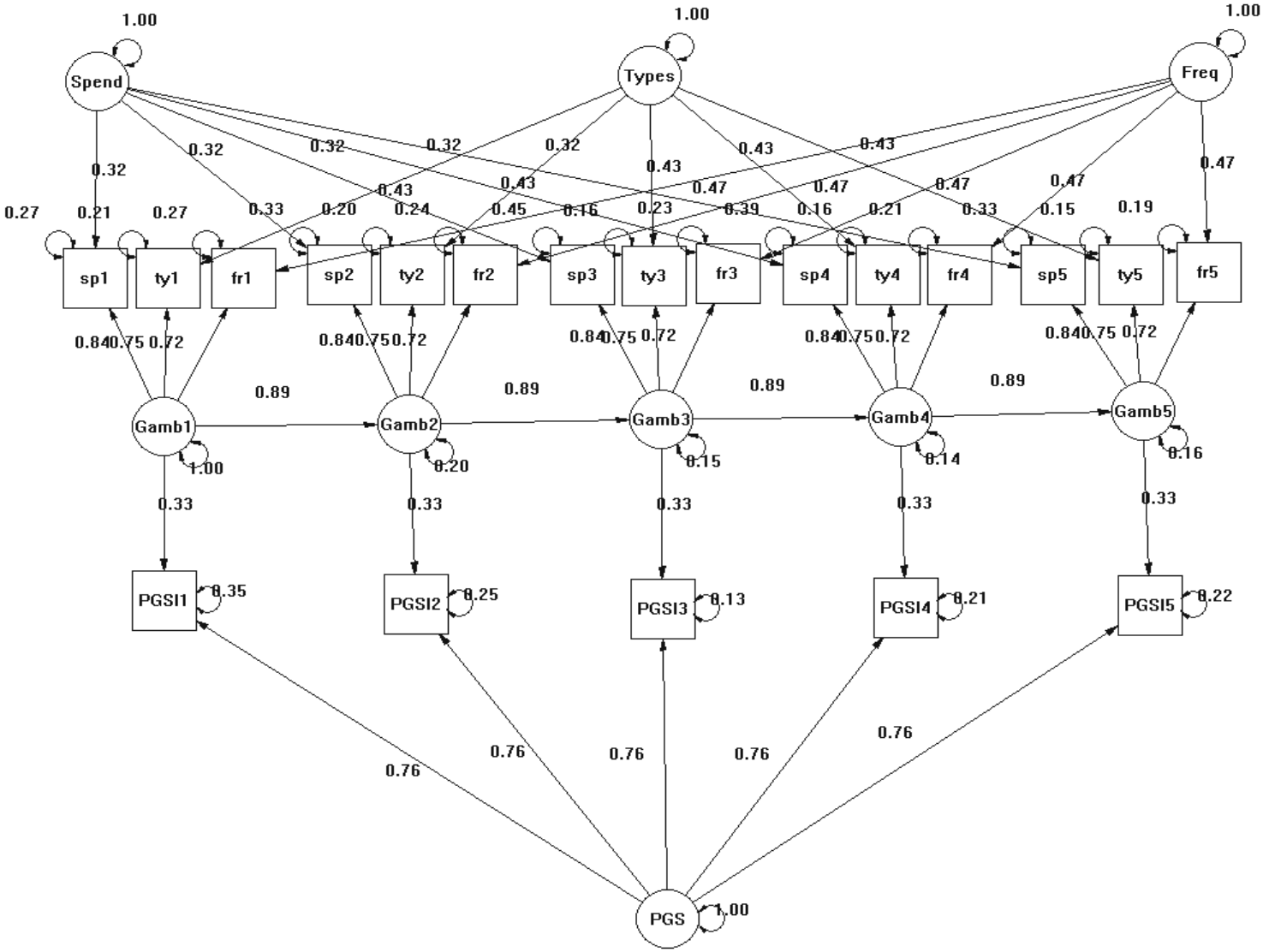


Figure 9: Basic Model for QLS Solved Across Five Waves

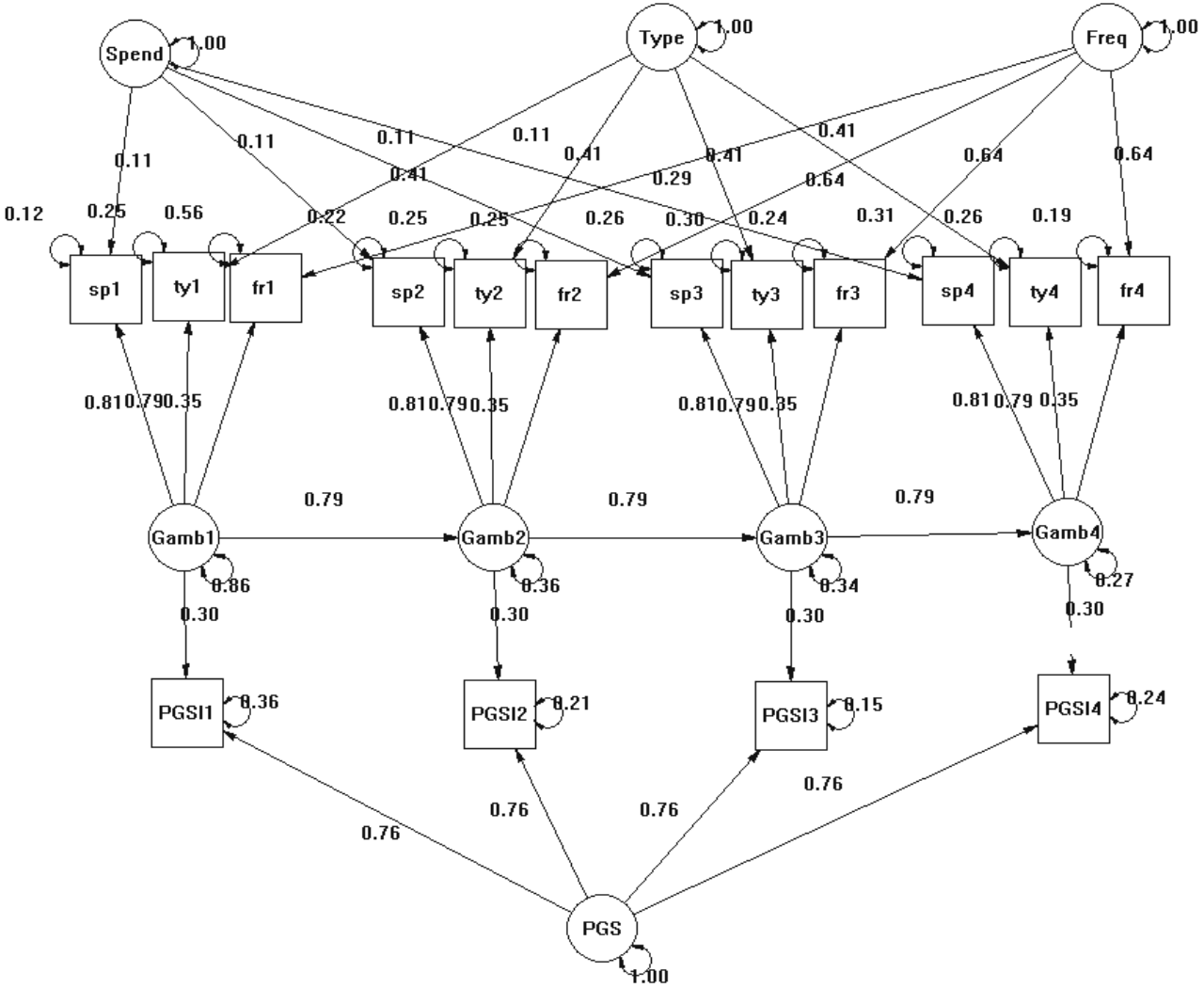


Figure 10: Basic Model for LLLP Solved Across Four Waves

Figure 11 is a summary of the coefficients for the QLS and Figure 12 is a summary of the coefficients for the LLLP data. In general, both models fit the data to an acceptable degree although the fit was better for the QLS data (RMSEA <0.05) than the LLLP data (RMSEA <0.07). There are also strong similarities between the two models despite the differences in the sampling design and measurement procedures across the two studies. Thus there is evidence that gambling behaviour is relatively stable from year to year (coefficients of 0.89 and 0.79). Further, the measures of gambling behaviour cohere to the same degree. All of the behaviour variables (preference for the number of types of gambling, frequency of play, and amount spent on gambling activities) show relatively stable elements through time. Gambling behaviour shows a smaller influence on the PGSI than on the individual elements of gambling behaviour in both studies, and this is interpreted as meaning that the relationship between gambling behaviour and problem gambling is a causal relationship between two separate latent variables, rather than as indicating that problem gambling is an indicator of gambling behaviour. Also notably, there is a consistent, but modest relationship (.33 for QLS; .30 for LLLP) between gambling behaviour and PGSI scores.

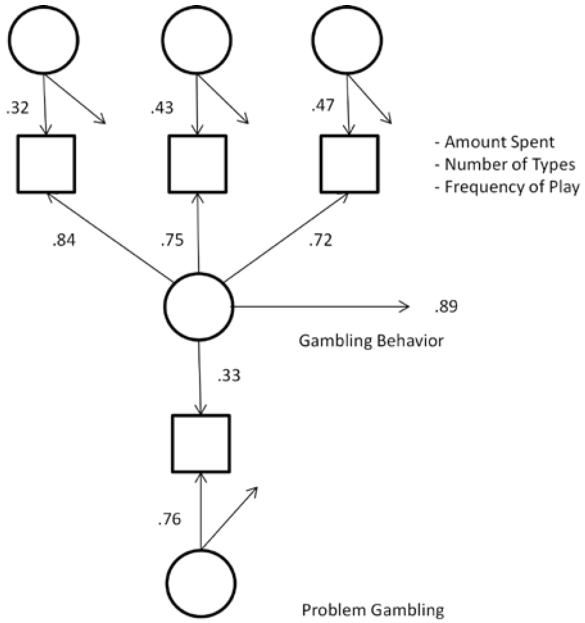


Figure 11: Coefficients for QLS

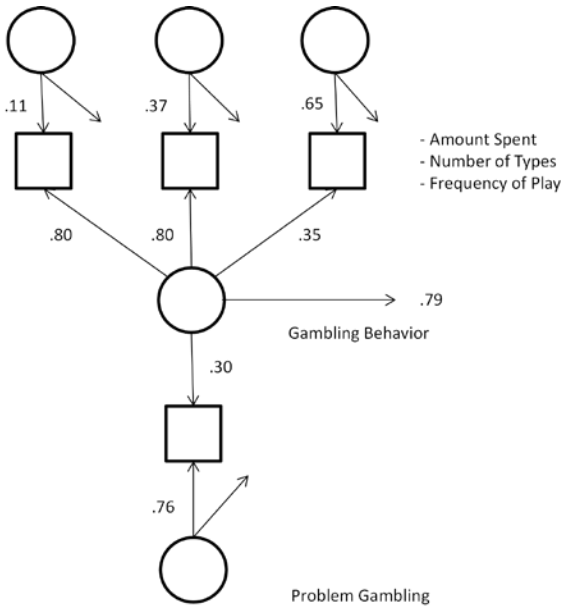


Figure 12: Coefficients for LLLP Study

Adding Stable Variables to the Model

Both the QLS and LLLP studies assessed a large number of variables in addition to those associated with gambling behaviour and problem gambling. It is therefore important to carefully plan analyses that explore the factors that influence the aforementioned gambling behaviour-problem gambling structure. The analyses reported here represent a small proportion of the analyses that can be conducted upon the data generated by the QLS and the LLLP. The analyses reported in this section are concerned with the influence of stable characteristics (i.e., those not expected to change) on gambling behaviour and problem gambling.

The analyses in this section involved variables in five sets: those related to validating the longitudinal design, standard demographic features, stable cognitive and personality traits where previous evidence had shown a relationship with gambling behaviour or problem gambling symptoms, early gambling experiences, and finally, additional variables related to problem gambling in particular, taken from Table 6. These variables were all considered as exogenous variables. As a result, only the direct effects of these variables are considered; neither indirect effects nor the possibility that variables are themselves measures of (i.e., reflective indicators of) a latent variable such as 'childhood gambling involvement', are considered in these analyses.

Specifically, in the first set of covariates we included a variable that represented the at-risk subgroup that was over sampled during the study recruitment (i.e., was at $\geq 70^{th}$ percentile on past month spending or frequency on gambling). This variable should predict greater gambling behaviour, and should also have a relationship to problem gambling symptoms, although the

nature of the relationship (whether direct or indirect) is unclear. The second set of variables included sex and age, although age was treated differently in the QLS and the LLLP studies as a result of differences in study design. The third set included excitement-seeking and impulsivity, sub-traits of extraversion and neuroticism respectively from the NEO big 5 personality traits (Costa & McCrae, 1992), intelligence (measured by different instruments in QLS and LLLP), and religiosity. These variables had been associated with gambling behaviour or problem gambling symptoms in previous research (as reviewed in Hodgins et al., 2012). The next set included the age at which an individual had first gambled, the proportion of friends who were gamblers, whether the parents gambled with the individual while the individual was growing up, whether a parent or parents were regular gamblers while the individual was growing up, and whether siblings were regular gamblers while the individual was growing up. These gambling context and early experience variables had also been shown to be associated with gambling behaviour or problem gambling symptoms in previous research (Hodgins et al., 2012). The final set included non-Caucasian ethnicity, whether an individual had an early big gambling win or loss, whether escape was a motivation for gambling, and whether a family member was a problem gambler. These variables were shown to be predictive of problem gambling in either the QLS or LLLP studies in the analyses previously reported in Table 6.

Analysis consisted of entering these variables into structural equation models in which the general structural longitudinal model of gambling behaviour and problem gambling symptoms was retained. In these models pathways from exogenous variables were initially restricted to be directed to the initial gambling behaviour latent variable and the stable latent trait for problem gambling symptoms. Modification indices were examined to determine if regressions on the latent variables gambling amount, gambling type, and gambling frequency would markedly improve the fit (as indexed by modification indices > 100); and such parameters were freed and the model refit. Relationships between the covariates were modeled with undirected associations. As previously, the initial analysis was conducted on the QLS, and then replicated to the extent possible with the LLLP data.

Results are shown in Table 10 for QLS and Table 11 for LLLP. (Note that the relationships involving age are more complex in Table 11 because the ages in the LLLP study were restricted to particular narrow ranges and are treated as a set of categorical variables rather than a single continuous variable).

Table 10: Standardized Coefficients for Latent Variables on Covariates for QLS Study

	Gambling Behaviour	Problem Gambling Symptoms	Gambling Amount	Number of Gambling Types	Gambling Frequency
At-risk group	0.326*	-0.004			
Age	-0.039	0.020	0.507*		0.248*
Sex (Male higher)	0.065*	-0.030			
Impulsivity	0.049*	0.158*			
Excitement Seeking	0.150*	-0.081*		0.166*	
Intelligence	-0.121*	0.010			
Religiosity	-0.099*	0.023			
Age first gambled	-0.065*	0.088*	0.171*		
Gambler friends	0.233*	-0.033			
Grew up gambling w parents	0.049*	-0.017			
Parents regular gamblers	0.009	0.002			
Siblings regular gamblers	0.065*	-0.009			
Non-Caucasian Ethnicity	0.059*	0.020			
Early big win	0.056*	0.049*			
Gamble to escape	0.093*	0.144*			
Problem Gambler in family	0.001	0.114*			

* $p<0.05$

Table 11: Standardized Coefficients for Latent Variables on Covariates for LLLP Study

	Gambling Behaviour	Problem Gambling Symptoms	Gambling Amount	Number of Gambling Types	Gambling Frequency
At-risk group	0.166*	0.019			
Age 18 to 20	-0.114*	0.003	-0.254*		-0.312*
Age 23 to 25	-0.112*	-0.040	-0.222		-0.257*
Age 43 to 45 (reference)	0	0	0		0
Age 63 to 65	0.087*	0.058	0.117		-0.015
Sex (Male higher)	0.075*	0.160*			
Impulsivity	0.033	0.227*			
Excitement Seeking	0.267*	0.065		0.147*	
Intelligence	-0.096*	-0.233*			
Religiosity	-0.079*	0.086			
Age first gambled	-0.156*	0.033	-0.163		
Gambler friends	0.162*	-0.027			
Grew up gambling w parents	0.094*	0.098			
Parents regular gamblers	0.078*	0.193*			
Siblings regular gamblers	0.041	0.095			
Non-Caucasian Ethnicity	-0.057*	-0.003			
Early big win	0.103*	0.166*			
Gamble to escape	0.163*	1.101*			
Problem Gambler in family	0.019	0.059			

$p<0.05$

The pattern of findings in the two studies is similar. In both studies, being at risk, being male, having higher excitement seeking traits, being less intelligent, being less religious, having started gambling younger, having gambler friends, gambling with parents while growing up, having an early big win or loss, and gambling to escape were all associated with increased gambling behaviour. In the LLLP study, younger gamblers gambled less, though age was not associated with gambling behaviour in the QLS study. Impulsivity was associated to a small extent with increased gambling behaviour in both studies but only statistically significant in the QLS study. In the QLS increased gambling was associated with having a sibling who was a regular gambler but not with having a parent who was a regular gambler, while the opposite pattern was observed in the LLLP study. Finally non-Caucasian ethnicity had opposite associations in the two studies, being associated with increased gambling behaviour in the QLS study but reduced gambling behaviour in the LLLP study. Problem gambling symptoms were associated with impulsivity, and early big win or loss, and gambling to escape in both studies. In the QLS study, problem gambling symptoms were negatively associated with excitement-seeking, positively associated with later onset of gambling behaviour, and having a problem gambler in the family; while in the LLLP study, being male, less intelligent, and having parents who were regular gamblers was associated with increased problem gambling symptoms. The size of the coefficients was generally small, which reflects the fact that no variable is overwhelmingly predictive of future gambling behaviour or problems – even gambling behaviour itself only correlates about .30 to .33 with problem gambling severity. Rather, consistent with the biopsychosocial etiology, there are many variables that each contribute a small but significant amount.

The findings for the QLS regarding the amount, number of gambling types, and gambling frequency unique latent variables were replicated in the LLLP study with the exception that larger amounts spent on gambling were associated with starting to gamble earlier in the LLLP and starting to gamble later in the QLS. Some of these differences may be due in part to the fact that that the age distributions were substantially different between the two studies; in particular, since there were no age restrictions in the QLS study there were relatively fewer younger persons in the sample, which may be responsible for the differing patterns involving age and gambling history variables.

Adding Mental Health Variables to the Model

In this section we consider mental health status variables measured at the first wave as exogenous variables influencing gambling behaviour and problem gambling symptoms. We consider these variables independently of the exogenous variables considered in the previous section. Based in part upon early analyses of the first wave LLLP data (Hodgins et al., 2012), we hypothesized that no particular mental disorder concurrent with the beginning of the study was differentially associated with problem gambling, but speculated that an association existed with the presence of one or more of these disorders. The impact of changes in mental health status during the studies is considered in a later section.

In the QLS the presence or absence of seven mental health disorders (post traumatic stress disorder, depression, mania, obsessive-compulsive disorder, generalized anxiety, panic disorder, and bulimia) were assessed by the CIDI instrument (Kessler, Andrews, Mroczek, Ustun, & Wittchem, 1998). Our model formed a single formative indicator from all of these variables that we called Mental Disorder. Additional exogenous variables included the presence of a childhood trauma (one question), the presence of a drug abuse disorder, tobacco use disorder, alcohol use disorder, and antisocial personality disorder (as measured by a scale from the PAI (Morey, 2007). As was the case above, these variables were then included in structural equation models where the general structural longitudinal model of gambling behaviour and problem gambling symptoms was retained. The fit was marginal and there was no indication (i.e., through high modification indices) that any of these variables had a strong relationship with the other latent variables in the general structural longitudinal model. The results are presented below in Table 12.

Table 12: Impact of Mental Health Variables on Gambling Behaviour and Problem Gambling Symptoms for QLS Study

	Gambling Behaviour	Problem Gambling Symptoms
Mental Disorder (Formative Index)	0.016	0.110*
Antisocial Personality Disorder	0.184*	0.016
Drug Abuse Disorder	0.006	0.076*
Tobacco Use Disorder	0.183*	-0.021
Alcohol Use Disorder	0.024	-0.057*
Childhood Trauma	-0.073*	0.052*

* $p<0.05$

Mental disorder was associated with problem gambling symptoms but not gambling behaviour, as was the presence of drug abuse disorder. Antisocial personality disorder showed the opposite pattern, being associated with Gambling behaviour but not problem gambling symptoms. Higher tobacco use was associated with higher Gambling Behavior, and lower alcohol use disorder with lower problem gambling symptoms. Finally the presence of childhood trauma was associated with more problem gambler symptoms, but lower gambling behaviour.

In the LLLP study, while the same variables are generally represented, they were generally measured in a different way. Thus, a different set of mental health disorders were measured including anxiety, depression, mania, somatic complaints, paranoia, schizophrenia, and borderline personality, all by PAI continuous scales. These scales and obsessive compulsive disorder as diagnosed by the CIDI instrument were combined into a single formative indicator that was called mental disorder. The additional variables included childhood trauma (as comprehensively measured by the CTQ), and antisocial personality disorder (also measured in the LLLP by the PAI). The presence of a drug abuse disorder, tobacco use or alcohol use disorder were also measured differently, using procedures from the CCHS. As above, these variables were included in a structural equation model in which the general structural longitudinal model of gambling behaviour and problem gambling symptoms was retained. The fit was acceptable,

though, as in other places, lower than with the model fit with QLS data). There was no indication (i.e., through high modification indices) that any of these variables had a strong relationship with the other latent variables in the general structural longitudinal model. The results are presented below in
Table 13.

Table 13: Impact of Mental Health Variables on Gambling Behaviour and Problem Gambling Symptoms for LLLP Study

	Gambling Behaviour	Problem Gambling Symptoms
Mental Disorder (Formative Index)	-0.026	0.226*
Antisocial Personality Disorder	0.271*	0.083*
Drug Abuse Disorder	0.037	0.139
Tobacco Use	-0.011	0.234*
Alcohol Use Disorder	0.008	0.055
Childhood Trauma	0.075*	0.086*

* $p<0.05$

The pattern of coefficients was similar to that discovered in the QLS, particularly for mental disorder which is related to problem gambling symptoms but not gambling behaviour. Antisocial personality is associated with gambling behaviour and less strongly with problem gambling symptoms whereas in the QLS it was not associated with problem gambling symptoms. Childhood trauma was associated in both studies with problem gambling symptoms, but was associated in different directions with gambling behaviour. Patterns of association with tobacco use and alcohol use disorder were different, though the pattern was similar for drug abuse disorder though the coefficient for association with problem gambling symptoms was not statistically significant in the LLLP study.

Additional Variables

Both the QLS and LLLP studies assessed a large number of variables. We have not yet developed models or added variables to current models to assess the full range of possibilities for effective causal models. In this section, we offer a preliminary investigation of some variables that exploratory analyses suggested might be associated with the gambling behaviour and problem gambling symptoms latent variables. For this purpose we again created indicators of gambling behaviour by summing standard scores for (the natural log of) amount spent gambling, number of types of gambling, and reported frequency of gambling; and of potential for problem gambling by summing the nine items of the PGSI-CPGI. Each of these two indicators was calculated for each of the five waves of the QLS and four waves of the LLLP and then these variables were correlated with other variables of interest. While full structural equation models directly incorporating these variables would be more definitive, the following tables are strongly suggestive of the significance of predictors.

In Table 14 and Table 15, the correlations between the gambling behaviour and the problem gambling potential variables and the NEO personality trait measures of agreeableness, conscientiousness, and openness are given (the other two major personality traits neuroticism, and extraversion are represented in previous models by the sub-traits impulsivity and excitement seeking). There were no formal hypotheses driving this analysis.

Table 14: Correlations Between Agreeableness, Conscientiousness, and Openness at Baseline and Gambling and Problem Gambling for the QLS

	Agreeableness	Conscientiousness	Openness
Gambling Behaviour Wave 1	-.143	-.011	-.171
Gambling Behaviour Wave 2	-.146	-.016	-.172
Gambling Behaviour Wave 3	-.116	-.012	-.171
Gambling Behaviour Wave 4	-.094	-.005	-.154
Gambling Behaviour Wave 5	-.097	-.011	-.166
Problem Gambling Wave 1	-.122	-.116	-.045
Problem Gambling Wave 2	-.107	-.099	-.021
Problem Gambling Wave 3	-.080	-.086	-.014
Problem Gambling Wave 4	-.048	-.069	-.009
Problem Gambling Wave 5	-.072	-.073	-.030

Note: Correlations greater in absolute value than 0.05 are statistically significant p<0.01

Table 15: Correlations Between Agreeableness, Conscientiousness, and Openness at Baseline and Gambling and Problem Gambling for the LLLP

	Agreeableness	Conscientiousness	Openness
Gambling Behaviour Wave 1	-.127	-.094	-.058
Gambling Behaviour Wave 2	-.092	-.048	-.098
Gambling Behaviour Wave 3	-.076	.001	-.092
Gambling Behaviour Wave 4	-.081	.012	-.113
Problem Gambling Wave 1	-.168	-.165	-.043
Problem Gambling Wave 2	-.129	-.130	-.056
Problem Gambling Wave 3	-.124	-.083	-.056
Problem Gambling Wave 4	-.167	-.099	-.045

Note: Correlations greater in absolute value than 0.06 are statistically significant p<0.01

The three traits show different patterns of relationship to the gambling variables. Specifically, agreeableness is associated with lower levels of gambling behaviour and lower levels of problem gambling symptoms; conscientiousness is not associated with gambling behaviour but appears to be associated with slightly lower potential for problem gambling symptoms; and openness is associated with lower gambling behaviour (though more clearly so in the QLS) and does not appear to be associated with problem gambling symptoms. It is unclear whether the traits assessed in the first wave have a decreasing size of association through time. In addition, the personality traits do show associations with each other. A more comprehensive set of findings must await a more detailed structural equation model.

The examination of the relationships between gambling behaviour, problem gambling symptoms, and attitudes towards gambling was initiated for the LLLP study in Smith et al. (2011) and included an analysis of the extent to which gambling attitudes could be considered unitary. The measures of attitudes towards gambling differed between the two studies; the QLS used a three item scale while the LLLP study used a ten item scale. Scoring was derived from the Smith et al. (2011) analysis.

Table 16 presents the correlations between a three item scale of attitudes towards gambling and estimated scores for the gambling latent variables at each of the five waves of the QLS. In theory this might allow an examination of the extent to which attitudes influence subsequent gambling and the extent to which gambling influences subsequent attitudes towards gambling. A detailed consideration is not attempted here.

Table 16: Associations Between Gambling Attitudes and Gambling Latent Variables for QLS

	Gambling Attitudes Wave 1	Gambling Attitudes Wave 2	Gambling Attitudes Wave 3	Gambling Attitudes Wave 4	Gambling Attitudes Wave 5
Gambling Behaviour Wave 1	.386	.362	.360	.339	.326
Gambling Behaviour Wave 2	.349	.360	.356	.330	.318
Gambling Behaviour Wave 3	.328	.342	.348	.318	.300
Gambling Behaviour Wave 4	.332	.336	.339	.330	.307
Gambling Behaviour Wave 5	.325	.330	.334	.317	.322
Problem Gambling Wave 1	-.099	-.107	-.092	-.099	-.111
Problem Gambling Wave 2	-.072	-.112	-.099	-.106	-.104
Problem Gambling Wave 3	-.079	-.101	-.093	-.113	-.127
Problem Gambling Wave 4	-.063	-.098	-.094	-.136	-.118
Problem Gambling Wave 5	-.105	-.121	-.107	-.129	-.133

Note: Correlations greater in absolute value than 0.05 are statistically significant $p<0.01$

There is a moderate relationship between greater gambling behaviour and the extent to which one manifests a positive attitude towards gambling. In general the relationship between attitudes at any given time and behaviour at subsequent times get successively smaller, as does the relationship between behaviours at any given time and attitudes at subsequent times. This alone is insufficient to allow causal inferences. The relationship between problem gambling symptoms and gambling attitudes is of lesser magnitude but appears slightly paradoxical. Specifically, positive attitudes towards gambling are associated with lower problem gambling

symptoms. Another way of stating this relationship is that higher problem gambling symptoms are associated with a more negative attitude towards gambling. There is no apparent consistency in the relationships of measures taken at any one time with measures taken subsequently.

Table 17 presents the correlations between a ten item scale of gambling attitudes and the gambling latent variables at each of the four waves of the LLLP study.

Table 17: Associations Between Gambling Attitudes and Gambling Latent Variables for LLLP

	Gambling Attitudes Wave 1	Gambling Attitudes Wave 2	Gambling Attitudes Wave 3	Gambling Attitudes Wave 4
Gambling Behaviour Wave 1	.315	.308	.336	.318
Gambling Behaviour Wave 2	.243	.279	.314	.306
Gambling Behaviour Wave 3	.228	.255	.301	.299
Gambling Behaviour Wave 4	.224	.249	.310	.276
Problem Gambling Wave 1	-.025	.000	-.006	.011
Problem Gambling Wave 2	.027	.044	.059	.058
Problem Gambling Wave 3	.003	.034	.028	.004
Problem Gambling Wave 4	.038	.094	.081	.015

Note: Correlations greater in absolute value than 0.09 are statistically significant $p<0.01$

Despite the fact that the scales measuring attitudes towards gambling differ between the two studies the broad pattern of results is similar for the LLLP study. That is, there is a positive relationship between attitudes toward gambling and gambling behaviour, and essentially no relationship between attitudes toward gambling and problem gambling level. In general, the relationship between gambling attitudes at a given time and subsequent gambling behaviour decays at successive time intervals as was also observed for the QLS (see Table 17 columns), however the relationship between gambling behaviour at a given time and attitudes at a subsequent time tends to increase at successive time intervals (see Table 17 rows). These differences are small, and do not allow causal inferences on the relationship between behaviour and attitudes through time. Further attention to the relationship between gambling attitudes and gambling latent variables is warranted.

Change Scores

There is strong evidence from the analyses above that both gambling behaviour and problem gambling level are relatively stable characteristics of individuals in these studies. However, there remain a sufficient amount of variability from one time period to the next within individuals to make it worthwhile examining whether changes in short term states of the individual may also lead to changes in gambling behaviour, in problem gambling severity, or both.

The methods used for examining these possibilities were fixed effects multiple regressions (Allison, 2009), a technique that requires longitudinal panel data because it operates on change scores. Consistent with the models above, these analyses were conducted on change scores for gambling behaviour (as derived from a combination of the variables previously described: Amount spent gambling in the past 12 months, number of types of gambling played in the last 12 months, and frequency of gambling in the past 12 months), and on change scores for the PGSI score as an indication of problem gambling. This analysis regresses the difference from the individual's mean at a given time point for each of the variables on the difference scores for variables that were assessed at the same time period. Analyses were restricted to variables expected to have shown some change (i.e., not stable traits) and controlled for time period. Separate analyses were conducted on concurrent state change to gambling behaviour and to problem gambling (controlled for gambling behaviour). We also conducted an analysis where we added changes in the previous year to the equations (with a consequent loss of one year of data) to determine if there was continued change in the current year.

For the first set of analyses all five panels of the QLS were used. The variables include: summary measures of marital/relationship functioning (score on a standard questionnaire), family functioning (a single rating), community involvement (sum of six ratings), stressful life events (number from a total of 58 events), number of illegal activities (number from a list of 14 crimes), mental distress (number of diagnoses from a set of seven disorders), substance abuse (change in substance abuse diagnosis), change in physical health (a single rating), change in household income (a single item), change in employment status (a single item), change in happiness rating (a single item), and change in life satisfaction. In line with the results from previous analyses, changes in gambling behaviour are analysed, and changes in problem gambling are analysed separately with changes in gambling behaviour included in the regression equation. Results are presented in Table 18.

Table 18 shows that current changes in most states were associated with slight increases in gambling behaviour (and it should be noted that it is *increases*, i.e., improvements, in community involvement). As expected, increases in stressful events, illegal activities, mental distress, and substance abuse led to increases in gambling behaviour. Improvements in the previous year for relationship functioning and family functioning are more predictive than contemporaneous changes, and changes in the previous year for stressful life events, illegal activities, mental distress, and (increases in) happiness are predictive of increases in gambling behaviour also with generally larger effects. Of the changes in the current year associated with

increases in gambling behaviour, only changes in substance abuse in the previous year fails to be associated with increases in gambling behaviour.

Table 18: Effect of Change in State on Gambling Behaviour and Problem Gambling for QLS

Change in:	Gambling Behaviour	Problem Gambling
In Current Year Change in		
Relationship Functioning	-0.006	-0.005
Family Functioning	-0.007	-0.017*
Community Involvement	0.017*	-0.006
Stressful Life Events	0.017*	0.035*
Illegal Activities	0.020*	0.025*
Mental Distress	0.018*	0.071*
Substance Abuse	0.028*	0.026*
Physical Health	0.005	0.003
Household Income	0.005	0.013
Employment	-0.001	0.012
Happiness	0.015	-0.019*
Life Satisfaction	0.009	-0.032*
Gambling Behaviour	¤	0.192*
In Addition Change in Previous Year in		
Relationship Functioning	0.018*	0.011
Family Functioning	0.017*	0.005
Community Involvement	-0.005	-0.019*
Stressful Life Events	0.021*	0.014
Illegal Activities	0.027*	0.008
Mental Distress	0.028*	0.002
Substance Abuse	-0.003	0.024*
Physical Health	-0.003	-0.004
Household Income	0.014	-0.005
Employment	0.011	-0.001
Happiness	0.025*	0.018
Life Satisfaction	-0.001	-0.021
Gambling Behaviour		0.018*

*Beta weights statistically significant ($p<0.05$)

Increases in problem gambling are associated with increases in stressful life events, illegal actvities, mental distress, substance abuse, and most of all, increases in gambling behaviour. Increases in family functionning, happiness, and life satisfaction are associated with decreases in problem gambling severity. For the previous year, only changes in substance abuse, and gambling behaviour are associated with increases in problem gambling level. Increases in

community involvement are associated with decreases in problem gambling. Overall, all of these effects are small.

The second set of analyses were conducted on the LLLP dataset, which had four waves. In addition, some concepts were not measured (relationship functioning, community involvement, happiness, satisfaction with life) or not consistently measured across the four waves (Mental Distress as the number of probable psychiatric diagnoses). Further some measures were assessed differently: family functionning was measured with the Family Environment Scale, drug abuse and alcohol diagnosis were separately diagnosed, and physical health and mental health were measured by the SF-8 (Table 19).

Table 19: Effect of Change in State on Gambling Behaviour and Problem Gambling for LLLP

Change in:	Gambling Behaviour	Problem Gambling
In Current Year Change in		
Family Functioning	0.002	-0.009
Stressful Life Events	0.022	0.021
Drug Abuse	-0.005	0.104*
Alcohol Abuse	0.032*	0.052*
Physical Health	-0.027	-0.025
Mental Health	-0.024	-0.033*
Household Income	0.037*	-0.022
Employment	-0.057*	-0.022
Gambling Behaviour		0.193*
In Previous Year Change in		
Family Functioning	-0.006	-0.039*
Stressful Life Events	0.003	-0.010
Drug Abuse	-0.031	0.030*
Alcohol Abuse	0.016	-0.028
Physical Health	-0.010	0.024
Mental Health	0.005	-0.008
Household Income	0.018	0.015
Employment	0.011	0.037
Gambling Behaviour		0.003

*Beta weights statistically significant (p<0.05)

Table 19 shows that current changes in most states were again associated with slight increases in gambling behaviour. Increases in alcohol abuse are associated with increases in gambling behaviour in the LLLP study. As well, an increase in income or becoming unemployed are also associated with increasing gambling behaviour. It should be noted that, while not significant, the coefficient for stressful events is of the same magnitude and direction as discovered in the QLS study (recall that the LLLP had one fewer wave of data and fewer participants). The same can be said about the mental distress and mental health variables although they were

measured in very different ways. None of the variables from the previous year has direct effects on gambling behaviour.

As in the QLS study, for problem gambling severity, increases are associated with decreases in mental health, drug and alcohol abuse, and most of all, increases in gambling behaviour. While not significant, the coefficient for stressful events is in the same direction and only slightly diminished in magnitude as discovered in the QLS. Consistent with the QLS, previous year changes in drug abuse were associated with increases in problem gambling. Increases in family functioning and community involvement were associated with decreases in problem gambling severity the following year.

Some caveats are necessary for the analyses reported here. First, because these models are regression models, the relationships with gambling behaviour and problem gambling have been attenuated relative to what would be expected in latent variable models such as the structural models presented earlier. Second, these models do not provide a strong basis for unraveling intermediate causal relationships; they are only concerned with estimating direct effects of the independent variables on the dependent variables, therefore it is not clear whether changes in substance abuse are associated with changes in mental distress for example. As well, the direction of causation is not unequivocal; for example, in the concurrent change models, it may be that a downward change in problem gambling level causes an increase in family functioning rather than the reverse. Finally, it should be noted that considerable potential remains for further analyses, both with more fine-grained items and with increasingly sophisticated analytic techniques such as latent variable structural equation modeling.

DISCUSSION

The LLLP and its sister study conducted in Quinte (QLS) are unique in their breadth and depth of assessment of relevant variables associated with gambling and problem gambling. This report focuses on a number of central research questions in the field that are best answered with longitudinal data, including identifications of factors that predict gambling and problem gambling, the natural course (stability and instability) of gambling problems, and the overall longitudinal relationship between gambling involvement and problem gambling severity. Because of the similarity in the design of these two cohorts, parallel analyses were conducted where possible to strengthen the confidence in our results.

Factors Associated with Concurrent Gambling Problems

Factors associated with a concurrent gambling problem across both the LLLP and QLS were largely consistent with previous cross-sectional research (Johansson et al., 2009). As expected, problem gamblers were more likely to have more frequent involvement and greater expenditure in most forms of gambling, as well as all aggregate measures of gambling involvement (number of formats, aggregate frequency, aggregate expenditure, and aggregate time spent). They also were more likely to report an early big win in their gambling history as well as family exposure to gambling and/or problem gambling while growing up. Finally, they were more likely to have gambling fallacies and more likely to indicate that they gamble to escape or distract from negative feelings, and to win money.

Demographically, the only characteristic robustly associated with concurrent problem gambling was being non-Caucasian. Unlike previous research, male gender, younger age, and lower income were not consistent correlates.

Problem gambling was robustly associated with several personality traits (neuroticism, depression, vulnerability, impulsivity, lower agreeableness, and lower conscientiousness). It was also robustly associated with lower physical health, and most mental health disorders. There was a consistent association with substance use and abuse in QLS, but not LLLP, in which only drug dependence was associated with gambling problems.

Factors Predicting First Onset of Gambling Problems

Whereas the analyses of factors concurrently associated with problem gambling serve to replicate previous research conducted with cross-sectional designs, the analyses of predictors of future onset of gambling problems capitalize on the unique features of longitudinal designs. Generally, variables indicating frequent and heavier involvement in gambling were as a set predictive of future problems in both the LLLP and QLS. In addition, indicators of development of future problems included gambling to escape, dissociating while gambling, and endorsing gambling cognitive fallacies. Reporting stressful life events was also a robust predictor.

Whereas a large number of variables were found to be associated with gambling problems concurrently, relatively fewer were predictive of first onset of problems. However, these robust predictors are modifiable risk factors.

Efforts to reduce the amount that people gamble may be the most effective way of preventing problem gambling. Despite the popularity and rapid expansion of gambling in the past ten years, there have been no widespread attempts by industry or regulators to limit how much people gamble. In contrast, several interventions exist to help the general public reduce alcohol consumption including low-risk drinking guidelines, mandatory reporting of alcohol content on bottles, and check stop programs. Strategies used to date designed to help people limit the amount they gamble have been either vague (guidelines such as 'set a limit and stick to it') or lack research evidence of their effectiveness (e.g., responsible gambling features and the use of 'pop-up' messages on VLTs; Williams, West, & Simpson, 2012). Strategies such as requiring players to set monthly and daily time and spending limits, preventing access to onsite ATMs and other sources of cash, or limiting maximum bets to small amounts are largely untested.

Employing the same methodology and population-based approach used in the low-risk drinking guidelines, an Alberta-based research team developed low-risk gambling limits for frequency, total expenditure, and proportion of income spent on gambling (Currie et al., 2006). The low-risk limits were validated on several population datasets, however the cross-sectional nature of the data remained a significant barrier for wider acceptance. The LLLP provided the opportunity to test the limits using longitudinal data. In a side study using data from the first two waves we demonstrated that gamblers who exceeded the low-risk limits at Wave 1 were more likely to experience gambling problems at Wave 2 compared to gamblers who stayed within the limits (Currie et al., 2011). For each additional low-risk limit exceeded the odds of experiencing future harm from gambling increased by a factor of three. We also found that gamblers who shifted from high-risk to low-risk levels of gambling reported less harm at Wave 2, although this result was not statistically significant. Nevertheless, the overall results provide preliminary evidence that a change in amount of gambling produces a change in gambling problems in the same direction (reducing the amount of gambling results in fewer problems; increasing the amount of gambling results in more problems). These results were based on only two time periods and using low-risk limits that are moderately conservative (the low-risk limit for frequency was gambling no more than three times per month). The results may be stronger using all four LLLP waves and exploring different thresholds.

While it may be unrealistic to expect gamblers to move to reduce their proximity to gambling venues, systemic interventions can address this risk factor by imposing limits on the number and availability of gambling machines. Alberta attempted to do this when it imposed a fixed cap on the number of video lottery terminals in province in 1996 although critics argue that gambling proprietors got around this cap by dramatically increasing the number of slot machines. The number of slot machines in the province increased 35% over the time period of the LLLP. It would not be necessary to limit availability of all forms of gambling, just EGMs,

which the research evidence consistently shows is the most problematic form of gambling (Breen & Zimmerman, 2002; Welte et al., 2004).

Stability of Problem Gambling

The analytic approach taken in determining stability and change in problem gambling status involved accounting for measurement imprecision in the instruments used to assess problem gambling. Previous analyses of change in problem gambling status over time have not considered measurement error and may, inadvertently, overestimate the frequency of change (e.g., Slutske, Jackson, & Sher, 2003b; Abbott, Volberg, & Williams, 1999; Winters et al., 2005). For example, on the CPGI problem severity measure (PGSI), which is considered to be a reliable screen for problem gambling, individuals' scores will often change one or two points if the scale is re-administered within a few weeks, even if their problem status is unchanged. Therefore, to avoid mislabelling such measurement variability as change, the analyses of stability in this report required a change of at least three points on the measure in order to be considered "reliable." This cut-off is derived statistically based upon previous research reports of the reliability of the scale in general population samples.

Examination of the patterns of stability and reliable change among individuals who met the scoring cut-off for problem gambling in the LLLP and QLS yields a few insights. First off, of the individuals who met the cut-off for problem gambling sometime during the study, roughly half were problem gamblers in only a single time period. One year thus represents the modal duration of problem gambling, with two years being the second most common duration. Chronic problem gambling is a less common pattern. Secondly, only a minority of problem gamblers were problem gamblers in three, four, or five consecutive time periods,[5] and risk of chronic problem gambling was observed to increase with each consecutive year of problem gambling status.

Approximately 80% of problem gamblers will have at least one year of remission in a five year period. Of those that do remit, only about one-third are observed to relapse, although the maximum time period to observe relapse was only the subsequent three years following a recovery year. The longer-term relapse rate is unknown, but is likely significantly higher. Probability of relapse increases with increased prior duration of problem gambling and with increased time. The relapse rate observed is lower than the rate seen in treatment samples where the majority of treatment participants lapse at some point in the post treatment period (Goudriaan et al., 2008; Hodgins & el-Guebaly, 2004; Ledgerwood & Petry, 2006).

[5] Chronicity is somewhat higher in LLLP compared to QLS. However, this is likely due to the pattern of missing assessments in LLLP. In LLLP there were 37 individuals who were CPGI 5+ problem gamblers at some point but did not complete all 4 assessments, leaving only 57 individuals to be displayed and quantified in the tables. A very high portion of these 37 people were problem gamblers in only *one* identified time period (i.e., 26/37 = 76.5%). If we assume these 26 individuals had the same high rate of recovery and relatively low rate of chronicity as other individuals identified as problem gamblers in a single time period, then the proportion of problem gamblers being problem gamblers in 3 or more time periods (consecutive or otherwise), decreases to rates more similar to the QLS.

It is important to acknowledge that addiction behaviours are inherently unstable and our results for problem gambling are not dissimilar from those found in other addictive disorders. Of course, comparisons to the stability of alcohol and drug use disorders are challenged by methodological variations in how conditions are assessed, how stability is defined, and frequency of follow-up periods. Most longitudinal studies of alcohol and drug use have examined the stability of specific diagnoses scored in dichotomous terms (i.e., presence or absence of alcohol dependence, abuse, etc.). Furthermore, these studies have not adjusted for the test-retest reliability of the assessment instruments as we have done using the reliable change index. Nonetheless, there appears to be natural instability with even a lifetime diagnosis of alcohol or drug dependence. In theory, a lifetime diagnosis for an addiction should remain constant across all time intervals; any change within the individual reflects a weakness of the assessment tool, participant recall problems, or both. In the Collaborative Study on the Genetics of Alcoholism, only 70% of individuals found to have a lifetime DSM-IV diagnosis of alcohol dependence at baseline also had a lifetime diagnosis of alcohol dependence at a 5-year follow-up interval (Culverhouse et al., 2005). The stability of lifetime DSM-IV diagnoses for marijuana and cocaine dependence over five years was about the same (66% and 74% had the diagnosis at both time periods). In one of the seminal longitudinal studies of the natural history of alcoholism 46% of male participants remained alcohol dependent after a four-year interval (Hasin, Grant, Endicott, 1990). The remaining participants showed complete remission of dependence (39%) or transitioned to less severe alcohol problems (15%). Most men who showed full or partial remission did so without formal treatment.

Similar results have been reported for less severe alcohol and drug problems. In a large community-recruited sample of at-risk drinkers, there was considerable shifting in and out of problematic drinking levels across the four waves separately by 6-month intervals (Booth et al., 2001). Comparable results have been found with adolescence cannabis use where a high rate of remission of cannabis abuse and dependence has been observed from baseline to follow-up intervals (Perkonigg et al., 1999).

More severe forms of problem gambling have similar patterns of episode duration, chronicity, recovery, and relapse compared with less severe forms when the definition of stable is that the person remains in the severe or 'pathological' category. However, when recovery is more conservatively defined as not evidencing *either* problem or pathological gambling, then more severe gambling problems show a more chronic and stable course than less severe problems.

The consistency between the LLLP and QLS samples provide support for the validity of these findings but, it is important to recognize that in both samples, the numbers of individuals who experienced problems and who were followed for all time periods were small. Data from individuals who missed one or more follow-up assessments are more difficult to interpret but they are largely consistent. We used a conservative definition of change (by excluding change that might be related to measurement error) but there are also likely to be some instances of false positive and false negatives, individuals who did not experience a problem despite scoring above the cut-off and individuals who did not "recover" despite a reliably lower score that was

below the cut-off. There are no objective, non-self-report measures of problem gambling to validate changes, however, we are currently conducting qualitative interviews with LLLP individuals who recover and relapse according to these criteria between the fourth assessment at five years and an ongoing seven-year follow-up of the sample. These interviews will provide greater detail about the nature of the change – for example, were people making intentional changes in their gambling or did "change" occur gradually and subconsciously?

Multivariate Models of Gambling and Problem Gambling Severity

Stability of Gambling and Problem Gambling

The results of our multivariate modeling clearly indicate that from a broad population perspective, gambling and problem gambling are relatively stable over time. The modeling showed that stability is found not only for overall gambling involvement but also for specific aspects of gambling such as amount spent, number of types of gambling engaged in, and frequency of gambling. These results at first glance seem inconsistent with our analysis of stability in gambling problems among people with gambling problems as defined categorically, which showed a great deal of recovery in addition to some enduring problems and some relapse. These results are not, however, inconsistent as the multivariate models focused on the entire range of gambling and problem gambling and not solely on the small group exceeding the cut-off on a gambling disorder measure sometime during the study time period. Overall, general stability at the population level does not preclude less stability among this extreme group.

An interesting feature of both data sets was that the overall level of gambling involvement of participants dropped from the first assessment and then remained relatively stable thereafter. Whether this represents a change in gambling in the population during this time period, which roughly coincided with the economic recession, or represents a change in data collection methodology (from telephone to online assessment) from the first to subsequent waves is unclear. Falling prevalence rates are a general trend in various jurisdictions around the world (Williams, Volberg, & Stevens, 2012), not specially related to economic factors.

Although gambling involvement and problem gambling severity were generally stable, some exploratory analyses were conducted on the relationship between changes in these areas and changes in other areas of functioning during the preceding time period and the same time period. Generally the relationships were small, although statistically significant. Of note, longitudinally both positive changes (improvements in relationship and family functioning and happiness) as well as negative changes (increase in illegal activities and stressful life events) in one time period were associated with greater gambling in the subsequent period. The fact that both negative and positive changes can lead to gambling, likely reflects the fact that people gamble to enhance positive feelings as well as escape from negative ones (Stewart & Zack, 2008). In contrast, only negative changes in one period were associated with increased problem gambling at a later period. Improvements in community involvement and family functioning were associated with decreases in problem gambling in the subsequent period. Finally,

increases in substance abuse as well as increases in gambling in one period were associated with increased problem gambling in the subsequent time period.

Biopsychosocial Predictors

The multivariate modeling suggests that gambling problems are linked to gambling behaviour in a causal manner as opposed to being a simple indicator of gambling behaviour. In fact, there is also clear evidence that different factors influence gambling behaviour and gambling problems, which is consistent with earlier analyses conducted on the baseline LLLP data (Hodgins et al., 2012). These analyses confirmed that the risk factors associated with relatively higher gambling involvement differ from risk factors that directly affect gambling disorders. In both samples, being less intelligent and less religious, having greater excitement-seeking tendencies (essentially greater sensation-seeking) and having grown up gambling with parents and having friends who gamble were factors associated with more gambling involvement, but not directly with greater likelihood of gambling problems. Being male was also predictive of greater gambling in both samples, although male gender was only associated with more gambling problems in the LLLP, not the QLS. Gambling to escape and experiencing an early "big win or big loss" were directly associated with both increased gambling and increased problem gambling in both samples.

The results from the two samples were largely similar although there were some differences. Being non-Caucasian (a diverse category of people) was associated with heavier gambling in Quinte county and less gambling in Alberta, although not with problem gambling in either location. Given the crudeness of this categorization, it is likely that different groups were represented in the different samples. Larger studies of these groups are necessary to explore this finding. Differences in availability of gambling as well as sampling differences may also explain age differences in results between the samples, with younger participants in Alberta likely to gamble less and older participants more, whereas age was unrelated to gambling in the QLS. Age was unrelated to problem gambling in either sample, however. Less easily explained, having parents who regularly gamble was associated with both gambling and problem gambling in the LLLP, but not the QLS.

One of the strongest predictors of problem gambling was greater impulsivity (impulsivity was also associated with gambling in the QLS and LLLP but less strongly). Impulsivity is emerging as a particularly consistent factor in gambling disorders. It is a factor that has been identified as linked to subsequent gambling problems in two previous longitudinal studies (Slutske et al., 2005; Vitaro et al., 1997). In the LLLP, QLS, and these other studies, the construct of impulsivity is briefly measured although it is clear that it is a complex, multidimensional construct with personality, motor, behavioural, and cognitive aspects (Gullo, Loxton, & Dawe, 2014). Understanding which facets of impulsivity are etiologically linked to gambling involvement and gambling problems is an important direction for the field.

Our exploratory analyses of other NEO-R personality traits (openness, agreeableness, conscientiousness) showed significant bivariate relationships that are worthy of further

analyses. Previous research comparing problem to non-problem gamblers using the NEO-R have yielded mixed results - generally problem gamblers have higher scores on neuroticism and lower scores on conscientiousness traits with variable results for openness (Vachon & Bagby, 2009; Myrseth, Pallesen, Molde, Johnsen, & Lorvik, 2009; MacLaren, Best, Dixon, & Harrigan, 2011). Examining the relative associations of these factors to gambling behaviour and to gambling problems is likely a fruitful direction.

An important finding of the modeling analysis is that a variety of mental health indicators predict problem gambling, consistent with previous research (Lorains, Cowlishaw, & Thomas, 2011). In our previous analysis of and report on the LLLP baseline data, it was noted that these indicators represent both externalizing and internalizing processes (Hodgins et al., 2012). The mental health formative indicator, largely comprised of internalizing disorder indicators (e.g., depression, anxiety, obsessive compulsive traits), did not influence gambling involvement, but did influence gambling problems. Individuals with more of these struggles were not more likely to gamble but were more likely to develop gambling problems. Of note, these results were replicated across the two samples despite significant differences in how these variables were measured.

The pattern of results for externalizing disorders, such as antisocial personality disorder, and substance abuse was more variable. Antisocial personality disorder traits were associated with greater gambling involvement in both samples but greater gambling problems in only the LLLP.

Drug abuse predicted greater gambling problems in both samples (similar size coefficients but only statistically significant in the QLS), but not gambling involvement. Alcohol use disorder was unrelated to gambling involvement in either sample but was negatively related to problem gambling in the QLS. Previous literature has also found inconsistent results concerning the association between alcohol and gambling use and disorders (Hodgins & el-Guebaly, 2010; Stewart & Kushner, 2005). Similarly, previous research has not uncovered a clear relationship between gambling, gambling disorders, and smoking (McGrath & Barrett, 2009). The QLS revealed an association between tobacco use and gambling involvement (not problems) and the LLLP found the opposite relationship.

The different influences of internalizing mental problems and antisocial traits on problem gambling are consistent with Blaszczynski and Nower (2002)'s pathway model of gambling problems that hypothesizes a mood dysregulation pathway and an antisocial impulsivist pathway. Their third pathway, a behavioural conditioned pathway comprised of individuals without pre-existing vulnerabilities is not as clearly represented in this model beyond the significant amount of unexplained variance in problem gambling not accounted for by the variables included in the model.

The negative impact of childhood trauma on the development of gambling problems (Jacobs, 1986; Petry & Steinberg, 2005; Hodgins et al., 2010) is confirmed in this longitudinal analysis. Prior research has documented not just psychological, but also biological-based effects of

childhood trauma on a range of adult mental and physical health outcomes (Andersen et al. 2008; Weiss & Wagner, 1998).

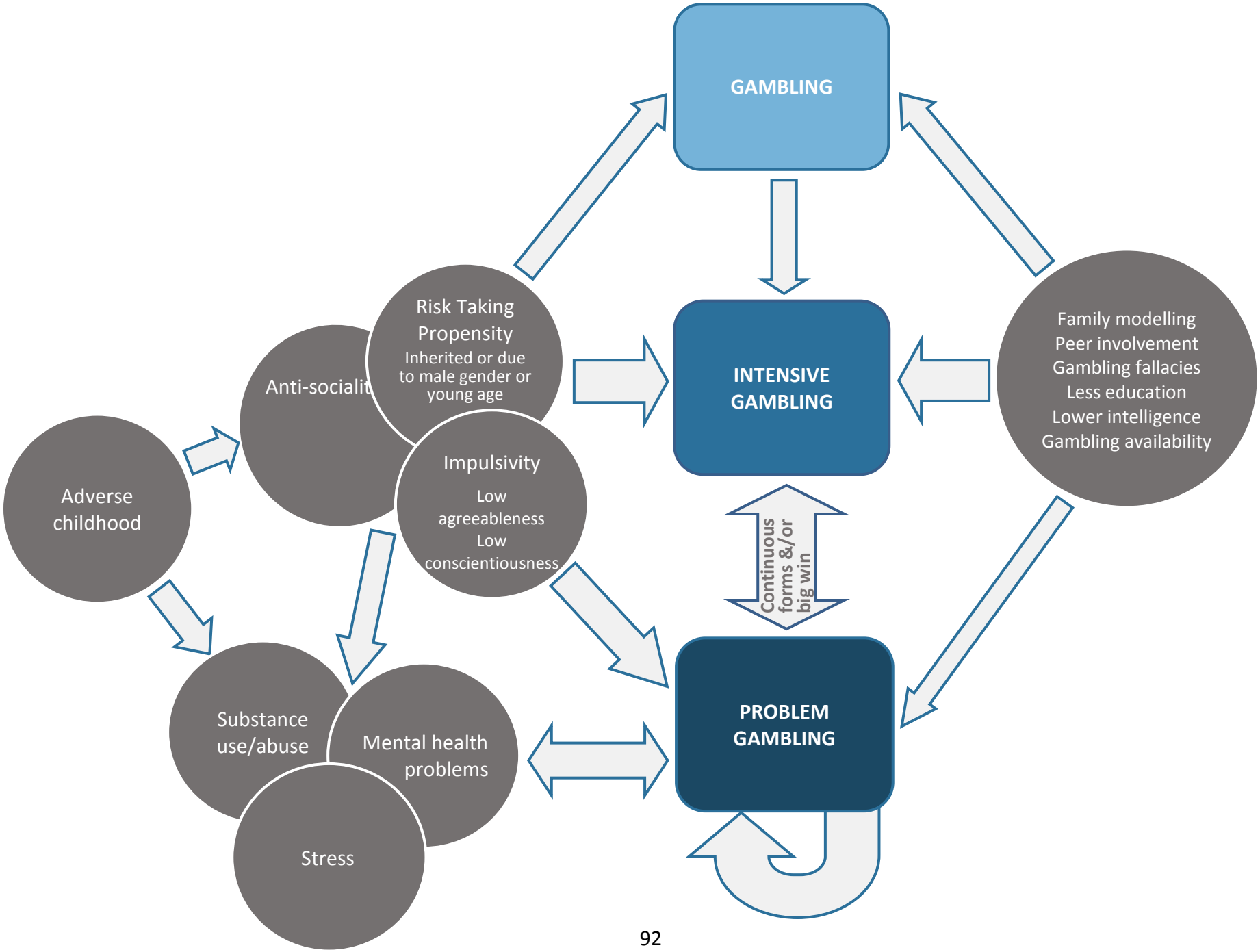
Although there are differences in the specific mental health and personality variables collected in the LLLP and QLS, the models are generally consistent, which supports their validity and generalizability. Attrition is always a challenge in longitudinal designs. In the LLLP, individuals with greater gambling involvement and problems were slightly more likely to discontinue and were therefore underrepresented in the follow-up data. The effect of this on the results is unclear although our initial analyses found that baseline descriptive variables, including gambling involvement, accounted for less than 10% of the variance in attrition, which is reassuring.

The LLLP was conducted between 2005 and 2011 and it is important to consider the gambling context in Alberta for that time period. For example, in Alberta, some types of gambling expanded (e.g., casinos, slot machines) and others contracted (e.g., bingo, horse racing). A number of responsible gambling initiatives were launched (e.g., protective features on VLTs), treatment availability was stable although offered by a reorganized health care system and the numbers seeking treatment declined. A worldwide economic recession occurred around 2008. The LLLP is not designed to assess the effects of these changes but it is important to consider their impacts. One measured effect was public attitudes toward gambling, which were assessed in both the LLLP and QLS with different measures. Exploratory analyses showed that, in both studies positive attitudes about gambling was modestly associated with gambling involvement. Specific analysis of the LLLP reported earlier showed that Albertans are ambivalent about gambling in the province, seeing both positive and negative aspects and that younger and male participants tended to be relatively more positive (Smith et al., 2011).

Emerging Etiological Model

Figure 13 outlines a tentative etiological model of gambling and problem gambling that emerges from the present findings and is consistent with the findings of the analyses contained both in the present report as well as additional multivariate analyses contained in the Quinte Longitudinal Study final report (Williams et al., 2015). Arrow width conveys the approximate strength of each of the relationships.

Figure 13: Etiological Model of Gambling and Problem Gambling



SUMMARY AND CONCLUSIONS

The LLLP and QLS provide the most comprehensive longitudinal profile of gambling and problem gambling currently in the literature. This report provides initial analyses of data focusing on a couple of specific research questions. The opportunity to conduct parallel analyses across two large data sets is invaluable, the consistency of the findings across studies conducted in two provinces as well as the consistency with previous cross-sectional, and longitudinal research is remarkable. In summary, the results identified a number of robust predictors of gambling and problem gambling including both fixed and modifiable factors. Fixed factors include gender, ethnicity, intelligence, and arguably income and impulsivity. Modifiable factors include mental and substance use disorders, gambling involvement, and proximity. Although some factors predicted both gambling involvement and gambling problems (e.g., gender), some factors were more predictive of gambling (e.g., excitement-seeking) and others more predictive of gambling problems (e.g., mental health problems). Taken together these findings provide a solid basis for designing prevention and intervention programs.

The results also shed light on the question of stability of gambling problems. At a broad population level, there is considerable stability in people's overall involvement in gambling and problems they experience. However, at the individual level, there is considerable amount of transition. These findings underscore the importance of looking at gambling problems at both the population and individual levels. Investigations at the population level inform the creation of focused interventions aimed at reducing overall gambling problems. Investigations concerning how individuals experience changes in their gambling habits over time, and the characteristics that lead to such changes, can inform interventions targeted at helping people make smooth and long-term transitions away from problematic gambling.

REFERENCES

Abbott, M. (2012, April 14). *Pacific Islands Longitudinal Families (PIF) Study*. PowerPoint presentation at the meeting of the Alberta Gambling Research Institute, Banff. Retrieved from http://goo.gl/2005YW

Abbott, M. W., & Volberg, R. (1991). *Gambling and problem gambling in New Zealand: Report on phase one of the national survey*. Research Unit, Department of Internal Affairs Wellington, New Zealand.

Abbott, M. W., Volberg, R. A., & Williams, M. M. (1999). *Seven years on: A follow-up study of frequent and problem gamblers living in the community*. Department of Internal Affairs Wellington, New Zealand. Retrieved from http://goo.gl/gqYhzG

Abbott, M. W., Williams, M. M., & Volberg, R. A. (2004). A prospective study of problem and regular nonproblem gamblers living in the community. *Substance Use & Misuse, 39,* 855-884.

ACCORD Research. (2000). *Alberta gaming and liquor commission study of gaming attitudes in Alberta: Final report 2000*. Presented to the Alberta Gaming and Liquor Commission by ACCORD Research at the University of Calgary. Retrieved from http://goo.gl/8JmDuA

Achenbach, T. M., & Rescorla, L. A. (2001). *Manual for the ASEBA school-age forms and profiles*. Burlington, VT: University of Vermont, Research Center for Children, Youth & Families.

Alberta Gaming and Liquor Commission. (2006). *Alberta Gaming and Liquor Commission Annual Report 2005-2006*. Edmonton, AB: Author. Retrieved from http://goo.gl/6qlSKp

Alberta Gaming and Liquor Commission. (2011). *Alberta Gaming and Liquor Commission Annual Report 2010-2011*. Edmonton, AB: Author. Retrieved from http://goo.gl/6qlSKp

Allison, P. D. (2009). *Fixed effects regression models*. Los Angeles, CA: Sage.

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders*. (4 ed.) Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders Text Revision*. (4th ed., text rev.) Arlington, VA: Author.

Anda, R. F., Felitti, V. J., Walker, J., Whitfield, C. L., Bremner, J. D., Perry, B. D., Dube, S. R., & Giles, W. H. (2006). The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology. *European Archives of Psychiatry and Clinical Neurosciences, 256*, 174-186.

Andersen, S. L., Tomada, A., Vincow, E. S., Valente, E., Polcari, A., & Teicher, M. H. (2008). Preliminary evidence for sensitive periods in the effect of childhood sexual abuse on regional brain development. *Journal of Neuropsychiatry and Clinical Neurosciences* 20, 292-301.

Asher, S. R., Hymel, S., & Renshaw, P. D. (1984). Loneliness in children. *Child Development, 55,* 1456-1464.

Asher, S. R., & Wheeler, V. A. (1985). Children's loneliness: A comparison of rejected and neglected peer status. *Journal of Consulting and Clinical Psychology, 53,* 500-505.

Australian Government Productivity Commission. (2010). Canberra, AU.

Australian Medical Association. (2013). Health effects of problem gambling. https://ama.com.au/position-statement/health-effects-problem-gambling (retrieved, Oct. 12, 2013).

Aquilino, W. S. (1997). Privacy effects on self-reported drug use: Interactions with survey mode and respondent characteristics. In L.Harrison & A. Hughes (Eds.), *The validity of self-reported drugs use: Improving the accuracy of survey estimates (NIDA Research Monograph 167)*. Rockville, MD: U.S. Department of Health and Human Services.

Azmier, J. J. (2000). *Canadian gambling behaviour and attitudes: Summary report*. Calgary, AB: Canada West Foundation. Retrieved from http://goo.gl/1mLEs

Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (1999). Gambling and alcohol use among youth: Influences of demographic, socialization, and individual factors. *Addictive Behaviours, 24,* 749-767.

Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (2002). Effects of alcohol misuse on gambling patterns in youth. *Journal of Studies on Alcohol and Drugs, 63,* 767.

Barnes, G. M., Welte, J. W., Hoffman, J. H., & Dintcheff, B. A. (2005). Shared predictors of youthful gambling, substance use, and delinquency. *Psychology of Addictive Behaviours, 19,* 165.

Beaver, K. M., Hoffman, T., Shields, R. T., Vaughn, M. G., DeLisi, M., & Wright, J. P. (2010). Gender differences in genetic and environmental influences on gambling: Results from a sample of twins from the National Longitudinal Study of Adolescent Health. *Addiction, 105,* 536-542.

Bell, R. Q. (1953). Convergence: an accelerated longitudinal approach. *Child Development, 24,* 145-152.

Bernstein, D. P., Ahluvalia, T., Pogge, D., & Handelsman, L. (1997). Validity of the Childhood Trauma Questionnaire in an adolescent psychiatric population. *Journal of the American Academy of Child & Adolescent Psychiatry, 36,* 340-348.

Bernstein, D. P., & Fink, L. (1998). *Childhood trauma questionnaire (CTQ): A retrospective self-report* San Antonio, TX: The Psychological Corporation.

Billi, R., Stone, C.A., Marden, P. Yeung, K. (2014). *Victorian Gambling Study: A Longitudinal Study of Gambling and Health in Victoria, 2008-2012.* Victoria, Australia: Victorian Responsible Gambling Foundation.

Blaszczynski, A., Ladouceur, R., & Moodie, C. (2008) The Sydney Laval Universities Gambling Screen: Preliminary data. *Addiction Research and Theory, 16*, 401-411.

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

Booth, B. M., Fortney, S. M., Fortney, J. C., Curran, G. M., & Kirchner, J. E. (2001). Short-term course of drinking in an untreated sample of at-risk drinkers. *Journal of Studies on Alcohol, 62*, 580-588.

Borrell, J. (2006). Critical commentary by an EGM gambler, October, 2004: Introduction by Jennifer Borrell. *International Journal of Mental Health Addiction*, 4, 181-188.

Bos, J. M., Huston, A. C., Granger, R. C., Duncan, G. J., Brock, T. W., & McLoyd, V. C. (1999). *New hope for people with low income: Two-year results of a program to reduce poverty and reform welfare*. New York: Manpower Demonstration Research Project.

Braverman, J. & Shaffer, H. J. (2012). How do gamblers start gambling: Identifying behavioural markers for high-risk internet gambling. *The European Journal of Public Health, 22,* 273-278.

Breen, R., & Zimmerman, M. (2002). Rapid onset of pathological gambling in machine gamblers. *Journal of Gambling Studies, 18*, 31–43.

Brody, N. (1992). *Intelligence* (2nd Ed.). San Diego, CA: Academic Press.

Brown, B. B., Mounts, N., Lamborn, S. D., & Steinberg, L. (1993). Parenting practices and peer group affiliation in adolescence. *Child Development, 64,* 467-482.

Buckner, J. C. (1988). The development of an instrument to measure neighborhood cohesion. *American Journal of Community Psychology, 16*, 771-791.

Cameron, J. E. (2004). A three-factor model of social identity. *Self and Identity, 3*, 239-262.

Canadian Partnership for Responsible Gambling (2012). *Canadian Gambling Digest 2010-2011*. Toronto, ON: Author. Retrieved from http://goo.gl/EoZh4h

Casey, D. M. (June, 2002). Summer activities and social competence of adolescents from low-income families: Individual, family, and neighborhood factors. *Dissertation Abstracts International: Section B: The Sciences and Engineering. Vol. 62*(12-B), pp. 5993.

Cassidy, J., & Asher, S. R. (1992). Loneliness and peer relations in young children. *Child Development, 63*, 350-365.

Chelune, G. J., & Baer, R. L. (1986). Developmental norms for the Wisconsin Card Sorting Test. *Journal of Clinical and Experimental Neuropsychology, 8*, 219-228.

Claus, R. E., Kindleberger, L. R., & Dugan, M. C. (2002). Predictors of attrition in a longitudinal study of substance abusers. *Journal of Psychoactive Drugs, 34,* 69-74.

Clay, C. M., Ellis, M. A., Griffin, M. L., Amodeo, M., & Fassler, I. R. (2007). Black women and White women: Do perceptions of childhood family environment differ? *Family Process, 46*, 243-256.

Collins, R. L., Ellickson, P. L., Hays, R. D., & McCaffrey, D. F. (2000). Effects of incentive size and timing on response rates to a follow-up wave of a longitudinal mailed survey. *Evaluation Review, 24,* 347-363.

Costa, P. T., & McCrae, R. R. (1992). *Revised NEO personality inventory (NEO-PI-R) and NEO five-factor inventory (NEO-FFI): Professional Manual*. Lutz, FL: Psychological Assessment Resources, Inc.

Cotton, M. A., Ball, C., & Robinson, P. (2003). Four simple questions can help screen for eating disorders. *Journal of General and Internal Medicine, 18*, 53-56.

Council of American Survey Research Organizations (CASRO). (1982). *On the definition of response rates.* Port Jefferson, NY: CASRO.

Crouter, A. C., MacDermid, S. M., McHale, S. M., & Perry-Jenkins, M. (1990). Parental monitoring and perceptions of children's school performance and conduct in dual- and single-earner families. *Developmental Psychology, 26,* 649-657.

Culverhouse, R., Bucholz, K. K., Crowe, R. R., Hesselbrock, V., Nurnberger, J. I. J., Porjesz, B., Schuckit, M. A., Reich, T., & Bierut, L. J. (2005). Long-term stability of alcohol and other substance dependence diagnoses and habitual smoking: An evaluation after 5 years. *Archives of General Psychiatry, 62*, 753-760.

Cummins, R. A., Eckersley, R., Lo, S. K., Okerstrom, E., Hunter, B., & Davern, M. (2004). *Australian unity wellbeing index: Cumulative psychometric record*. Melbourne: Australian Centre on Quality of Life, School of Psychology, Deakin University. Retrieved from http://goo.gl/wv3mu9

Cummins, R. A., Eckersley, R., Pallant, J., Van Vugt, J., & Misajon, R. (2003). Developing a national index of subjective wellbeing: The Australian Unity Wellbeing Index. *Social Indicators Research, 64*, 159-190.

Currie, S. R., Hodgins, D. C., & Casey, D. M. (2012). Validity of the Problem Gambling Severity Index interpretive categories. *Journal of Gambling Studies, 29,* 311-327.

Currie, S. R., Hodgins, D. C., Casey, D. M., el-Guebaly, N., Smith, G. J., Williams, R. J., Schopflocher, D. P., & Wood, R. T. (2012). Examining the predictive validity of low-risk gambling limits with longitudinal data. *Addiction*, 107, 400-6.

Currie, S. R., Hodgins, D. C., Wang, J., el-Guebaly, N., Wynne, H., & Chen, S. (2006). Risk of harm from gambling in the general population as a function of level of participation in gambling activities. *Addiction, 101*, 570-580.

Cyders, M. A., & Smith, G. T. (2008). Clarifying the role of personality dispositions in risk for increased gambling behaviour. *Personality and Individual Differences, 45,* 503-508.

Dedrick, R. F., Tan, T. X., & Marfo, K. (2008). Factor structure of the Child Behaviour Checklist/6-18 in a sample of girls adopted from China. *Psychological Assessment, 20*, 70-75.

DeFuentes-Merillas, L., Koeter, M. W. J., Schippers, G. M., & Van Den Brink, W. (2004). Temporal stability of pathological scratchcard gambling among adult scratchcard buyers two years later. *Addiction, 99,* 117-127.

De Groot, A., Koot, H. M., & Verhulst, F. C. (1994). Cross-cultural generalizability of the Child Behaviour Checklist Cross-Informant Syndromes. *Psychological Assessment, 6*, 225-230.

Del Boca, F. K., & Noll, J. A. (2000). Truth or consequences: The validity of self-report data in health services research on addictions. *Addiction, 95,* S347-S360.

Delfabbro, P. H., Winefield, A. H., & Anderson, S. (2009). Once a gambler - always a gambler? A longitudinal analysis of gambling patterns in young people making the transition from adolescence to adulthood. *International Gambling Studies, 9,* 151-163.

Desai, R. A., Desai, M. M., & Potenza, M. N. (2007). Gambling, health and age: Data from the National Epidemiologic Survey on Alcohol and Related Conditions. *Psychology of Addictive Behaviours, 21,* 431.

Dickerson, M., Haw, J. & Shepherd, L. (2003). *The psychological causes of problem gambling: A longitudinal study of at risk EGM players*. Sydney, AU: A report prepared for the Casino Community Benefit Fund.

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment, 49*, 71-75.

Dong, M., Giles, W. H., Felitti, V. J., Dube, S. R., Williams, J. E., Chapman, D. P., & Anda, E. F. (2004). Insights into casual pathways for ischemic heart disease: The adverse childhood experience study. *Circulation, 110*, 1761-1766.

Doughney, J. (2007). Ethical blindness, EGMs and public policy: A tentative essay comparing the EGM and tobacco industries. *International Journal of Mental Health Addiction, 5*, 311-319.

Dow Schull, N. (2012). *Addiction by Design*. Princeton, NJ: Princeton University Press.

Dube, S. R., Anda, R. F., Felitti, V. J., Chapman, D., Williamson, D. F., & Giles, W. H. (2001). Childhood abuse, household dysfunction and the risk of attempted suicide throughout the life span: Findings from Adverse Childhood Experience Study. *Journal of the American Medical Association, 286*, 3089-3096.

Dube, S. R., Felitti, V. J., Dong, M., Giles, W. H., & Anda, R. F. (2003). The impact of adverse childhood experiences on health problems: Evidence from four birth cohorts dating back to 1900. *Preventive Medicine, 37*, 268-277.

Dussault, F., Brendgen, M., Vitaro, F., Wanner, B., & Tremblay, R. E. (2011). Longitudinal links between impulsivity, gambling problems and depressive symptoms: a transactional model from adolescence to early adulthood. *Journal of Child Psychology and Psychiatry, 52,* 130-138.

Dutra, L., Campbell, L., & Westen, D. (2004). Quantifying clinical judgment in the assessment of adolescent psychopathology: Reliability, validity, and factor structure of the Child Behaviour Checklist for clinician report. *Journal of Clinical Psychology, 60*, 65-85.

Edwards, V. J., Anda, R. F., Dube, S. R., Dong, M., Chapman, D. F., & Felitti, V. J. (2005). The wide-ranging health consequences of adverse childhood experiences. In Kendall-Tackett, K., & Giacomoni, S. (Eds.), *Child victimization: Maltreatment, bullying, and dating violence prevention and intervention* (pp. 8-1-8-12). Kingston, NJ: Civic Research Institute.

el-Guebaly, N., Casey, D. M., Hodgins D. C, Smith, G. J., Williams, R. J., Schopflocher, D. P., Wood, R. T. (2008). Designing a longitudinal cohort study of gambling in Alberta: Rationale, methods, and challenges. *Journal of Gambling Studies, 24,* 479-504.

Endler, N. S., & Parker, J. D. A. (1990a). *Coping Inventory for Stressful Situations (CISS): Manual*. Toronto: Multi-Health Systems.

Endler, N. S., & Parker, J. D. A. (1990b). Multidimensional assessment of coping: A critical evaluation. *Journal of Personality and Social Psychology, 58*, 844-854.

Endler, N. S., & Parker, J. D. A. (1994). Assessment of multidimensional coping: Task, emotion, and avoidance strategies. *Psychological Assessment, 6*, 50-60.

Endler, N. S., and Parker, J. D. A. (1999). *Coping Inventory for Stressful Situations (CISS): Manual* (Revised Edition). Toronto: Multi-Health Systems.

Fairburn, C. G., & Beglin, S. J. (1994). Assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders, 16*, 363-370.

Farrington, D. P. (1991). Longitudinal research strategies: Advantages, problems, and prospects. *Journal of the American Academy of Child and Adolescent Psychiatry, 30,* 369-374.

Feigelman, W., Gorman, B. S., & Lesieur, H. (2006). Examining the relationship between at-risk gambling and suicidality in a National Representative Sample of Young Adults. *Suicide and Life-Threatening Behaviour, 36,* 396-408.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., Koss, M. P., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experience Study. *American Journal of Preventive Medicine, 14*, 245-258.

Ferris, J., & Wynne, H. (2001). *The Canadian Problem Gambling Index: Final Report, Phase II, Inter-Provincial Task Force on Problem Gambling.* Ottawa, ON: Canadian Centre on Substance Abuse. Retrieved from http://goo.gl/J6okFx

Ferris, J., Wynne, H., & Single, E. (1999). *Measuring Problem Gambling in Canada: Final Report, Phase 1, Inter-Provincial Task Force on Problem Gambling.* Ottawa, ON: Canadian Centre on Substance Abuse.

Fisher, S. E. (1992). Measuring pathological gambling in children: The case of fruit machines in the UK. *Journal of Gambling Studies, 8*, 263-285.

Fisher, S. E. (2000). Developing the DSM-IV criteria to identify adolescent problem gambling in non-clinical populations. *Journal of Gambling Studies, 16,* 253-273.

Freeman, H. E. (1983). Research opportunities related to CATI. *Sociological Methods and Research, 12,* 143-152.

Fuligini, A. J., & Eccles, J. S. (1993). Perceived parent-child relationships and early adolescents' orientation toward peers. *Developmental Psychology, 29,* 622-632.

Gnys, J. A., & Willis, W. G. (1991). Validation of executive function tasks with young children. *Developmental Neuropsychology, 7*, 487-501.

Goudriaan, A. E., Grekin, E. R., & Sher, K. J. (2007). Decision making and binge drinking: A longitudinal study. *Alcoholism: Clinical and Experimental Research, 31,* 928-938.

Goudriaan, A. E., Oosterlaan, J. A. A. P., De Beurs, E. D. W. I., & Van den Brink, W. (2008). The role of self-reported impulsivity and reward sensitivity versus neurocognitive measures of disinhibition and decision-making in the prediction of relapse in pathological gamblers. *Psychological Medicine, 38,* 41-50.

Goudriaan, A. E., Slutske, W. S., Krull, J. L., & Sher, K. J. (2009). Longitudinal patterns of gambling activities and associated risk factors in college students. *Addiction, 104,* 1219-1232.

Grant, B. F., Hasin, D. S., Stinson, F. S., Dawson, D. A., Chou, S. P., Ruan, W. et al. (2004). Prevalence, correlates, and disability of personality disorders in the United States: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Journal of Clinical Psychiatry, 65*, 948-958.

Greenbaum, P. E., & Dedrick, R. F. (1998). Hierarchical confirmatory factor analysis of the Child Behaviour Checklist/4-18. *Psychological Assessment, 10*, 149-155.

Gullo, M. J., Loxton, N.J., & Dawe, S. (2014). Impulsivity: Four ways five factors are not basic to addiction. *Addictive Behaviours*. Advance online publication doi: 10.1016/j.addbeh.2014.01.002

Hasin, D. S., Grant, B., & Endicott, J. (1990). The natural history of alcohol abuse: Implications for definitions of alcohol use disorders. *The American Journal of Psychiatry, 147*, 1537-1541.

Health Surveillance and Environmental Health Branch Alberta Health and Wellness. (2007). *Population projections for Alberta and its health regions, 2006 to 2035*. Edmonton, AB: Author. Retrieved from http://goo.gl/Q6DuXMpdf

Heaton, R. K. (1981). *A manual for the Wisconsin Card Sorting Test*. Odessa, FL: Psychological Assessment Resources.

Heaton, R. K., Chelune, G. J., Talley, J. L., Kay, G. G., & Curtis, G. (1993). Wisconsin Card Sorting Test (WCST): Manual revised and expanded. Odessa, FL: Psychological Assessment Resources.

Hillis, S. D., Anda, R. F., Dube, S. R., Felitti, V. J., Marchbancks, P. A., & Marks, J. S. (2004). The association between adolescent pregnancy, long-term psychosocial outcome, and fetal death. *Pediatrics, 113*, 320-327.

Hillis, S. D., Anda, R. F., Felitti, V. J., & Marchbanks, P. A. (2001). Adverse childhood experiences and sexual risk behaviours in women: A retrospective cohort study. *Family Planning Perspectives, 33*, 206-211.

Hodgins, D. C., & el-Guebaly, N. (2004). Retrospective and prospective reports of precipitants to relapse in pathological gambling. *Journal of Consulting and Clinical Psychology, 72,* 72-80.

Hodgins, D. C., & el-Guebaly, N. (2010). The influence of substance dependence and mood disorders on outcome from pathological gambling: Five-year follow-up. *Journal of Gambling Studies*, *26*, 117-127.Hodgins, D. C., Peden, N., & Cassidy, E. (2005). The association between comorbidity and outcome in pathological gambling: A prospective follow-up of recent quitters. *Journal of Gambling Studies, 21,* 255-271.

Hodgins, D. C., Schopflocher, D. P., el-Guebaly, N., Casey, D. M., Smith, G. J., Williams, R. J., & Wood, R. T. (2010). The association between childhood maltreatment and gambling problems in a community sample of adult men and women. *Psychology of Addictive Behaviours, 24*, 548-554.

Hodgins, D. C., Schopflocher, D. P., Martin, C. R., el-Guebaly, N., Casey, D. M., Currie, S. R.,… Williams, R.J. (2012). Disordered gambling among higher-frequency gamblers: who is at risk? *Psychological Medicine, 42,* 2433-2444.

Horch, J. D. (2012). Problem gambling stigma: Stereotypes, labels, self-stigma, and treatment-seeking. *Dissertation Abstracts International: Section B: The Sciences and Engineering*. *73*(4-B), pp. 2503.

Horch, J. D., & Hodgins, D. C. (2008). Public stigma of disordered gambling: Social distance, dangerousness, and familiarity. *Journal of Social and Clinical Psychology, 27*, 505-528.

Horse Racing Alberta (2006). *2006 Annual Report*. Edmonton, AB: Horse Racing Alberta. Retrieved from http://goo.gl/ho2q1a

Horse Racing Alberta (2010). *2010 Annual Report*. Edmonton, AB: Horse Racing Alberta. Retrieved from http://goo.gl/cNrCGv

International Wellbeing Group. (2006). *Personal Wellbeing Index*. Melbourne, AU: Australian Centre on Quality of Life, Deakin University.

Ivanova, M. Y., Achenbach, T. M., Dumenci, L., Rescorla, L. A., Almqvist, F., et al. (2007). Testing the 8-syndrome structure of the Child Behaviour Checklist in 30 societies. *Journal of Clinical Child and Adolescent Psychology, 36*, 405-417.

Jacobs, D. F. (1986). A general theory of addictions: A new theoretical model. *Journal of Gambling Behaviour, 2*, 15-31.

Jacobs, D. F., Marston, A. R., Singer, R. D., Widaman, K., Little, T., & Veizades, J. (1989). Children of problem gamblers. *Journal of Gambling Studies, 5,* 261-268.

Jacobson, K. C., & Crockett, L. J. (2000). Parental monitoring and adolescent adjustment: An ecological perspective. *Journal of Research on Adolescence, 10,* 65-97.

Jacobson, N., & Truax, P. (1991). Clinical significance: A statistical approach to defining meaningful change in psychotherapy research. *Journal of Consulting and Clinical Psychology, 59,* 12-19.

Jacques, C., & Ladouceur, R. (2006). A prospective study of the impact of opening a casino on gambling behaviours: 2-and 4-year follow-ups. *The Canadian Journal of Psychiatry/La Revue canadienne de psychiatrie, 51,* 764-773.

Jacques, C., Ladouceur, R., & Ferland, F. (2000). Impact of availability on gambling: A longitudinal study. *The Canadian Journal of Psychiatry/La Revue canadienne de psychiatrie, 45*, 810-815.

Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Gotestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies, 25,* 67-92.

Kairouz, S., Nadeau, L., & Luce, C. (2012, April). *The pathways of gamblers in Québec from 2009 to 2011: Have they changed and why?* PowerPoint presentation at the meeting of the Alberta Gambling Research Institute, Banff. Retrieved from http://goo.gl/ZAiX7i

Kamphaus, R. W. (1993). *Clinical assessment of children's intelligence*. Boston: Allyn and Bacon.

Kaufman, A. S. (1990). *Assessing adolescent and adult intelligence*. Boston: Allyn and Bacon.

Kessler, R. C., Adler, L., Ames, M., Demler, O., Faraone, S., Hiripi, E., Howes, M. J., Jin, R., Secnik, K., Spencer, T., Ustun, T. B., & Walters, E. E. (2005). The World Health Organization Adult ADHD Self-Report Scale (ASRS): A short screening scale for use in the general population. *Psychological Medicine, 35*, 245-256.

Kessler, R. C., Andrews, G., Mroczek, D., Ustun, B., & Wittchem, H. (1998). The World Health Organization Composite International Diagnostic Interview Short-Form (CIDI-SF). *International Journal of Methods in Psychiatric Research, 7,* 171-185.

Kessler, R. C., McGonagle, K. A., Zhao, S., Nelson, C. B., Hughes, M., Eshleman, S., Wittchen, H. U., & Kendler, K. S. (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States. Results from the National Comorbidity Survey. *Archives of General Psychiatry, 51*, 8-19.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling*. New York: Guilford Press.

Kongs, S. K., Thompson, L. L., Iverson, G. L., & Heaton, R. K. (2000). *Wisconsin Card Sorting Test – 64 card version professional manual*. Lutz, FL: Psychological Assessment Resources.

LaBrie, R. A., Kaplan, S. A., LaPlante, D. A., Nelson, S. E., & Shaffer, H. J. (2008). Inside the virtual casino: A prospective longitudinal study of actual Internet casino gambling. *The European Journal of Public Health, 18,* 410-416.

LaBrie, R. A., LaPlante, D. A., Nelson, S. E., Schumann, A., & Shaffer, H. J. (2007). Assessing the playing field: A prospective longitudinal study of internet sports gambling behaviour. *Journal of Gambling Studies, 23,* 347-362.

LaBrie, R. A., & Shaffer, H. J. (2011). Identifying behavioural markers of disordered Internet sports gambling. *Addiction Research & Theory, 19,* 56-65.

Lambert, M. C., Schmitt, N., Samms-Vaughan, M. E., An, J. S., Fairclough, M., & Nutter, C. A. (2003). Is it prudent to administer all items for each Child Behaviour Checklist Cross-informant Syndrome: Evaluating the psychometric properties of the youth self-report dimensions with confirmatory factor analysis and item response theory. *Psychological Assessment, 15*, 550-568.

LaPlante, D. A., Kleschinsky, J. H., LaBrie, R. A., Nelson, S. E., & Shaffer, H. J. (2009). Sitting at the virtual poker table: A prospective epidemiological study of actual Internet poker gambling behaviour. *Computers in Human Behaviour, 25,* 711-717.

LaPlante, D. A., Schumann, A., LaBrie, R. A., & Shaffer, H. J. (2008). Population trends in

Internet sports gambling. *Computers in Human Behaviour, 24,* 2399-2414.
Larson, R., & Richards, M. H. (1991). Daily companionship in late childhood and early adolescence: Changing developmental contexts. *Child Development, 62,* 284-300.
Lau, A. L. D., Cummins, R. A., & McPherson, W. (2005). An investigation into the cross-cultural equivalence of the Personal Wellbeing Index. *Social Indicators Research, 72*, 403-432.
Ledgerwood, D. M., & Petry, N. M. (2006). What do we know about relapse in pathological gambling? *Clinical Psychology Review, 26,* 216-228.
Lee, G. P., Storr, C. L., Ialongo, N. S., & Martins, S. S. (2011). Compounded effect of early adolescence depressive symptoms and impulsivity on late adolescence gambling: A longitudinal study. *Journal of Adolescent Health, 48,* 164-169.
Lengua, L. J., Sadowski, C. A., Friedrich, W. N., & Fisher, J. (2001). Rationally and empirically derived dimensions of the children's symptomatology: Expert ratings and confirmatory factor analyses of the CBCL. *Journal of Consulting and Clinical Psychology, 69*, 683-698.
Link, B. G. (1987). Understanding labeling effects in the area of mental disorders: An assessment of the effects of expectations of rejection. *American Sociological Review, 52*, 96-112.
Link, B. G., Mirotznik, J., & Cullen, F. T. (1991). The effectiveness of stigma coping orientations: Can negative consequence of mental illness labeling be avoided? *Journal of Health and Social Behaviour, 32*, 302-320.
Link, B. G., Phelan, J. C., Bresnahan, M., Stueve, A., & Pescosolido, B. A. (1999). Public conceptions of mental illness: Labels, causes, dangerousness, and social distance. *American Journal of Public Health, 89*, 1328-1333.
Little, T. D., & Card, N. A. (2013). *Longitudinal structural equation modeling*. New York: Guilford Publications.
Livingstone, C., & Woolley, R. (2007). Risky business: A few provocations on the regulation of electronic gambling machines. *International Gambling Studies, 7*(3), 361-376.
Loeber, R., & Farrington, D. P. (1994). Problems and solutions in longitudinal and experimental treatment studies of child psychopathology and delinquency. *Journal of Consulting and Clinical Psychology, 62,* 887-900.
Loeber, R., & Farrington, D. P. (1995). Longitudinal approaches in epidemiological research of conduct problems. In F. C.Verhulst & H. M. Koot (Eds.), *The Epidemiology of Child and Adolescent Psychopathology* (pp. 309-336). Oxford: Oxford University Press.
Lorains, F. K., Cowlishaw, S., & Thomas, S. A. (2011). Prevalence of comorbid disorders in problem and pathological gambling: Systematic review and meta-analysis of population surveys. *Addiction, 106,* 490-498.
Loveland-Cherry, C. J., Youngblut, J. M., & Kline Leidy, N. W. (1989). A psychometric analysis of the Family Environment Scale. *Nursing Research, 38*, 262-266.
Lubben, J. E. (1988). Assessing social networks among elderly populations. *Family and Community Health, 11*, 42-52.
Luck, A. J., Morgan, J. F., Reid, F., O'Brien, A., Brunton, J., Price, C., et al. (2002). The SCOFF questionnaire and clinical interview for eating disorders in general practice: Comparative study. *British Medical Journal, 325*, 755-756.
MacLaren, V. V., Best, L. A., Dixon, M. J., & Harrigan, K. A. (2011). Problem gambling and the five factor model in university students. *Personality and Individual Differences,* 335-338.

MacLaren, V., Harrigan, K., & Dixon, M. (2012). Gambling motives and symptoms of problem gambling in frequent slots players. *Journal of Gambling Issues, 27*, 1-13.

Martin, F., Lichtenberg, P. A., & Templin, T. N. (2011). A longitudinal study: Casino gambling attitudes, motivations, and gambling patterns among urban elders. *Journal of Gambling Studies, 27,* 287-297.

Martins, S. S., Storr, C. L., Ialongo, N. S., & Chilcoat, H. D. (2008). Gender differences in mental health characteristics and gambling among African-American adolescent gamblers. *The American Journal on Addictions, 17,* 126-134.

Maruish, M. E., & DeRosa, M. A. (2009). *A guide to the integration of certified Short Form survey scoring and data quality evaluation capabilities*. Lincoln, RI: QualityMetric Incorporated.

McAllister, I., & Makkai, T. (1991). Correcting for the underreporting of drug use in opinion surveys. *International Journal of the Addictions, 26,* 945-961.

McGrath, D. S., & Barrett, S. P. (2009). The comorbidity of tobacco smoking and gambling: A review of the literature. *Drug and Alcohol Review, 28,* 676-681.

Miller, N. V., Currie, S. R., Hodgins, D. C., & Casey D. (2013). Validation of the problem gambling severity index using confirmatory factor analysis and rasch modelling. *International Journal of Methods in Psychiatric Research, 22*, 245-255.

Miller, C., Knox, V., Auspos, P., Hunter-Manns, J., & Orenstein, A. (1997). *Making welfare work and work pay: Implementation and 18-month impacts of the Minnesota Family Investment Program*. New York: Manpower Demonstration Research Corporation.

Mond, J. M., Hay, P. J., Rodgers, B., Owen, C., & Beumont, P. J. V. (2004). Validity of the Eating Disorder Examination Questionnaire (EDE-Q) in screening for eating disorders in community samples. *Behaviour Research and Therapy, 42*, 551-567.

Mond, J. M., Myers, T. C., Crosby, R. D., Hay, P. J., Rodgers, B., Morgan, J. F., Lacey, J. H., & Mitchell, J. E. (2008). Screening for eating disorders in primary care: EDE-Q versus SCOFF. *Behaviour Research and Therapy, 46*, 612-622.

Moos, R. H., & Moos, B. S. (2002). *A social climate scale: Family Environment Scale Manual: Development, Applications, Research* (3rd ed.). Palo Alto, CA: Mind Garden, Inc.

Moos, R. H., & Moos, B. S. (2009). *A social climate scale: Family Environment Scale Manual: Development, Applications, Research* (4th ed.). Palo Alto, CA: Mind Garden, Inc.

Morey, L. (2007). *The Personality Assessment Inventory: Professional Manual* (2 ed.) Lutz: Psychological Assessment Resources Incorporated.

Morey, L. C. & Hopwood, C. J. (2006). The Personality Assessment Inventory and the measurement of normal and abnormal personality constructs. In Strack, Steve. (Ed.). *Differentiating normal and abnormal personality.* New York: Springer Publishing.

Morgan, J. F., Reid, F., & Lacey, J. H. (2004). The SCOFF questionnaire: Assessment of a new screening tool for eating disorders. *British Medical Journal, 319*, 1467-1468.

Morrisson, T. C., Wahlgren, D. R., Hovell, M. F., Zakarian, J. U., Burhman-Kreitner, S., Hofstetter, C. R. et al. (1997). Tracking and follow-up of 16,915 adolescents: Minimizing attrition bias. *Controlled Clinical Trials, 18,* 383-396.

Munet-Vilaro, F., & Egan, M. (1990). Reliability issues of the Family Environment Scale for cross-cultural research. *Nursing Research, 39*, 244-247.

Myrseth, H., Pallesen, S., Molde, H., Johnsen, B. H., & Lorvik, I. M. (2009). Personality factors as predictors of pathological gambling. *Personality and Individual Differences,* 933-937.

National Gambling Impact Study Commission (1999). *National Gambling Impact Study Commission Final Report*. Washington, DC: Author. Retrieved from http://goo.gl/tRNrp2

Neal, P., Delfabbro, P., & O'Neil, M. (2005). *Problem gambling and harm: Towards a national definition.* Commissioned for the Ministerial Council on Gambling. Prepared by the SA Centre for Economic Studies with the Department of Psychology, University of Adelaide. November 2005.

Nelson, S. E., LaPlante, D. A., Peller, A. J., Schumann, A., LaBrie, R. A., & Shaffer, H. J. (2008). Real limits in the virtual world: Self-limiting behaviour of Internet gamblers. *Journal of Gambling Studies, 24,* 463-477.

Pagani, L. S., Derevensky, J. L., & Japel, C. (2009). Predicting gambling behaviour in sixth grade from kindergarten impulsivity: A tale of developmental continuity. *Archives of Pediatrics & Adolescent Medicine, 163,* 238.

Perkonigg, A., Lieb, R., Hofler, M., Schuster, P., Sonntag, H., & Wittchen, H. U. (1999). Patterns of cannabis use, abuse and dependence over time: Incidence, progression and stability in a sample of 1228 adolescents. *Addiction, 94*, 1663-1678.

Petry, N. M., Steinberg, K. L. (2005). Childhood maltreatment in male and female treatment-seeking pathological gamblers. *Psychology of Addictive Behaviours, 19*, 226-229.

PsychCorp (1999). *Wechsler Abbreviated Scale of Intelligence Manual*. San Antonio, TX: Harcourt Assessment Inc.

Raylu, N., & Oei, T. P. S. (2002). Pathological gambling: A comprehensive review. *Clinical Psychology Review, 22,* 1009-1061.

Ritsher, J. B., Otilingam, P. G., & Grajales, M. (2003). Internalized stigma of mental illness: Psychometric properties of a new measure. *Psychiatry Research, 12*, 31-49.

Rohrbaugh, J., & Jessor, R. (1975). Religiosity in youth: A personal control against deviant behaviour. *Journal of Personality, 43*, 136-155.

Romild, U., Volberg, R., & Abbott, M. (2014). The Swedish Longitudinal Gambling Study (Swelogs): Design and methods of the epidemiological (EP-) track. *International Journal of Methods in Psychiatric Research*. Retrieved from http://goo.gl/bsTxac

Ross D., Kincaid, H., Hofmeyr, A., & Dellis, A. (2013, May). *The National Longitudinal Study of Gambling Behaviour (NLSGB): Preliminary Results*. PowerPoint presentation at the meeting of the International Gaming Institute, Las Vegas. Retrieved from http://goo.gl/19DHI7

Rutter, M. (1981). Prospective longitudinal research: An empirical basis for the primary prevention of psychosocial disorders. In S. Mednick & A. Baert (Eds.), *Longitudinal studies: A psychatric perspective* (pp. 326-336). Oxford: Oxford University Press.

Saklofske, D. H., Caravan, G., & Schwartz, C. (2000). Concurrent validity of the Wechsler Abbreviated Scale of Intelligence (WASI) with a sample of Canadian children. *Canadian Journal of School Psychology*, 16, 87-94.

Sanford, K., Bingham, C. R., & Zucker, R. A. (1999). Validity issues with the Family Environment Scale: Psychometric resolution and research application with alcoholic families. *Psychological Assessment, 11*, 315-325.

Sattler, J. M. (1988). *Assessment of children* (3rd Ed.). San Diego, CA: Author

Schaeffer, N. C. (2000). Asking questions about threatening topics: A selective overview. In A. A. Stone & J. S. Turkkan (Eds.), *The science of self-report: Implications for research and practice* (pp. 105-121). Mahwah, NJ: Erlbaum.

Schaie, K. W. (2005). *Developmental influences on adult intelligence: The Seattle Longitudinal Study*. New York: Oxford University Press.

Scher, C. D., Stein, M. B., Asmundson, G. J. G., McCrearly, D. R., & Forde, D. R. (2001). The Childhod Trauma Questionnaire in a community sample: Psychometric properties and normative data. *Journal of Traumatic Stress, 14,* 843-857.

Scherrer, J. F., Slutske, W. S., Xian, H., Waterman, B., Shah, K. R., Volberg, R., Eisen, S.A. (2007). Factors associated with pathological gambling at 10-year follow-up in a national sample of middle-aged men. *Addiction, 102,* 970-978.

Schumm, W. R., Anderson, S. A., Benigas, J. E., McCutchen, M. B., Griffin, C. L., Morris, J. E., & Race, G. S. (1985). Criterion-related validity of the Kansas Marital Satisfaction Scale. *Psychological Reports, 56*, 719-722.

Schumm, W. R., Paff-Bergen, L. A., Hatch, R. C., Obiorah, F. C., Copeland, J. M., Meens, L. D., & Bugaighis, M. A. (1986). Concurrent and discriminant validity of the Kansas Marital Satisfaction Scale. *Journal of Marriage and the Family, 48*, 381-387.

Shaffer, H. J., & Hall, M. N. (2002). The natural history of gambling and drinking problems among casino employees. *The Journal of Social Psychology, 142,* 405-424.

Shaw, D. S., Wagner, E. F., Arnett, J., & Aber, M. S. (1992). The factor structure of the Reckless Behaviour Questionnaire. *Journal of Youth and Adolescence, 21*, 305-323.

Slutske, W. S. (2006). Natural recovery and treatment-seeking in pathological gambling: Results of two US national surveys. *American Journal of Psychiatry, 163,* 297-302.

Slutske, W. S., Caspi, A., Moffitt, T. E., & Poulton, R. (2005). Personality and problem gambling: A prospective study of a birth cohort of young adults. *Archives of General Psychiatry, 62,* 769.

Slutske, W. S., Jackson, K. M., & Sher, K. J. (2003). The natural history of problem gambling from age 18 to 29. *Journal of Abnormal Psychology, 112,* 263.

Slutske, W. S., Meier, M. H., Zhu, G., Statham, D. J., Blaszczynski, A., & Martin, N. G. (2009). The Australian Twin Study of Gambling (OZ-GAM): Rationale, sample description, predictors of participation, and a first look at sources of individual differences in gambling involvement. *Twin Research and Human Genetics, 12,* 63-78.

Slutske, W. S., Moffitt, T. E., Poulton, R., & Caspi, A. (2012). Undercontrolled temperament at age 3 predicts disordered gambling at age 32: A longitudinal study of a complete birth cohort. *Psychological Science, 23,* 510-516.

Smith, G., & Campbell, C. (2007). Tensions and contentions: An examination of electronic gaming issues in Canada. *American Behavioral Scientist, 51*(1), 86-101.

Smith, G. J., Schopflocher, D. P., el-Guebaly, N., Casey, D. M., Hodgins, D. C., Williams, R. J., & Wood, R. (2011). Community attitudes toward legalised gambling in Alberta. *International Gambling Studies, 11*, 57-79.

Smith, G. J., & Wynne, H. J. (2002). *Measuring gambling and problem gambling in Alberta using the Canadian Problem Gambling Index.* Edmonton, AB: Alberta Gambling Research Institute. Retrieved from http://goo.gl/TYYIoX

Spanier, G. B., & Cole, C. L. (1976). Toward a clarification and investigation of marital adjustment. *International Journal of Sociology and the Family, 6*, 121-146.

Statistics Canada. (2001). *Statistics Canada 2001 Census*. Ottawa, ON: Author. Statistics Canada. (2008). *Gambling. Perspectives on labour and income, 9,* 1-5. Ottawa, ON: Author. Retrieved from http://goo.gl/gNgeAX

Statistics Canada & the Canadian Institutes of Health Research. (2002) *Canadian Community Health Survey - Mental Health and Well-Being (CCHS) (Cycle 1.2)*. Ottawa, ON: Author. Retrieved from http://goo.gl/E9QyaO

Stewart, S. H., & Kushner, M. G. (2005). Introduction to the special issue on "relations between gambling and alcohol use". *Journal of Gambling Studies, 21,* 223-231.

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

Supple, A. J., Aquilino, W. S., & Wright, D. L. (1999). Collecting sensitive self-report data with laptop computers: Impact on the response tendencies of adolescents in a home interview. *Journal of Research on Adolescence, 9,* 467-488.

Svensson, J., & Romild, U. (2011). Incidence of Internet gambling in Sweden: Results from the Swedish longitudinal gambling study. *International Gambling Studies, 11,* 357-375.

Thomas, A., Sullivan, G., & Allen, F. (2009). A theoretical model of EGM problem gambling: More than a cognitive escape. *International Journal of Mental Health Addiction, 7*, 97-107.

Tiliouine, H., Cummins, R. A., & Davern, M. (2006). Measuring wellbeing in developing countries: The case of Algeria. *Social Indicators Research, 75*, 1-30.

Toneatto, T., & Nguyen, L. (2007). Individual characteristics and problem gambling behaviour. In G. Smith, D. C. Hodgins, & R. J. Williams (Eds.), *Research and measurement issues in gambling studies* (pp. 279-303). San Diego, California: Academic Press.

Tourangeau, R., & Smith, T. W. (1996). Asking sensitive questions: The impact of data collection mode, question format, and question context. *Public Opinion Quarterly, 60,* 275-304.

Tucker, C., Vuchinich, R. E., & Gladsjo, J. A. (1994). Environmental events surrounding natural recovery from alcohol-related problems. *Journal of Addictions Nursing, 6*, 117-128.

Vachon, D. D., & Bagby, R. M. (2009). Pathological gambling subtypes. *Psychological Assessment, 21,* 608-615.

Van der Zouwen, J., & de Leeuw, E. D. (1990). The relationship between mode of administration and quality of data in survey research. *Bulletin de Methodologie Sociologique, 29,* 3-14.

Vander Bilt, J., Dodge, H. H., Pandav, R., Shaffer, H. J., & Ganguli, M. (2004). Gambling participation and social support among older adults: A longitudinal community study. *Journal of Gambling Studies, 20,* 373-389.

Verhulst, F. C., & Koot, H. M. (1991). Longitudinal research in child and adolescent psychiatry. *Journal of the American Academy of Child & Adolescent Psychiatry, 30,* 361-368.

Vitaro, F., & Areseneault, L. (1999). Impulsivity predicts problem gambling in low SES adolescent males. *Addiction, 94,* 565-575.

Vitaro, F., Arseneault, L., & Tremblay, R. E. (1997). Dispositional predictors of problem gambling in male adolescents. *American Journal of Psychiatry, 154,* 1769-1770.

Vitaro, F., Brendgen, M., Ladouceur, R., & Tremblay, R. E. (2001). Gambling, delinquency, and drug use during adolescence: Mutual influences and common risk factors. *Journal of Gambling Studies, 17,* 171-190.

Vitaro, F., Ladouceur, R., & Bujold, A. (1996). Predictive and concurrent correlates of gambling in early adolescent boys. *The Journal of Early Adolescence, 16,* 211-228.

Vitaro, F., Wanner, B., Ladouceur, R., Brendgen, M., & Tremblay, R. E. (2004). Trajectories of gambling during adolescence. *Journal of Gambling Studies, 20,* 47-69.

Vuchinich, R. E., Tucker, J. A., & Harllee, L. M. (1986). *Individual differences in the reliability of alcoholics' report on drinking*. Washington, DC: American Psychological Association.

Wanner, B., Vitaro, F., Carbonneau, R., & Tremblay, R. E. (2009). Cross-lagged links among gambling, substance use, and delinquency from midadolescence to young adulthood: Additive and moderating effects of common risk factors. *Psychology of Addictive Behaviours, 23,* 91.

Wanner, B., Vitaro, F., Ladouceur, R., Brendgen, M., & Tremblay, R. E. (2006). Joint trajectories of gambling, alcohol and marijuana use during adolescence: A person-and variable-centered developmental approach. *Addictive Behaviours, 31,* 566-580.

Ware, J. E., Kosinski, M., Dewey, J. E., & Gandek, B. (2001). *How to score and interpret single-item health status measures: A manual for users of the SF-8 Health Survey*. Lincoln, RI: Quality Metrics Incorporated.

Wechsler, D. (1991). *Wechsler Intelligence Scale for Children – Third Edition*. San Antonio, TX: The Psychological Corporation.

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale – Third Edition*. San Antonio, TX: The Psychological Corporation.

Weiss, M. J., & Wagner, S. H. (1998). What explains the negative consequences of adverse childhood experiences on adult health? Insights from cognitive and neuroscience research. *American Journal of Preventive Medicine, 14*, 356-360.

Welsh, M. C., & Pennington, B. F. (1988). Assessing frontal lobe functioning in children: Views from developmental psychology. *Developmental Psychology, 4*, 199-230.

Welte, J., Barnes, G., Wieczorek, W., Tidwell, M. C., & Parker, J. (2004). Risk factors for pathological gambling. *Addictive Behaviours, 29*, 323–335.

Whitfield, C. L., Anda, R. F., Dube, S. R., & Felitti, V. J. (2003). Violent childhood experiences and the risk of intimate partner violence in adults: Assessment in a large health maintenance organization. *Journal of Interpersonal Violence, 18*, 166-185.

Wiebe, J., Cox, B., & Falkowski-Ham, A. (2003a). *Psychological and social factors associated with problem gambling in Ontario: A one year follow-up study*. Toronto, ON: Canadian Centre on Substance Abuse, Responsible Gambling Council. Retrieved from http://goo.gl/QyDq1c

Wiebe, J., Single, E., & Falkowski-Ham, A. (2003b). *Exploring the evolution of problem gambling: A one year follow-up study* Toronto, ON: Canadian Centre on Substance Abuse, Responsible Gambling Council. Retrieved from http://goo.gl/ySXoSq

Wiebe, J., Single, E., Falkowski-Ham, A., & Council, F. G. (2001). *Measuring gambling and problem gambling in Ontario*. Toronto, ON: Canadian Centre on Substance Abuse, Responsible Gambling Council. Retrieved from http://goo.gl/1egurQ

Williams, R. J. (2003). Reliability and validity of four scales to assess gambling attitudes, gambling knowledge, gambling fallacies and ability to calculate gambling odds. Unpublished technical report, Faculty of Health Sciences, University of Lethbridge, Lethbridge, Canada.

Williams, R. J., Belanger, Y. D., & Arthur, J. N. (2011). *Gambling in Alberta: History, Current Status, and Socioeconomic Impacts.* Edmonton, AB: Alberta Gaming Research Institute. Retrieved from http://hdl.handle.net/1880/48495

Williams, R. J., Connolly, D., Wood, R. T., & Nowatzki, N. (2006). Gambling and problem gambling in a sample of university students. *Journal of Gambling Issues,* 16. Retrieved from http://goo.gl/7Y2qGu

Williams, R. J, Hann, R., Schopflocher, D., West, B., McLaughlin, P., White, N. King, K., & Flexhaug, T. (2015). *Quinte Longitudinal Study of Gambling and Problem Gambling*. Guelph, ON: Ontario Problem Gambling Research Centre.

Williams, R. J., Rehm, J., & Stevens, R. (2011). *The Social and Economic Impacts of Gambling.* Final Report for the Canadian Consortium on Gambling Research. March 2011. http://hdl.handle.net/10133/1286

Williams, R. J., & Volberg, R. A. (2010). *Best practices in the population assessment of problem gambling.* Guelph, ON: Ontario Problem Gambling Research Centre. Retrieved from http://hdl.handle.net/10133/1259

Williams, R. J., & Volberg, R.A. (2014). Classification accuracy of four problem gambling assessment instruments. *International Gambling Studies, 14 (1),* 15-28.

Williams, R. J., Volberg, R. A., & Stevens, R. M. G. (2012). *Population prevalence of problem gambling: Methodological influences, standardized rates, jurisdictional differences, and worldwide trends.* Ontario Ministry of Health and Long-Term Care and the Ontario Problem Gambling Research Centre. Retrieved from http://hdl.handle.net/10133/3068

Williams, R. J., West, B. L., & Simpson, R. I. (2007b). *Prevention of problem gambling: A comprehensive review of the evidence*. Guelph, ON: Ontario Problem Gambling Research Centre. Retrieved from http://hdl.handle.net/10133/414

Williams, R. J., West, B. L., & Simpson, R. I. (2012). *Prevention of problem gambling: A comprehensive review of the evidence, and identified best practices.* Ontario Ministry of Health and Long Term Care and the Ontario Problem Gambling Research Centre. Retrieved from http://hdl.handle.net/10133/3121

Williams, R. J., & Wood, R. T. (2007). *Internet Gambling: A Comprehensive Review and Synthesis of the Literature.* Guelph, ON: Ontario Problem Gambling Research Centre. Retrieved from http://hdl.handle.net/10133/432

Winters, K. C., Stinchfield, R. D., Botzet, A., & Anderson, N. (2002). A prospective study of youth gambling behaviours. *Psychology of Addictive Behaviours, 16,* 3.

Winters, K. C., Stinchfield, R. D., Botzet, A., & Slutske, W. S. (2005). Pathways of youth gambling problem severity. *Psychology of Addictive Behaviours, 19,* 104-107.

Winters, K. C., Stinchfield, R. D., & Kim, L. G. (1995). Monitoring adolescent gambling in Minnesota. *Journal of Gambling Studies, 11,* 165-183.

Wohl, M. J. A., & Sztainert, T. (2011). Where did all the pathological gamblers go? Gambling symptomatology and stage of change predict attrition in longitudinal research. *Journal of Gambling Studies, 27,* 155-169.

World Health Organization. (1990). *Composite International Diagnostic Interview*. Geneva, Switzerland: Author.

World Health Organization. (1997). *Composite international diagnostic interview (CIDI, Version 2.1)*. Geneva, Switzerland: Author.

Wynne, H., Smith, G., & Volberg, R. (1994). *Gambling and problem gambling in Alberta: Final report prepared for Alberta Lotteries and Gaming*. Edmonton, AB: Wynne Resources.

Xian, H., Scherrer, J. F., Slutske, W. S., Shah, K. R., Volberg, R., & Eisen, S. A. (2007). Genetic and environmental contributions to pathological gambling symptoms in a 10-year follow-up. *Twin Research and Human Genetics, 10,* 174-179.

Xuan, Z., & Shaffer, H. (2009). How do gamblers end gambling: Longitudinal analysis of Internet gambling behaviours prior to account closure due to gambling related problems. *Journal of Gambling Studies, 25,* 239-252.

Yeo, D., Mantel, H., & Liu, T. P. (1999). *Bootstrap variance estimation for the National Population Health Survey: Proceedings of the Survey Research Methods Section*. Alexandria, VA: American Statistical Association. Retrieved from http://goo.gl/6PKCfz.

Appendix A: Gambling in Alberta

Alberta has one of the most liberal gambling regimes in Canada. The past two decades have seen the emergence of new gambling formats and a corresponding loosening of restrictions. For example, gambling venues open 364 days a year and for longer hours; alcohol consumption allowed on the gambling floor; maximum bet limits increased; ATMs on gambling premises; EGMs equipped with bill acceptors; and the prospect of Internet wagering just around the corner. All of these changes were made to increase revenues, but with minimal public consultation and without full consideration of the likely social impacts on citizens and the community.

While legal gambling generates significant revenue for the province ($1.2 billion a year, 84% of which is derived from EGM play), this study shows there are significant health and social effects due to this heavy reliance on gambling profits. For instance, frequent and intense gambling (especially on EGMs) leads to an elevated risk for problem gambling, which, in turn is linked with mental health disorders and immutable characteristics such as lower intelligence and being non-Caucasian. An implication of Alberta's near saturated gambling environment is that a disproportionate amount of gambling revenue is being harvested from vulnerable individuals.

Changes to the Alberta Gambling Landscape Over the Time Period Covered by the LLLP

An important contextual factor in the LLLP results is the change in gambling availability, policies, and prevention efforts that occurred over the 5-year period of data collection (Alberta Gaming and Liquor Commission, 2006; 2011; Horse Racing Alberta, 2006; 2010). Gambling is an expanding industry and it would be naïve to assume that gambling availability at the beginning of the LLLP would be the same as the last data collection cycle. In this section, we summarize changes in the Alberta gambling landscape that occurred between 2005-06 and 2010-11.

Change in Legal Gambling Infrastructure and Gross Revenue Totals Over Period of LLLP

Table A1 summarizes the changes in legal gambling availability and revenue from 2005-06 to 2010-11. The information comes from the Alberta Gaming and Liquor Commission (2006; 2011) and Horse Racing Alberta Annual Reports (Horse Racing Alberta, 2006; 2010) (see also Williams, Belanger & Arthur, 2011).

Table A1: Changes in Legal Gambling Infrastructure and Gross Revenue Totals Over Period of LLLP

	2005-06		2010-11		Change	
Activity	**Venues**	**Revenue (millions)**	**Venues**	**Revenue (millions)**	**Venues**	**Revenue (millions)**
Horse Racing	5 tracks	41	4 tracks	37	-1	-4
Raffles	306[1]	35	278	39	-28	+4
Pull Tickets	228 licenses	7	241 licenses	18	+13	+11
Bingo[2]	47 halls	42	29 halls	20	-18	-22
Lottery Products	2,280 retailers	205	2565 retailers	319	+285	+114
Video Lottery Terminals (VLTs)	5,981 machines	695	5982	493	+1	-202
Slot Machines	8,658 machines[3]	606	13,278[4]	809	4,620	+203
Casinos	17	172	24	235	+7	+63
	Total	**1803**	**Total**	**1970**	**Total**	**+167**

[1] > $10,000 prizes

[2] Including electronic bingo, [3] 20 locations, & [4] 27 locations

Summary of Changes in Gambling Availability and Generated Revenue from 2005-06 to 2010-11

Although Alberta net gambling revenues remained similar in 2006 and 2011 there were several noteworthy changes to the Alberta gambling landscape. The number of casinos grew from 17 to 24; including five First Nation and two traditional casinos. Two First Nation casinos (Enoch Cree and T'suu T'ina generated $20 million or more in revenues in 2009-2010, while the three smaller First Nation casinos (Alexis Nakota Sioux, Cold Lake, and Stoney Nakoda each took in less than $5 million).

The increased number of casinos corresponded to a major jump in the number of slot machines; slot machine numbers went from 8,658 in 2005-2006 to 13,278 in 2010-2011 and slot revenues rose from $606 to $809 million. During this time period slots eclipsed VLTs as the most profitable gambling format. This was not surprising because of the 6,000 cap that has been placed on VLTs since 1996 and the fact that no cap exists for slot machines. Unexpected, was the significant plunge in VLT revenues from $695 to $493 million.

Comparing 2005-2006 with 2010-2011, lottery product revenues increased by more than 33% from $205 to $319 million; casino profits increased from $172 to $235 million (although with the addition of seven new casinos, this was a rather modest increase); pull ticket sales rose from $7 to $18 million, and electronic bingo proceeds doubled from $4 to $8 million. On the other hand, bingo profits showed a precipitous decline from $38 to $12 million and horse racing continued its gradual revenue slide, going from $41 to $37 million.

Gambling-Related Social Responsibility Initiatives

During the five year period of LLLP data collection period the following initiatives aimed at mitigating gambling-related harms were introduced by the Alberta Gaming and Liquor Commission (AGLC). Responsible Gambling Information Centres (GICs) were placed in several Calgary and Edmonton casinos. The GICs-staffed initially with Alberta Alcohol and Drug Abuse Commission (AADAC) counselors and later trained (AGLC) personnel, offer information on the cost of play, the house advantage, voluntary self-exclusion, and problem gambling. Also provided at GICs are Player Awareness Terminals (PATs); interactive devices that allow players to self-test their gambling knowledge and behaviour, provide tips on responsible gambling, and dispel commonly held gambling myths. Each year, new GICs are added; at present there are 17 in total, located in most Alberta casinos and racing entertainment centres.

Responsible gaming features were added to VLTs such as problem gambling referral information, pop-up reminders about the amount of time the player has been on the machine, and indicators telling players how much money they have spent on a machine. ATMs were made less accessible; a new regulation stipulated that ATMs could be no closer than 15 feet from a VLT. Since 2001 there has been a gradual reduction (18%) in the number of VLT locations in the province. As a result of lottery ticket improprieties in Ontario and British Columbia, AGLC instituted criminal background checks on lottery ticket retailers and added self-service lottery ticket checkers.

Various publicity campaigns implemented by AGLC centered on issues such as “minor’s awareness,” reminding lottery players about the 18 years and older age restriction to participate; “responsible gambling week,” which highlights AGLC’s focus on controlled gambling and involves stakeholder meetings to foster innovative ways to engender responsible gambling; and “holiday minor’s awareness,” which spells out the dangers of giving lottery tickets as presents to children.

The AGLC routinely offers training programs for gambling venue staff on problem gambling and social responsibility awareness. In addition, AGLC collaborates with outside agencies such as Alberta Health Services (developing strategies to minimize gambling-related harms); Interprovincial Lottery Corporation (examining worldwide best social responsibility practices); and Gamtalk a national support forum for problem gamblers.

In 2009 the AADAC was disbanded by the Alberta government and folded into an omnibus public health entity called Alberta Health Services. A theoretical advantage of this merger is that treatment for addictions now also covers mental health disorders.

Commentary on Alberta's Gambling Environment

Legal gambling has thrived in Alberta more so than in any other Canadian jurisdiction. With 10.2% of adult Canadians (age 18 and over) living in the province (Statistics Canada, 2008), Alberta generates 22% of Canada's net gambling revenues (Canadian Partnership for Responsible Gambling, 2012). There are more casinos in Alberta than in any other province with 24 casino locations throughout the province. In contrast, Ontario, with nearly four times the population of Alberta, has 11 casinos and Quebec, with two and-a-half times more residents than Alberta, has four casinos. In terms of gambling availability (number of gambling outlets and games offered), Alberta surpasses all other provinces on a per capita comparison. Moreover, Alberta along with Manitoba are the second leading provinces (Saskatchewan ranks first at $855) in annual net gambling revenue generated per adult ($737), well above the national average of $547 (Canadian Partnership for Responsible Gambling, 2012). Alberta remains at the top of provincial rankings in terms of the percentage of total revenue derived from gambling (4.2%), in contrast to the national average of 2.3% (Canadian Partnership for Responsible Gambling, 2012).

In the 2001 Alberta problem gambling prevalence survey (Smith & Wynne, 2002), 5.2% of the 1,804 person adult sample qualified as either moderate-risk or problem gamblers, which, at the time, placed Alberta second to Saskatchewan in terms of the nation's highest problem gambling prevalence rate. A 2008 survey administered to a sample of 3,001 adult Albertans revealed that the problem gambling prevalence rate had dropped to 2.1%, and the gambling participation rate (those reporting having gambled at least once in the previous year) fell from 77% in 2001 to 71% in 2008 (Williams, Belanger, & Arthur, 2011). A smaller sample prevalence study (n=1054) administered in 2009 showed the problem gambling prevalence rate had increased to 3.1% (Williams, Belanger et al., 2011). Despite the lower gambling involvement percentage, overall gambling revenues have remained constant, suggesting that fewer gamblers are wagering more dollars.

It is also important to note that by a wide margin, EGMs (VLTs or slot machines) are considered by problem gamblers to be the gambling format that causes them the most trouble (Williams, Belanger et al., 2011). The Social and Economic Impact of Gambling in Alberta (SEIGA) study (Williams, Belanger et al., 2011) concluded that the minor economic benefits of gambling are offset by the minor economic costs of the activity, while the important social benefits of gambling are offset by some serious negative consequences. One dramatic negative consequence noted in the SEIGA report is the fact that the 5.8% of the adult population, who are problem gamblers, account for an astonishing 75% of reported gambling expenditures (Williams, Belanger et al., 2011).

Availability of Treatment for Problem Gambling

Treatment availability for problem gambling remained relatively stable during the period of the LLLP data collection. Alberta neither lost nor gained specific treatment resources for problem gambling. AADAC provided the majority of treatment services for gamblers. In 2009, AADAC

was amalgamated with the health regions to form Alberta Health Services, however this did not result in any downsizing of treatment for gamblers. Notwithstanding, Alberta ranks last among all provinces in the percentage of gambling revenue allocated for problem gambling treatment and prevention (0.04% when last reported, compared to the national provincial average of 1.4%). It is interesting to note that the overall volume of individuals seeking treatment for addictive behaviours decreased between 2006-07 and 2010-11, the same period of the LLLP. The decrease was seen in both absolute and per capita terms. Specifically, 1,492 Albertans per 100,000 sought treatment for addictions in 2006. This number decreased to 1,238 per 100,000 in 2010. The proportion of problem gamblers represented in these figures is unknown.

Appendix B: Instruments

Measures Related to Gambling

Gambling behaviour was measured using questions from the **Canadian Problem Gambling Index** (CPGI; Ferris & Wynne, 2001) that ask about the types of gambling engaged in, frequency of involvement, amount of time spent gambling on each type, expenditure on each type, the largest amount of money spent on each type, when individuals gamble, and who participants engage in each type of gambling with. The types of gambling considered were: lottery tickets, raffle tickets, instant win tickets, Sports Select, slot machines, VLTs, casino table games, horse betting, bingo, betting on sports with a bookie, buying high risk stocks, and betting against other people for money during activities such as card games or sports events.

There were questions from the CPGI regarding the age when participants first gambled for money, the type of gambling they first participated in, if they remembered having a big win when they started to gamble, and if they remembered having a big loss when they started to gamble (Ferris & Wynne, 2001). There were also seven questions from the Composite International Diagnostic Interview's - Gambling Module (CIDI-GM; World Health Organization, 1997) that examined respondent's behaviour during gambling. Four of these questions asked the extent to which they gambled: for excitement; to relax or have fun; to win money; and to be with friends or to make new friends. The other three items asked when they gamble, how often they: lose track of time; go into a trance-like state; and feel like they are outside of their body, as if they were watching him/herself gamble.

Problem gambling was assessed with the 9-item problem gambling severity index (PGSI) from the Canadian Problem Gambling Index (CPGI). The CPGI resulted from a three-year (1997-2000) national research project called 'Measuring Problem Gambling in Canada' (Ferris, Wynne, & Single, 1999). The aim of the project was to develop an instrument that accurately identifies and classifies non-problem, at-risk, and problem gamblers in the general population. The CPGI was the result of this project. Previously used instruments in general population surveys such as the South Oaks Gambling Screen (SOGS) and the DSM-IV manual diagnostic criteria for 'pathological gambling,' are now considered to be less sophisticated than the CPGI because they have been validated only on clinical populations. The CPGI is thought to be a more precise instrument for measuring problem gambling behaviour among non-clinical populations. The Canadian Problem Gambling Index (CPGI) was administered at Waves 1, 2, 3, and 4.

In developing the CPGI, theories and models used to explain problem gambling were inspected, and the various measures used to identify problem gamblers and those at-risk for becoming problem gamblers, were reviewed. Ten different problem gambling measures, not counting derivatives, were detected in the literature. The SOGS was used most extensively; indeed, the SOGS was used in the first Alberta problem gambling prevalence survey (Wynne, Smith & Volberg, 1994). In the process of creating the CPGI, the research team critically analyzed existing instruments, and examined the domains and variables that each purported to measure for the purpose of incorporating the best of these into the CPGI's first draft. This draft was

scrutinized by an international panel of gambling-research experts, modified, and then pilot-tested with three groups (a random sample from the general population, regular gamblers who responded to newspaper ads, and problem gamblers in treatment [N=50 per group]).

Following the pilot-test, the 31-item CPGI was tested in an Anglo/Franco national general population survey sample of 3,120 Canadian adults drawn from all provinces. To establish reliability, the CPGI was re-administered to a sample of 417 respondents from the initial survey. Finally, to further validate the classification accuracy of the CPGI, problem gambling treatment specialists conducted clinical interviews with 143 survey participants. As a result of these investigations, the CPGI is the first problem gambling behaviour measurement tool to be rigorously tested prior to its use in community-based surveys.

As indicated above, the CPGI was designed for the purpose of making a finer distinction between respondents who have gambling problems and those who do not, and between gamblers who are at a low or moderate risk for developing problems. The CPGI is designed to measure gambling behaviours in general populations but not clinical populations as yet. Gambling frequency was assessed by the following question: roughly how often do you play one or more of these activities in a typical month (e.g., Sports Select; slot machines; VLTs; casino table games; horse race betting; bingo; betting on sports with a bookie; Internet gambling; or betting against other people on games such as pool, darts, video games, board games, cards, etc.)? Would you say: daily, almost every day, several times a week, a few times a week, once a week, a couple times a month, once a month, less than once a month, or never?

Problem gambling severity over the past year was estimated using the **Problem Gambling Severity Index** (PGSI; Ferris & Wynne, 2001) that provides a continuous score and categorizes individuals into non-gambler, non-problem gambler, low risk, moderate risk, and problem gambler groupings. Using a sample of over 25,000 gamblers including the LLLP, Currie and colleagues (2012) conducted validity and reliability analyses and revised the PGSI categorization cutoffs. The authors re-scored the low risk (PGSI = 1-4) and moderate risk (PGSI = 5-7) categories to improve the scale. Confirmation of this rescoring has been found by Williams and Volberg, 2010, 2014), where an improvement in the classification accuracy of the PGSI against clinical assessment was demonstrated when a 5+ cut-off rather than 8+ cut-off was used to designate problem gambling (kappa increased to .69).

Extra questions regarding Internet gambling were asked at Wave 2 and 3 of the LLLP. The researchers wanted to gather more detailed information regarding the frequency of Internet gambling, the amount of time spent participating in Internet gambling, the amount of money spent on Internet gambling, and who the individual was participating with while involved in the Internet gambling activity. The types of gambling considered with these extra Internet questions were: lottery tickets, raffle tickets, instant win tickets, Sports Select, casino table games, horse betting, bingo, betting on sports with a bookie, buying high risk stocks, and betting against other people for money, such as cards or sports events.

Finally, Pathological gambling was measured in adults by means of the **Composite International Diagnostic Interview's - Gambling Module** (CIDI-GM; World Health Organization, 1997), which uses the DSM-IV criteria for pathological gambling (CIDI-DSM-IV) (American Psychiatric Association, 1994). The 17 dichotomous questions (yes or no) included in the CIDI-GM combine to map onto the 10 diagnostic criteria for pathological gambling that are in the DSM-IV (American Psychiatric Association, 1994). Four of the questions in the CIDI-GM are directly related to four of the individual DSM-IV criteria for pathological gambling. In the case of the other six DSM-IV criteria for pathological gambling, either two or three individual questions from the CIDI-GM can trigger an affirmative 'yes' for that item (i.e., an "or" statement). A total of The Composite International Diagnostic Interview's Gambling Module (CIDI-GM) was administered at Waves 1, 2, 3, and 4.

The construct of gambling attitudes was measured by items from three different surveys: the Alberta Gaming and Liquor Commission (ACCORD Research, 2000); the Canada West Foundation (Azmier, 2000); and the Gambling Attitudes Measure (Williams, 2003; Williams, Connolly, Wood, & Nowatzki, 2006). The 16 items from the **Alberta Gaming and Liquor Commission** asked participants for their impression of the level of harm associated with various forms of gambling (ACCORD Research, 2000) and the 12 items from the **Canada West Foundation** focused on participant's attitudes toward gambling (Azmier, 2000). The **Gambling Attitudes Measure (GAM)** (Williams, 2003) consists of 3 questions on the benefit/harm of gambling; whether gambling is morally wrong; and the person's opinion about legalized gambling. This instrument has low internal consistency (Cronbach alpha = .57) due to just having 3 questions and the fact that each question addresses a somewhat different issue (which is why the instrument is described as a "measure" rather than a "scale"). However, one month test-retest reliability is good (r = .78, $p < .01$ using a sample of 585 first year university students in Alberta in 2002-2003; r = .73, $p < .01$ using a random sample of 491 Canadian adults in 2006-2007). Concurrent validity is established by the GAM's significant positive correlation with current gambling involvement in all studies the first author has conducted (8 studies with ~30,000 participants). The overall magnitude of the correlation is only moderate (ranging from r = .25 to r = .50), which is partly due to the fact that some of the people with the highest levels of involvement (problem gamblers), have very negative attitudes toward gambling. The strength of this correlation is lower for money spent gambling compared to time spent gambling, frequency of gambling, and number of gambling formats engaged in. Predictive validity is established by GAM's significant positive correlation with future gambling involvement in all studies the first author (i.e., Williams) has conducted (3 studies with ~6,500 participants; all correlations of similar magnitude to those established with concurrent validity).

Gambling fallacies were assessed with the **Gambling Fallacies Measure (GFM)** (Williams, 2003). The GFM is a 10-item questionnaire addressing common gambling fallacies: failure to understand the independence of random events; belief that one is luckier than other people; illusion of control; believing in or being susceptible to superstitious conditioning; ignoring or being unaware of the statistical probabilities when gambling; insensitivity to sample size in calculating odds; insensitivity to the law of large numbers; and applying stereotypic notions of randomness. Internal consistency of the GFM is low (Cronbach alpha = .51; n = 2080 randomly

selected Canadian adults in 2006-2007), which reflects the fact these 10 questions are assessing a wide range of different fallacies. However, one month test-retest reliability is relatively good (r = .70; random sample of 2080 Canadian adults in 2006-2007). Concurrent validity is established by the GFM's significant positive correlation with current gambling involvement (r = .10 for number of types engaged in; r = .13 for frequency of gambling; n = 3,936 Ontario adults in 2006-2007), paranormal beliefs (r = .14 to r = .22 depending on the specific paranormal belief; random sample of 2,091 adults in 2006-2007) as well as problem gambling status (r = .11 to r = .15 depending on the study). In general, the magnitude of the correlations between gambling fallacies and gambling involvement are consistently positive, but low. This is due to the fact that very high rates of gambling fallacies are also present in non-gamblers and recreational gamblers.

The Devaluation-Discrimination Scale (Link, 1987; Link, Mirotznik, & Cullen, 1991) is a 12-item Likert-type 6-point scale that assesses the degree to which respondents have a perceived devaluation and discrimination toward individuals with a history of psychiatric treatment. The original Devaluation-Discrimination Scale has been modified (Horch & Hodgins, 2008) to facilitate an examination of the perceived devaluation and discrimination toward individuals with a history of problem gambling. In the Devaluation Discrimination Questionnaire (DDQ) for gambling, the phrase "mental patient" was replaced with "problem gambler" in each of the 12-items (Horch & Hodgins, 2008). The original scale has well established psychometric properties (Ritsher, Otilingam, & Grajales, 2003), with good internal consistency (Link et al., 1991; Ritsher et al., 2003) and the majority of individuals believing that mental patients are devalued and discriminated against. The revised DDQ has been shown to have good internal consistency in examining devaluation and discrimination towards individuals with a history of problem gambling (Horch, 2012). At Wave 1 and 2 of the LLLP, the **Devaluation Discrimination Questionnaire – Short Form** (DDQ-SF) was used to examine the devaluation and discrimination of individuals with a gambling problem. Instead of having all 12-items in the full DDQ, the DDQ-SF has six items with a 6-point Likert-type scale ranging from (1) "strongly disagree" to (6) "strongly agree".

At all waves of data collection LLLP participants were asked specific questions regarding treatment for a gambling problem. These questions were similar to the **National Comorbidity Study Treatment and Family History Questions** that have been used for alcohol and drugs. In the gambling section of the LLLP survey, participants were asked if they had ever talked to a medical doctor or other professional about their gambling problems, if they had ever attended a self-help group for people with gambling problems, and if they had ever received treatment or counseling for their gambling problems that they considered helpful or effective.

At all four data collection waves, participants in the LLLP were asked whether they had attended any type of information session (i.e., lecture, class, or presentation) on gambling or problem gambling in the last six months. Participants were also asked whether they had used drugs or alcohol while gambling, the percentage of their close friends that gamble regularly, whether their parents gamble regularly, whether their siblings gamble regularly, how much

gambling there was at their work or school, and how much their parents gambled when they were growing up.

The **Sydney and Laval Universities Gambling Screen** (SLUGS) used at Wave 1 of the LLLP included 16-items to identify the types of gambling individuals were participating in during the last six months. The types of gambling included: wagering on horses, wagering on dogs, wagering on standardbred horses, poker-machines, video-draw poker or blackjack, keno, electronic horse racing, electronic roulette, Lotto (649, Super 7, or Pick 3), scratch cards, sports lotto or pools, other lotteries, card games, roulette, Internet casino games, and any other forms of gambling (Blaszczynski, Ladouceur, & Moodie, 2008). As well, the SLUGS included 7-items that were developed to identify impaired control, subjective harm, plus need and expressed desire for treatment (Blaszczynski et al., 2008). These 7-items were developed to be used in community populations, and were not limited to use with only samples of problem or pathological gamblers. Preliminary results that have examined the effectiveness of the SLUGS have found that it is significantly correlated with the SOGS. In terms of the usefulness of the SLUGS for clearly quantifying the constructs of impaired control and harm, further examination is required (Blaszczynski et al., 2008).

Measures Related to Mental Health, Personality, Stress, and Coping

The **Composite International Diagnostic Interview** (CIDI-SF) is the short form of the World Health Organization's structured interview assessment of psychiatric disorders (Kessler et al., 1998) and has been used in the general population. All items used in the CIDI-SF were selected from the larger pool of items that make-up the World Health Organization's (WHO) Composite International Diagnostic Interview (CIDI; World Health Organization, 1990) and were selected based on analyses of the United States National Comorbidity Survey (NCS; Kessler et al., 1994). Although the empirical work to develop the CIDI-SF was based on lifetime diagnoses, the CIDI-SF is scripted in a 12-month prevalence format. The CIDI-SF was administered at Waves 1, 3, and 4.

As described elsewhere (Kessler et al., 1998), the CIDI-SF was developed to evaluate hierarchy-free diagnoses according to the definitions and criteria of the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994). The CIDI-SF evaluates six DSM-IV mental disorders and two DSM-IIIR substance disorders: major depression, generalized anxiety disorder, specific phobia, social phobia, agoraphobia without a history of panic disorder, panic attack, obsessive-compulsive disorder, alcohol dependence, and drug dependence. The alcohol dependence and drug dependence sections were excluded from the current study. The CIDI-SF yields a probability-of-caseness ranging from 0.0 to 1.0 for each disorder. This score can be interpreted as the probability that a respondent with a particular response profile would meet full diagnostic criteria if given the complete CIDI interview. Because it may be desirable to have dichotomous outcomes defining whether the respondent is possibly a case (i.e. meets full non-hierarchical diagnostic criteria), guidelines for specifying these outcomes are also provided (Kessler et al., 1998). The CIDI-SF uses a stem-branch logic in which a small number of initial diagnostic stem questions are used in each section to skip-out people who are least likely to be

cases before they are asked further symptom questions. Please refer to Kessler et al. (1998) for more details on the development of the CIDI-SF.

The **Personality Assessment Inventory** (PAI) is a self-report instrument, with multiple scales that can be used with adults 18 years of age or older (Morey, 2007). The PAI has a total of 344 items, which include 22 unique non-overlapping scales. The four validity scales are: inconsistency (10 items); infrequency (8 items); negative impression (9 items); and positive impression (9 items). The 11 clinical scales are: somatic complaints (24 items); anxiety (24 items); anxiety-related disorders (24 items); depression (24 items); mania (24 items); paranoia (24 items); schizophrenia (24 items); borderline features (24 items); antisocial features (24 items); alcohol problems (12 items); and drug problems (12 items). The five treatment scales are: aggression (18 items); suicidal ideation (12 items); stress (8 items); nonsupport (8 items); and treatment rejection (8 items). Finally, the two interpersonal scales are dominance (12 items) and warmth (12 items; Morey, 2007). The PAI has been used on a wide variety of populations of adults and has been found to have excellent reliability and validity (Morey, 2007; Morey & Hopwood, 2006). It comprehensively assesses all main areas of psychopathology, which is needed in order to ascertain which types of pathology are related to problem gambling. The PAI has a 4-point Likert-type scale ranging from “false, not at all true” to “very true.”

At Wave 1, a total of 296 items from the PAI were used in the LLLP, with the following scales excluded from the study: inconsistency (10 items); alcohol problems (12 items); drug problems (12 items); dominance (12 items); and warmth (12 items). These scales were not included in the LLLP since they were being measured using other valid instruments or were deemed to not be directly related to gambling behaviour. For example, alcohol and drug questions were asked in the Canadian Community Health Survey (CCHS).

At Wave 2 and 4 of the LLLP, these same scales were excluded as well as non-support (8 items), negative impression (9 items), positive impression (9 items), infrequency (8 items), and stress (8 items). The shortened versions of the paranoia scale (12 items) and the schizophrenia scale (12 items) were used at Wave 2 and 4 of the LLLP. As a result there were a total of 230 items from the PAI that were used at Wave 2 and 4 of the LLLP. Please refer to Morey (2007) for more details on the development, reliability, validity, and scoring of the PAI.

The **Revised Neuroticism, Extroversion, Openness Personality Inventory** (NEO PI-R; Costa & McCrae, 1992) is a widely used measure that provides a comprehensive description of personality traits. It focuses on “normal” personality traits and is therefore, ideal for a general population survey. The NEO PI-R is a long version measure of the five major domains of personality as well as the six, more specific scales that measure facets for each individual domain, for a total of 240 questions (Costa & McCrae, 1992). Taken together, the five domain scales and thirty facet scales of the NEO PI-R facilitate a comprehensive and detailed assessment of normal adult personality and it is recognized internationally as a gold standard for personality assessment (Costa & McCrae, 1992).

A short version exists as well, providing indicators of the same five major domains and some questions from a large majority of the 30 sub-traits. The five domains are neuroticism, extraversion, openness, agreeableness, and conscientiousness. The short version (NEO-FFI) is a 60-item version of Form S of the NEO PI-R (Costa & McCrae, 1992). The NEO-FFI provides a brief, comprehensive measure of the five domains of personality, with 12-items from each of the domains (Costa & McCrae, 1992).

The Short Version of the NEO Personality Inventory (NEO-FFI) was the measure used in the LLLP (only at Wave 1). For two of the personality domains (extraversion and neuroticism), all questions from the long version (NEO PI-R) were asked in the LLLP. It was anticipated that the extraversion and neuroticism domains would be highly associated with addictive behaviour such as problem gambling. Therefore, it was important to include these extra questions to be able to conduct a more complete analysis of the relationship between key domains and sub-traits of the NEO PI-R and NEO-FFI and problem gambling. All the individual questions for the following sub-traits of the neuroticism domain were asked: anxiety; angry hostility; depression; self-consciousness; impulsiveness; and vulnerability (eight questions in each sub-trait). Finally, all the individual questions for the following sub-traits of the extraversion domain were asked: warmth; gregariousness; assertiveness; activity; excitement-seeking; and positive emotions (eight questions in each sub-trait). The shortened version of the NEO (NEO-FFI; 60-questions) is somewhat less reliable and valid than the full NEO PI-R with all 240-questions for each of the five domain scales (Costa & McCrae, 1992). The NEO PI-R and the shortened NEO-FFI version have a 5-point Likert-type scale ranging from (1) “strongly disagree” to (5) “strongly agree.” Please refer to Costa and McCrae (1992) for more details on the development, reliability, validity, and scoring of the NEO-FFI.

The **Life Events Questionnaire** (LEQ; Vuchinich, Tucker, & Harllee, 1986) was used to assess a wide variety of issues in the lives of participants in the LLLP. In particular, the LEQ assessed events in nine categories over the past 12 months, with a total of 93 dichotomous (yes or no) questions. The nine categories were: work (15 questions); residence (9 questions); marriage and intimate relationships (14 questions); family and children (14 questions); friendship and social activities (9 questions); finances (7 questions); physical health (5 questions); legal matters (8 questions); and other events (12 questions). Most of the questions in the LEQ are close-ended (e.g., promoted at work), while some are open-ended (e.g., providing a description for the question “did you experience any additional work events during this one year period?”). The LEQ yields a frequency score for each category and a total score. The LEQ has been shown to have good agreement with collateral reports (Tucker, Vuchinich, & Gladsjo, 1994) and have excellent retest reliability over a two-week period (Vuchinich et al., 1986).

The original LEQ was used at Wave 1 of the LLLP, with a slightly revised version used at Wave 2, 3, and 4. The revised version of the LEQ used at Wave 2, 3, and 4, was shorter, but had many of the same questions. In particular, the revised LEQ assessed events in six categories over the past 12 months, with a total of 58 dichotomous (yes or no) questions. The six categories in the revised version of the LEQ were: work and school (16 questions); family and friends (21 questions); property and finances (6 questions); legal matters and crime (9 questions); health (5

questions); and other events (1 question). The revised LEQ yields a frequency score for each category and a total score.

The **Coping Inventory for Stressful Situations** (CISS) was used at Wave 2, 3, and 4 of the LLLP to measure the impact coping styles had on the physical and psychological well-being of participants. It is especially important to measure individual's coping styles when they are dealing with negative or stressful life events such as problem gambling (Endler & Parker, 1990a; 1990b; 1994; 1999). There is a full version of the CISS that consists of 48 items and a short-version of the CISS that consists of 21 items. The shortened version of the CISS was used in the LLLP. Respondents were asked to rate each of the 21 items on a five-point Likert-type scale ranging from (1) "not at all" to (5) "very much." In particular, respondents were asked how much they use these various coping mechanisms when they encounter a difficult, stressful, or upsetting situation (Endler & Parker, 1990a; 1990b; 1994; 1999). In the shortened version of the CISS, there are three coping dimensions: task-oriented coping, emotion-oriented coping, and avoidance-oriented coping (Endler & Parker, 1990a; 1990b; 1994; 1999). One of the co-authors of the instrument, J. Parker, gave the investigators involved in the LLLP permission to use the shortened version of CISS free of charge for academic research.

The **Adult ADHD Self-Report Scale, Version 1.1** (ASRS-V1.1) was used to examine the potential diagnosis of ADHD among adult participants in the LLLP (Kessler et al., 2005). The ASRS was developed in conjunction with the World Health Organization (WHO) and researchers from New York University Medical School and Harvard Medical School (Kessler et al., 2005). The ASRS has 18 questions, which are consistent with the DSM-IV (American Psychiatric Association, 2000) criteria and address the manifestations of ADHD symptoms in adults. The content of the questionnaire also confirms the importance that DSM-IV places on symptoms, impairments, and history for a correct diagnosis (American Psychiatric Association, 2000; Kessler et al., 2005). The ASRS-V1.1 has a 5-point Likert-type scale ranging from (0) "never" to (5) "very often." The symptom checklist cut-offs for each of individual questions varies for each of the 18 questions. For some questions, individuals meet the criteria for ADHD symptoms if they answer either (2) "sometimes", (3) "often", or (4) "very often", while for other questions, individuals meet the criteria for ADHD symptoms if they answer only (3) "often" or (4) "very often." Please refer to Kessler et al. (2005) for more details on the development, reliability, validity, and scoring of the ASRS-V1.1.

Measures Related to Health

The **SF-8 Health Survey**, a multipurpose short-form survey of health status, was used at all four waves of the LLLP. The SF-8 Health Survey is a shorter version of the SF-36 Health Survey, and despite the similarity of the items, none of the individual items on the SF-8 are identical to the questions included in the SF-36 (Ware, Kosinski, Dewey, & Gandek, 2001). The SF-36 Health Survey has been used widely with both medical patients and general population samples and is useful in monitoring changes over time. The individual items selected for inclusion in the SF-8 Health Survey maximize the discrimination between the higher and lower levels of health status (Ware et al., 2001). Since the SF-8 single-item scales and summary measures are scored on the

same metric as the full SF-36 version, the scores between the SF-8 and SF-36 are directly comparable (Ware et al., 2001).

Three forms of the SF-8 Health Survey have been developed, with the recall period being 4-weeks, 1-week, or 24-hour (Ware et al., 2001). The 4-week recall was the version of the SF-8 Health Survey used in the LLLP, with the eight questions having either five or six Likert-type response options. The eight questions included in the SF-8 Health Survey deal with the following areas: general health, physical functioning; physical health, bodily pain; vitality; social functioning; mental health; and emotional problems (Ware et al., 2001). Please refer to Ware et al. (2001) for a more detailed description regarding the development, reliability, validity, and scoring for the SF-8 Health Survey.

At Wave 1 of the LLLP, two dichotomous questions (yes or no) from the **Canadian Community Health Survey** (CCHS) Cycle 1.2, Mental Health and Well-being (Statistics Canada & the Canadian Institutes of Health Research, 2002) were used to examine the health of participants. The first question asked participants: "do you have any difficulty hearing, seeing, communicating, walking, climbing stairs, bending, learning or doing other activities?" The second question asked participants: "do you have a physical, mental, or health problem that reduces the amount or kind of activity you can do at home, work, or school?" Finally, at Wave 1, 3, and 4 of the LLLP, participants were asked what current prescription medication they were taking, the purpose of the medication, and how long they had been taking the medication. Each respondent could list up to five different types of prescription medications.

The **Personal Well-being Index – Adult (PWI-A)** was used at Wave 3 and 4 of the LLLP. The PWI-A contains eight items of satisfaction, each one corresponding to a specific quality of life domain: standard of living, health, achieving in life, relationships, safety, community-connectedness, future security, and spirituality/religion (International Wellbeing Group, 2006). These eight domains in combination are thought to represent the global question: 'how satisfied are you with your life as a whole?' There were also two related questions asked at the same time of the PWI-A: "how satisfied are you with your spirituality or religion?" and "how satisfied are you with your own happiness?"

The basic psychometric characteristics of the PWI in Australian samples have been described (Cummins et al., 2004; Cummins, Eckersley, Pallant, Van Vugt, & Misajon, 2003), while more detailed data concerning scale composition, reliability, validity, and sensitivity are provided in other reports on the Australian Unity Wellbeing Index (Lau, Cummins & McPherson, 2005; Tiliouine, Cummins, & Davern, 2006). In general, research has shown that the eight domains consistently form a single stable factor and account for about 50% of the variance in Australia and other countries (International Wellbeing Group, 2006). In terms of convergent validity, a correlation of .78 with the Satisfaction with Life Scale (Diener, Emmons, Larsen, & Griffin, 1985) has been reported (International Wellbeing Group, 2006), while the Cronbach alpha ranges from .70 to .85 in samples within Australia and overseas (International Wellbeing Group, 2006). The PWI-A has also demonstrated good test-retest reliability across 1-week and 2-week intervals, with an intra-class correlation coefficient of .84 (Lau et al., 2005). The International

Wellbeing Group (2006) provides a more detailed description regarding the development, reliability, validity, and scoring for the PWI-A.

The **Eating Disorder Examination Questionnaire** (EDE-Q; Fairburn & Beglin, 1994) was used at Wave 3 of the LLLP. The first 12 questions and question 19 in the EDE-Q focus on the individual's eating habits over the past 28 days, with a 7-point, forced-choice ranging from (0) "no days" to (6) "every day." A total of five items ask for open-ended answers regarding an individual's eating, and one item has a 7-point Likert-type scale that varies from (0) "none of the times" to (6) "every time." Another 8-items question issues regarding weight and eating using a Likert-type scale that varies from (0) "not at all" to (6) "markedly." Finally, the EDE-Q asked for a specific height and weight, if females have missed any menstrual periods, and if females have been taking the pill. Scores for the four subscales, restraint (5 questions), eating concern (5 questions), weight concern (4 questions), and shape concern (8 questions), as well as a global score are derived from 22 of the items in the EDE-Q. All 22 of these items have scores ranging from "0" to "6", with the total scores for the four subscales and global score all based on an assessment of the number of episodes over the past four weeks. Research appears to support the fact that the EDE-Q is an accurate self-report assessment of the attitudinal aspects of eating disorder psychopathology (Mond et al., 2004; Mond et al., 2008). Numerous researchers (Fairburn & Beglin, 1994; Mond et al., 2004; Mond et al., 2008) provide a more detailed description regarding the development, reliability, validity, and scoring for the EDE-Q.

The **SCOFF** (Morgan, Reid, & Lacey, 2004) eating disorder questionnaire was used at Wave 3 of the LLLP as well. The SCOFF is comprised of 5 dichotomous (yes or no) items, with the number of positive responses being summed so that the total score ranges from 0 to 5 (Cotton, Ball, & Robinson, 2003; Luck et al. 2002; Morgan et al., 2004). The five questions are: "do you make yourself vomit because you feel uncomfortably full?"; "do you worry that you have lost control over how much you eat?"; "have you recently lost more than 15 pounds in a 3-month period?"; "do you believe that you are fat when others say you are too thin?'; and "would you say that food dominates your life?" Research has shown the SCOFF questionnaire to be highly effective as a screening instrument for detecting eating disorders (Cotton et al., 2003; Luck et al. 2002; Mond et al., 2004; Morgan et al., 2004). Please refer to the many researchers (Cotton et al., 2003; Luck et al. 2002; Mond et al., 2004; Morgan et al., 2004) that provide a more detailed description regarding the development, reliability, validity, and scoring for the SCOFF.

Measures Related to Substance Use

For all four waves of the LLLP, measures regarding drugs, alcohol, and smoking were used from the **Canadian Community Health Survey** (CCHS; Statistics Canada & the Canadian Institutes of Health Research, 2002). The Canadian Community Health Survey (CCHS) cycle 1.2, Mental Health and Well-being section was conducted in the ten provinces in 2002. The LLLP survey used the World Mental Health version of the **Composite International Diagnostic Interview** (WMH-CIDI; Kessler et al., 1994) to estimate the prevalence of various mental disorders (including alcohol and drug use) in the Canadian household population aged 15 or older. The WMH-CIDI is generally based on diagnostic criteria outlined in the *Diagnostic and Statistical*

Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV®-TR; American Psychiatric Association, 1994).

Alcohol consumption and drug use were assessed over the last 12 months and lifetime. Alcohol use in the past year was determined by asking respondents if they had had a drink of beer, wine, liquor or any other alcoholic beverage in the past year. Respondents were told that a "drink" meant one bottle or can of beer, or glass of draft; one glass of wine or wine cooler; or one drink or cocktail with 1 1/2 ounces of liquor. Heavy drinking or binge drinking was determined by asking respondents how often in the past 12 months they have had five or more drinks on one occasion. Alcohol dependence was determined for respondents who reported that they drank heavily at least once a month. Using a short-form measure containing a series of questions, seven different symptoms were measured. Respondents who had "five or more drinks during one occasion at least once a month during the past 12 months" were asked seven questions to determine how their drinking affected everyday activities. For example, "during the past 12 months have you ever been drunk or hung-over while at work, school or while taking care of children? This short-form was developed to reproduce a measure that operationalized both Criteria A and B of the DSM-III-R diagnosis for psychoactive substance use disorder (Kessler et al., 1994; 1998). Respondents who reported three or more symptoms were considered to have alcohol dependence.

To determine illicit drug use, participants were asked if they had ever used an illicit drug. Those who said "yes" were asked how often they had done so in the past 12 months: less than once a month, one to three times a month, once a week, more than once a week, or every day. This was asked separately for the following drugs: marijuana, cannabis or hashish; cocaine or crack; speed (amphetamines); ecstasy (MDMA) or similar drugs; hallucinogens, PCP or LSD (acid); glue, gasoline or other solvents (sniffing); or heroin. Respondents were assigned a frequency for the drug they used most often. For example, someone who used cannabis once a week and cocaine one to three times a month was assigned a frequency of illicit drug use of once a week.

Follow-up questions measuring symptoms of dependence were posed to respondents who had used such illicit drugs at least monthly in the past year. Individuals were considered to have illicit drug dependence if they experienced at least three symptoms related to aspects of tolerance, withdrawal, loss of control, and social or physical problems related to their illicit drug use in the past 12 months. Six symptoms were measured, including tolerance with questions like: "during the past 12 months, did you ever need to use more drugs than usual in order to get high, or did you ever find that you could no longer get high on the amount you usually took?"

At Wave 4 of the LLLP, the questions measuring symptoms of dependence were posed to respondents in a slightly different format. At Wave 4 only, individuals who had admitted to marijuana use in the past 12 months or in their lifetime were asked the drug dependency questions exclusively for marijuana first. Then if the same individual had used any other illicit drug in the past 12 months or in their lifetime, they were asked the drug dependency questions for all the other drugs at the same time. That is, the questions measuring symptoms of dependence were potentially posed to respondents twice, once for marijuana only and once for

all other drugs combined. This separation of the dependency questions for illicit drugs at Wave 4 was done to be able to examine the dependency to marijuana separately from the rest of the illicit drugs. The 'highest score' for either the marijuana only or other illicit drug dependency questions was the one used to calculate whether an individual met the criteria for being dependent on an illicit drug.

For all four waves of the LLLP, measures regarding smoking and nicotine dependence were from the **Canadian Community Health Survey** (CCHS; Statistics Canada & the Canadian Institutes of Health Research, 2002). These questions included: whether they had ever smoked more than 100 cigarettes in their lifetime, if they had ever smoked a whole cigarette, what age they had their first cigarette, how much they presently smoke, and how many cigarettes they smoke each day. The questions related to nicotine dependence asked how soon after they wake up do they smoke their first cigarette, if they find it difficult to refrain from smoking in places where it is forbidden, whether they smoke more frequently during the first few hours after waking compared to the rest of the day, and if they ever smoke even when they are ill.

At Wave 1 of the LLLP participants were asked specific questions regarding treatment for their use of alcohol or drugs and any family history of problems with alcohol or drugs. These questions were first developed for the National Comorbidity Study in the United States, with these specific individual items coming from the sub-section entitled the **National Comorbidity Study Treatment and Family History Questions**. In the LLLP, these questions asked participants if they had ever talked to a medical doctor or other professional about their use of alcohol or drugs; if they ever sought treatment for their use of alcohol or drugs that they found to be helpful or effective; if they had received professional treatment for episodes of alcohol or drugs in the past 12 months; if they were ever hospitalized overnight for their use of alcohol or drugs; and if they had attended a self-help group like Alcoholics Anonymous or Rational Recover for help with their use of alcohol or drugs. Finally, they were asked how many of their close relatives, including biological parents, brothers, sisters, and children, had ever had problems with alcohol or drug use.

Measures Related to Family, Friends, Religion, and Cohesion

Childhood and adolescent physical and sexual abuse and neglect were assessed with the **Childhood Trauma Questionnaire** (CTQ; Bernstein, Ahluvakia, Pogge, & Handelsman, 1997; Bernstein & Fink, 1998). This 28-item self-report inventory provides brief, reliable, and valid screening for a history of abuse and neglect. The CTQ can be used for adolescents between the age of 12 and 17 as well as with adults. The self-completion scale provides five internally reliable subscales or types of maltreatment: emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect (Bernstein & Fink, 1998). There are 5-items associated with each of these five subscales, with another 3-items included in the minimization/denial scale that is used to detect false-negative trauma (Bernstein & Fink, 1998). Finally, there is a total score that measures prior childhood emotional and physical neglect and abuse, and sexual abuse.

There is a 5-point Likert-type scale for each question ranging from “never” to “very often.” The items are summed to produce five subscale scores and a total score that all quantify the level of severity of neglect and abuse (Bernstein & Fink, 1998). There are specific unique cut-offs scores for each subscale that provides details regarding whether the individual meets the criteria for the various maltreatments (Bernstein & Fink, 1998). The CTQ has been validated among a large number of respondents, with test-retest reliability over 36 months being good and validity and interpretation guidelines have been independently established in a number of community and clinical samples (Bernstein et al., 1997; Bernstein & Fink, 1998; Scher, Stein, Asmundson, McCrearly, & Forde, 2001). Please refer to Bernstein & Fink (1998) for a more detailed description regarding the development, reliability, validity, and scoring for the CTQ.

The **Adverse Child Experience** (ACE) was administered to participants at Wave 3 of the LLLP. This instrument was developed as a result of the Adverse Childhood Experience (ACE) Study that examined the childhood origins of many of the leading health and social problems in the United States. The Adverse Childhood Experience (ACE) Study was looking at the relationship between traumas and family dysfunction suffered in childhood, and subsequent poor adult health status and premature death (Anda et al., 2006). Specifically, the goal of the Adverse Childhood Experience (ACE) Study was to examine whether stressful or traumatic childhood experiences such as abuse, neglect, witnessing domestic violence, or growing up in an environment of alcohol or substance abuse, mental illness, parental discord, or crime in the home were common pathways to social, emotional, and/or cognitive impairment (Anda et al., 2006). Conceptually, this study wanted to examine if these stressful or traumatic childhood experiences would increase the risk of unhealthy behaviours (Anda et al., 2006; Edwards et al., 2005), risk or violence or re-victimization (Hillis, Anda, Felitti, & Marchbanks, 2001; Whitfield, Anda, Dube, & Felitti, 2003), disease (Dong et al., 2004; Dube, Felitti, Dong, Giles, & Anda, 2003), and/or premature mortality (Dube et al., 2001; Felitti et al., 1998; Hillis et al., 2004).

There are a total of ten items in the **Adverse Child Experience (ACE)**, with five of the items examining experiences perpetrated against the individual during their childhood (i.e., emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect) and the other five items measuring dysfunction within the child’s household or family (i.e., mother treated violently, household substance abuse, household mental illness, parental separation or divorce, and incarcerated household member). The 10-items in the ACE have dichotomous response options of (0) “no” and (1) “yes”, with the total potential ACE score ranging from 0 to 10, with a higher score being associated with a wide variety of outcomes before and after the age of 18 (Anda et al., 2006; Dong et al., 2004; Dube et al., 2001, 2003; Edwards et al., 2005; Felitti et al., 1998; Hillis et al., 2001, 2004; Whitfield et al., 2003).

The **Family Environment Scale** (FES; Moos & Moos, 2002, 2009) is a comprehensive measure of family functioning and social climate that is widely used and recognized. The FES is composed of ten subscales that measure the actual, preferred, and expected family environments using a dichotomous response-choice of “true of your family” or “false of your family” (Moos & Moos, 2002, 2009). Consequently, the instrument provides important information regarding the individual’s perception of the overall climate within their family. It allows researchers to

determine which (if any) areas of family functioning are related to subsequent problem gambling or resiliency against problem gambling. The FES has a total score as well as scores for 10 subscales that assess three dimensions. The subscales of cohesion, expressiveness, and conflict are part of the relationship dimension (Moos & Moos, 2002, 2009). The subscales of independence, achievement orientation, intellectual-cultural orientation, active-recreational orientation, and moral-religious emphasis are part of the personal growth dimension (Moos & Moos, 2002, 2009). Finally, organization, and control are part of the system maintenance dimension (Moos & Moos, 2002, 2009). Research indicates that the relationship and system maintenance dimensions tend to reflect internal family functioning, whereas the personal growth dimensions reflect more broad linkages between the family and the larger social context (Moos & Moos, 2002, 2009).

The FES has demonstrated good test-retest reliability across 2-month and 4-month intervals, with an intra-class correlation coefficient ranging from .68 to .86 (Moos & Moos, 2002, 2009). The internal consistencies (Cronbach's alpha) for each of the ten subscales are all in the acceptable range and vary from moderate (e.g., independence and achievement orientation) to substantial (e.g., cohesion, organization, intellectual-cultural orientation, and moral-religious emphasis; Moos & Moos, 2002, 2009). The validity of the FES as a retrospective rating of family environment is supported by the fact that adult siblings tend to agree relatively well when rating the characteristics of their shared family of origin (Clay, Ellis, Griffin, Amodeo, & Fassler, 2007; Schaie, 2005). Other research using the FES has not been as definitive, with some findings showing conflicting results regarding the reliability and validity of the FES, with some researchers finding strong validity for at least some of the subscales (Sanford, Bingham, & Zucker, 1999), and other researchers finding less validity in the subscales (Loveland-Cherry, Youngblut, & Leidy, 1989; Munet-Vilaro & Egan, 1990). Please refer to Moos & Moos (2009) for a more detailed description regarding the development, reliability, validity, and scoring for the FES.

At all four waves of the LLLP, levels of marital satisfaction were measured using the **Kansas Marital Satisfaction Scale** (Schumm et al., 1985; 1986; Spanier & Cole, 1976). The Kansas Marital Satisfaction Scale was based on theoretical work by Spanier and Cole (1976), and was developed to address a need for a shorter measure of marital satisfaction. This three item scale has a 7-point Likert-type scale ranging from (1) "extremely dissatisfied" to (7) "extremely satisfied." The reliability and validity of this scale is as good as or better than other much longer scales in current use. The three items are: "how satisfied are you with your (common law) marriage?", "how satisfied are you with your husband/wife/partner as a spouse?", and "how satisfied are you with your relationship with your husband/wife/partner?" Research seems to indicate that the scale has reasonably good internal consistency reliability, test-retest reliability, construct validity, and criterion-related validity (Schumm et al., 1985). Please refer to Schumm et al. (1985, 1986) and Spanier and Cole (1976) for a more detailed description regarding the development, reliability, validity, and scoring for the Kansas Marital Satisfaction Scale.

Measures Related to Society: Friends, Religion, Cohesion, and Ethnicity

The nature and quality of people's social networks was assessed using the **Lubben Social Network Scale.** The Lubben Social Network Scale is a ten item measure of social networks that is easy to score and takes only 5-10 minutes to complete (Lubben, 1988). Thus far, the scale has been validated primarily among older populations, but should be easily adaptable to other age groups. The questions on the Lubben Social Network Scale ask participant's how many relatives they have contact with at least once a month, how often they have contact with their relatives, how many relatives they feel close to, how many close friends they have, how often they have contact with their friends, and whether someone relies on them on a consistent basis. As part of the Lubben Social Network Scale, individuals are also asked if they have someone to discuss important decisions with or if people ask them for their opinion when they have an important decision to make. Please refer to Lubben (1988) for a more detailed description regarding the development, reliability, validity, and scoring for the Lubben Social Network Scale.

Religiosity was measured using the **Rohrbaugh Jessor Religiosity Scale** (Rohrbaugh & Jessor, 1975). This measure was developed to evaluate the impact that religion has had on the respondent's daily, secular life as well as getting an indication of how much the individual is participating in ritual practices affiliated with religion. The measure was developed with the intention that it would be applicable to religiosity in general (Rohrbaugh & Jessor, 1975). This eight item scale measures a range of dimensions of religiosity, and appears to be well suited for use in a multi-religious social landscape such as Canada. This scale has eight items, with four dimensions of religiosity: ritual, consequential, theological, and experiential, and an overall total score. Each item is scored from zero (option indicating the least religiosity) to four (option indicating the greatest religiosity). One item is an open-ended question that asks respondents the number of religious services they had attended in the previous year. Thus the total score for this scale is 28, and this is the score that was used for the current analysis. Cronbach coefficient alphas were over .90, which indicated a high internal consistency for the instrument and support for the reliability and validity of the subscales has also been found (Rohrbaugh & Jessor, 1975). Please refer to the Rohrbaugh and Jessor (1975) for a more detailed description regarding the development, reliability, validity, and scoring for the Rohrbaugh Jessor Religiosity Scale.

The degree and nature of neighborhood cohesion (social organization) experienced by participants was assessed using two items from the **Buckner Neighborhood Cohesion Scale** (Buckner, 1988). Neighborhood cohesion is a variable that encompasses a psychological sense of community as well as a social interaction within a neighborhood, with both of these concepts placing normative constraints on the individual's behaviour (Buckner, 1988). In the LLLP, only 2 of the 18 questions from the full Buckner Neighborhood Cohesion Scale were asked: "given the opportunity, I would like to move out of my neighborhood" and "a feeling of fellowship runs deep between me and other people in my neighborhood." For the full version of the Buckner Neighborhood Cohesion Scale, the Cronbach coefficient alphas were over .90, which indicated a high internal consistency for the instrument and support for the reliability of the measure

(Buckner, 1988). Please refer to the Buckner (1988) for a more detailed description regarding the development, reliability, validity, and scoring for the Buckner Neighborhood Cohesion Scale.

At Wave 1 and 3 of the LLLP, social/ethnic identity was assessed using the **York Ethnicity Scale** (Cameron, 2004). The York Ethnicity Scale is an 18-item, 3-factor scale that measures social/ethnic identity in terms of ingroup ties, centrality, and ingroup affect. An ingroup tie is the perception that an individual has regarding similarities, bonds, and belongingness with other group members (Cameron, 2004). There are 6-items included in the ingroup ties subscale, with a 5-point Likert-type scale for each question ranging from "strongly disagree" to "strongly agree." There are 7-items included in the centrality subscale, with centrality being an indication of the amount of time spent thinking about being a group member (Cameron, 2004). Finally, there 5-items included in the ingroup affect subscale, with ingroup affect being the positive feelings associated with membership in the group (Cameron, 2004).

The internal consistencies of the subscales and total score were acceptable, with alpha coefficients for ingroup ties ranging between .76 and .84, for centrality ranging between .67 and .78, and for ingroup affect ranging between .77 and .82 (Cameron, 2004). When the York Ethnicity Scale was re-administered to the same individuals twice, one week apart, the test-retest reliability coefficients indicated excellent stability ranging between .65 and .86 (Cameron, 2004). The correlational and regression analyses of the three-factor model of social identity identified in the York Ethnicity Scale with other related constructs show evidence of both convergent and discriminant validity (Cameron, 2004). Please refer to the Cameron (2004) for a more detailed description regarding the development, reliability, validity, and scoring for the York Ethnicity Scale.

Measures Related to Cognitive Abilities

The **Wechsler Abbreviated Scale of Intelligence** (WASI; PsychCorp, 1999) was used to measure intelligence among both adolescents and adults at Wave 1 of the LLLP. The WASI was developed to provide clinicians and researchers with a short and reliable measure of intelligence. The WASI is individually administered and has been normed for use with individuals 6 to 89 years of age (PsychCorp, 1999). The WASI is a battery of four sub-tests designed to provide a brief and reliable estimate of a person's intellectual functioning (PsychCorp, 1999). The abbreviated version is nationally standardized and yields scores that are linked to the *Wechsler Intelligence Scale for Children—Third Edition* (WISC–III; Wechsler, 1991)) and the *Wechsler Adult Intelligence Scale—Third Edition* (WAIS–III; Wechsler, 1997). The WASI has been used on a wide variety of populations of adults and has been found to have excellent reliability and validity (PsychCorp, 1999). As well, researchers have found that the WASI is a valid instrument to measure intelligence among Canadian children (Saklofske, Caravan, & Schwartz, 2000).

The WASI consists of four subtests: vocabulary, similarities, block design, and matrix reasoning. All four of these subtests are similar in format to the WISC–III (Wechsler, 1991) and WAIS–III (Wechsler, 1997), and are the specific subtests with the highest loadings on "g", or general

intellectual functioning from the longer Wechsler counterparts. These specific four subtests were included in the WASI due to their strong association with general cognitive abilities (Brody, 1992; Kamphaus, 1993; Kaufman, 1990; Sattler, 1988; Wechsler, 1991, 1997). These four subtests were also chosen due to their strong relationship to constructs of intelligence, for example, verbal and performance scales, as well as the dichotomies of crystallized and fluid intelligence (PsychCorp, 1999). The four-subtest version of the WASI yields the three traditional verbal (vocabulary and similarities), performance (block design and matrix reasoning), and full scale IQ scores. The two-subtest form of the WASI consists of vocabulary and matrix reasoning and only provides a full IQ score. The abbreviated two-subtest form of the WASI was used in the present study. An estimate of general intellectual ability can be obtained from the two-subtest form, which can be given in about 15-20 minutes. The vocabulary subtest is a 42-item section, with start and end points dependent on the age and knowledge of the respondent (PsychCorp, 1999). The matrix reasoning is a 35-item section with incomplete gridded patterns to solve, with start and end points dependent on the age and knowledge of the respondent (PsychCorp, 1999). Please refer to PsychCorp (1999) for more details on the development, reliability, validity, and scoring of the WASI.

The **Wisconsin Card Sorting Test-64 Computer Version** (WCST-64; Kongs, Thompson, Iverson, & Heaton, 2000) was used at Wave 1 of the LLLP. The WCST-64 Computer Version is an abbreviated form of the standard 128-item version of the Wisconsin Card Sorting Test (WCST; Heaton, 1981). The WCST is a neuropsychological measure of abstract reasoning ability and the ability to shift cognitive strategies (Kongs et al., 2000). The WCST is considered a measure of executive functioning since the test requires the ability to develop and maintain an appropriate problem-solving strategy as the stimulus conditions change over time (Kongs et al., 2000). It has been shown that the WCST, similar to other measures of executive functioning, requires the respondent to concentrate, plan, organize, use cognitive flexibility to shift their strategy, use their working memory, and avoid impulsive responding (Chelune & Baer, 1986; Gnys & Willis, 1991; Welsh & Pennington, 1988). It was critical to include the WCST-64 Computer Version in the LLLP since executive functioning and problems with impulse control are two factors that have been shown to be related to problem gambling.

The WCST-64 Computer Version uses only the first 64 items of the standard version of the WCST, with respondents required to complete all 64 items (Kongs et al., 2000). The WCST-64 normative, reliability, and validity data are derived from the same samples described in the Wisconsin Card Sorting Test Manual-Revised and Expanded (Heaton, et al., 1993). As well, there is normative data for the WCST-64 for use with individuals ranging from 6.5 through 89 years of age (Kongs et al., 2000). Kongs et al. (2000) and Heaton et al. (1993) provide details on the development, reliability, validity, and scoring of the WCST-64 Computer Version and the standard 128-item Wisconsin Card Sorting Test.

Other Measures (e.g., demographics, activity participation)

Participants in the LLLP were asked a number of demographic questions at all four waves of the study, including date of birth, age, number of people living in the household, level of education, school attendance, household income, personal income, employment status (current and former), religious preference, and their cultural and racial background. The question regarding the participant's cultural and racial background was not asked at Wave 4 of the LLLP. During the initial telephone screener at Wave 1 of the LLLP, participants were asked how long they had lived in Alberta, which community within Alberta they were currently living in, how often they eat out at restaurants, how much money they spend on restaurant meals each month, how much money they spend on gambling in a typical month, how often they gamble in a typical month, how often they go to the movies or rent a video in a typical month, how much money they spend on movies and video rentals in a typical month, a rating of their current physical health, a rating of their current mental health, and whether they smoked or drank. Finally at Wave 1 of the LLLP, participants were also asked for a description of their job (if currently employed), what kind of company they work for, what service or product the company they work for provides or supplies, whether the participant was self-employed or worked for someone else, what kind of sector their employer was in (e.g., government, private sector, etc.), the religion in which they were raised growing up, whether they were adopted, and their birth order in the family.

At Wave 3 and 4 of the LLLP, adults were asked about their participation in video games and time spent on the computer. Specifically adult participants were asked the following: "how often do you play video games using console, handheld, or PC devices?"; "how often do you play massive multiplayer online role-playing games?"; "how often do you spend time on social networking sites?"; and "how often do you use a computer, including the Internet?" For each of these four questions the Likert-type scale was (0) never, (1) less than once a month, (2) about every month, (3) about every week, and (4) about every day. In cases where the respondent answered 'about every week' they were asked a follow-up question about how many hours they were spending on this activity in a typical week. If a respondent answered 'about every day' they were asked a follow-up question about how many hours they were spending on this activity in a typical day.

Some new questions were added to the LLLP at Wave 4, including questions about the participant's family of origin, siblings, step-siblings, birth order, and sexual orientation. In particular, participants were asked the following: "how would you best describe your family structure when you were growing up?"; "do you have any biological siblings?"; "how many biological siblings do you have?"; "what is your birth order?"; "do you have any step-siblings?"; "how many step-siblings do you have?"; and "how would you describe your sexual orientation/preference?"

Measures Specific to Adolescents

At all four waves of the LLLP, gambling behaviour among adolescents was measured using questions from the **Canadian Problem Gambling Index** (CPGI; Ferris & Wynne, 2001) that ask about the types of gambling engaged in, frequency of involvement, expenditure on each type, the largest amount of money spent on each type, when they gamble, who they participate with, and the main reasons why they participate. The types of gambling considered were: lottery tickets, raffle or fundraising tickets, instant win tickets, VLTs or slot machines, private games against other people for money, sport betting, bingo, casino table games, horse betting, buying high risk stocks, options, or futures, casinos outside the province, and other forms of gambling. There were also questions from the CPGI regarding the age when they first gambled for money, what type of gambling was the first gambling they participated in, if they remembered a big win when they started to gamble, and if they remembered a big loss when they started to gamble (Ferris & Wynne, 2001). Finally, there were four questions from the Composite International Diagnostic Interview's - Gambling Module (CIDI-GM; World Health Organization, 1997) that examined respondent's behaviour during gambling. These questions asked the respondent how much they: gamble for excitement; to relax or have fun; to win money; and to be with friends or to make new friends.

Since the CPGI measure of problem gambling has not been normed for adolescents, problem gambling among adolescents was assessed using a different instrument, the 9-item Fisher DSM-IV-J-MR for adolescents. The first adaption of the DSM-IV psychiatric criteria for use in surveys among adolescents (17 or younger) was completed by Fisher (1992). Subsequently, Fisher (2000) published a revised version of the Fisher DSM-IV-J that allowed multiple responses to each of the items rather than restricting respondents to a dichotomous (yes or no) answer. The revised version of the DSM-IV-J, renamed the **Fisher DSM-IV-J-MR** ("J" for juvenile and "MR" for multiple responses), has performed well in a national youth study in the United Kingdom and the screen has demonstrated good internal consistency (Cronbach alpha of .75), factor structure, and construct validity (Fisher, 2000). The total score for the Fisher DSM-IV-J-MR is currently the most accurate measure for problem gambling among a sample of respondents under the age of 18.

Extra questions regarding Internet gambling were also asked of the adolescent participants at Wave 2 and 3 of the LLLP. The researchers wanted to gather more detailed information regarding the frequency of Internet gambling, the amount of time spent participating in Internet gambling, the amount of money spent on Internet gambling, and who the individual was participating with while involved in the Internet gambling activity. The types of gambling considered with these extra Internet question were: lottery tickets, raffle tickets, instant win tickets, Sports Select, casino table games, horse betting, bingo, betting on sports with a bookie, buying high risk stocks, and betting against other people for money in activities such as cards or sports events.

At all four waves of the LLLP, adolescent participants were asked if they had attended any type of information session (lecture, class, presentation) on the topic of gambling or gambling

problems in the past year, whether they had used drugs or alcohol while gambling, the percentage of their close friends that gamble regularly, whether their parents gamble regularly, whether their siblings gamble regularly, how much gambling there was at their work or school, and how much their parents gambled when they were growing up.

The **Child Behaviour Checklist – Youth Self Rating** (CBCL-YSR; Achenbach & Rescorla, 2001**)** was used to measure the adolescent problem behaviours and competencies at all four waves of the LLLP. The Child Behaviour Checklist (CBC) is the most widely used and best standardized broad-based assessment of adolescent psychopathology in existence. The CBCL-YSR is part of the Achenbach System of Empirically Based Assessment (ASEBA) developed by Achenbach and Rescorla (2001). The first section of this questionnaire consists of items related to school, friends, hobbies, and activities. These questions asked respondents if they are participating in a variety of activities, and if so, they are then asked how much time they spend on this activity as well as how well they do the activity. The CBCL-YSR also asks about the respondents experience at school, including asking what grade they are in, what subjects they are taking at school, and how they are doing in their subjects. Finally, there is another question in the CBCL-YSR that asked if the respondent has any illnesses, physical disability, or handicap (Achenbach & Rescorla, 2001**).**

The second section consists of 104-items on behaviour or emotional problems during the past six months, with the response options being, (0) “not true”, (1) “somewhat true or sometimes true”, and (2) “very true or often true”. There are eight subscales within the CBCL-YSR: anxious/depressed (13 questions); withdrawn/depressed (8 questions); somatic complaints (10 questions); social problems (11 questions); thought problems (12 questions); attention problems (9 questions); rule-breaking behaviour (15 questions); and aggressive behaviour (17 questions). The 41 items from three subscales, anxious/depressed, withdrawn/depressed, and somatic complaints are combined to create a score for internalizing behaviour problems (Achenbach & Rescorla, 2001**)**. As well, the 32 items from two subscales (rule-breaking behaviour and aggressive behaviour) are combined to create a score for externalizing behaviour problems (Achenbach & Rescorla, 2001**)**. There are two other subscales in the CBCL-YSR, other (9 questions) and social desirability (14 questions), with the other subscale being included in the calculation of the total score for the CBCL-YSR. Consequently, the total score for the CBCL-YSR is based on the 104 items included in the following subscales: anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviour, aggressive behaviour, and other (Achenbach & Rescorla, 2001**)**.

With only a few exceptions (Lambert et al., 2003; Lengua, Sadowski, Friedrich, & Fisher, 2001), the CBCL in general, and the CBCL-YSR in particular, have been found to be both reliable and valid in identifying problem behaviours and competencies in youth from a wide variety of countries (Ivanova et al., 2007), for both clinical (De Groot, Koot, & Verhulst, 1994; Dutra, Campbell, & Weston, 2004; Greenbaum & Dedrick, 1998) and non-clinical populations (Dedrick, Tan, & Marfo, 2008). Please refer to Achenbach and Rescorla (2001) for more details on the development, reliability, validity, and scoring of the CBCL-YSR.

At Wave 2, 3, and 4, adolescents were asked nine questions regarding their risky or reckless behaviour. These questions were revised from the original source, the **Reckless Behaviour Questionnaire** (Shaw, Wagner, Arnett, & Aber, 1992), so the questions more clearly reflected the population of adolescents in the LLLP. For example, questions regarding driving were converted from miles per hour to kilometers per hour. The questions included in the risky behaviour questionnaire used in the LLLP were: driving a vehicle while under the influence of alcohol;, having unprotected sex; damaging or destroying public or private property; using marijuana; shoplifting; driving a car over 130 kilometers per hour; having sex with someone you don't know well; using cocaine; and driving more than 30 kilometers per hour over the speed limit. There were 10-items in the original Reckless Behaviour Questionnaire but only 9-items in the revised version used for the LLLP. The question regarding the use of illegal drugs other than marijuana or cocaine was dropped from the version of the questionnaire used for the LLLP. Similar questions regarding drug use were asked with the Canadian Community Health Survey (CCHS), so it was felt that this one item from the Reckless Behaviour Questionnaire would be repetitive. Shaw et al. (1992) provide a more detailed description regarding the development, reliability, validity, and scoring for the original Reckless Behaviour Questionnaire.

The **Life Events Questionnaire (LEQ;** Vuchinich, Tucker, & Harllee, 1986) was used to assess a wide variety of issues in the lives of adolescent participants in the LLLP. In particular, for the adolescent version, the LEQ assessed events in ten categories over the past 12 months, with a total of 75 dichotomous (yes or no) questions. The eight categories were: work (12 questions); residence (9 questions); intimate relationships (7 questions); family (9 questions); friendship and social activities (9 questions); finances (4 questions); physical health (5 questions); legal matters (8 questions); school (6 questions); and other events (6 questions). Most of the questions in the LEQ are closed-ended (e.g., promoted at work), while some are open-ended (e.g., did you experience any additional work events during this one year period?). The LEQ yields a frequency score for each category and a total score. The LEQ has been shown to have good agreement with collateral reports (Tucker et al., 1994) and to have excellent retest reliability over a two-week period (Vuchinich et al., 1986).

The original adolescent version of the LEQ was used at Wave 1 of the LLLP, with a slightly revised version used at Wave 2, 3, and 4. The revised adolescent version of the LEQ used at Wave 2, 3, and 4, was shorter, but had many of the same questions. In particular, the revised LEQ assessed events in six categories over the past 12 months, with a total of 54 dichotomous (yes or no) questions. The six categories in the revised version of the LEQ were: work and school (17 questions); family and friends (16 questions); property and finances (6 questions); legal matters and crime (9 questions); health (5 questions); and other events (1 question). The revised adolescent version of the LEQ yields a frequency score for each category and a total score.

The **SF-10 Health Survey for Children** (Maruish & DeRosa, 2009) is a parent-completed survey that contains 10 questions adapted from the Child Health Questionnaire (CHQ). The SF-10 provides coverage across a wide range of domains, including physical function (two questions),

the role of social emotional-behavioural (one question), the role of social physical (one question), bodily pain (one question), general behaviour (one question), mental health (one question), self-esteem (two questions), and general health perceptions (one question). The SF-10 is scored in such a way that a physical and psychosocial health summary measure is calculated. The survey provides a quick and efficient means to measure health status and is intended for children between the ages of 5 and 18, and is available with a standard four-week recall period (Maruish & DeRosa, 2009). The SF-10 was only used at Wave 1, 2, and 3 for the adolescent sample from the LLLP. Please refer to Maruish & DeRosa (2009) for a more detailed description regarding the development, reliability, validity, and scoring for the SF-10.

The **Canadian Community Health Survey** (CCHS) cycle 1.2, Mental Health and Well-being section (Statistics Canada & the Canadian Institutes of Health Research, 2002) was used to measure the consumption of drugs and alcohol, and smoking among adolescents at all waves of the LLLP. The questions asked of the adolescent sample were the same as for the adult sample, with the exception of the youth smoking questions. At the first three waves, adolescents were asked a series of questions from the CCHS regarding how they accessed their cigarettes, if they bought their own cigarettes or someone else bought them for them, if they had been asked for identification verifying their age when they attempted to buy cigarettes, if anyone had refused to sell them cigarettes, and if they had asked a stranger to buy cigarettes for them. These questions regarding youth smoking were asked of any adolescent under the age of 18 at Wave 1, 2, and 3, with the time period for the questions being within the last 12 months.

At Wave 1, 2, and 3, parents of the adolescent participants in the LLLP were asked some of the demographic questions since the participants were under the age of 18. At Wave 1, parents were asked questions regarding household income, personal income, what country they were born in, if they were born a Canadian citizen, what year they arrived in Canada, and which ethnic or cultural group their ancestors belong to. At Wave 2 and 3 of the LLLP, parents were asked their date of birth, age, gender, level of education, school attendance, for a description of their job (if currently employed), household income, and personal income. Parents of adolescent participants were not included in Wave 4 of the study, since the vast majority of the adolescent participants were 18 or older.

At Wave 1, 2, and 3, the adolescent participants were asked a number of demographic questions directly. At Wave 1, adolescents were asked questions regarding date of birth, age, number of people living in the household, employment status (current and former), level of education, school attendance, religious preference, their cultural and racial background, and their father's and mother's (or guardian's) type of work. The question regarding the participant's cultural and racial background was not asked at Wave 4 of the LLLP. At Wave 2 and 3 of the LLLP, adolescents were asked which community they live in, their date of birth, age, number of people living in their household, level of education, their current religious preference, school attendance, employment status (current and former), for a description of their job (if currently employed), and a description of their father's and mother's (or guardian's) work. At Wave 3, adolescent participants in the LLLP were also asked their gender. Finally, at Wave 4, adolescents were asked the community in which they live, their gender, date of birth,

age, number of people living in their household, level of education, current religious preference, school attendance, employment status (current and former), for a description of their job (if currently employed), a description of their father's and mother's (or guardian's) work, household income, and personal income. At Wave 4 only, since the majority of adolescent participants were now 18 years of age or older, the adolescents were asked the marital status question, and if married or common-law, they were asked the 3-items from the Kansas Marital Satisfaction Scale.

During the initial telephone screener at Wave 1 of the LLLP, participants were asked how long they had lived in Alberta, which community within Alberta they were currently living in, how often they eat out at restaurants, how much money they spend on restaurant meals each month, how much money they spend on gambling in a typical month, how often they gamble in a typical month, how often they go to the movies or rent a video in a typical month, how much money they spend on movies and video rentals in a typical month, a rating of their current physical health, a rating of their current mental health, and whether they smoked or drank. Finally at Wave 1 of the LLLP, adolescent participants were also asked for a description of their job (if currently employed), the company they work for, what service or product their company provides or supplies, whether the participant was self-employed or worked for someone else, which sector their employer is in (e.g., government, private sector, etc.), the religion in which they were raised growing up, whether they were adopted, and their birth order in the family.

Some new questions were added to the LLLP at Wave 4, including questions about the participant's family of origin, siblings, step-siblings, birth order, and sexual orientation. In particular, participants were asked the following: "how would you best describe your family structure when you were growing up?"; "do you have any biological siblings?"; how many biological siblings do you have?"; "what is your birth order?"; "do you have any step-siblings?"; "how many step-siblings do you have?"; and "how would you describe your sexual orientation/preference?"

At Wave 2 and 3 of the LLLP, parents of adolescent participants and the adolescent respondents themselves were asked how much parental monitoring was occurring. Parental monitoring can be defined as parental knowledge regarding their child's whereabouts, companions, and activities (Crouter, MacDermid, McHale, & Perry-Jenkins, 1990; Jacobson & Crockett, 2000). During late childhood and early adolescence there is a shift in a child's reference group orientation from their family to their peer group. It is during this transition that parents become more concerned about how their children are spending unsupervised time (Brown, Mounts, Lamborn, & Steinberg, 1993; Larson & Richards, 1991). Many parents believe unsupervised youth are susceptible to involvement in negative outcomes such as delinquent behaviour and drug use (Brown et al., 1993). Consequently, it is important to try and measure the level of parental monitoring that is happening for each of the adolescent participants.

The **Parental Monitoring Scale – Modified Version** used at Wave 2 and 3 was a scale specifically designed for another study (Casey, 2002); however the individual items are based on questions from two other studies (Fuligini & Eccles, 1993; Miller, Knox, Auspos, Hunter-

Manns, & Orenstein, 1997). At Wave 2 and 3, parents and adolescent respondents were asked 11 questions regarding their perception of the amount of parental monitoring that was occurring. These questions were related to the following issues: how much television the adolescent watched; which television programs they watched; who they are hanging out with when away from home; where they are when they are away from home; when they are expected home; what they are doing after school; when out on a school night, if they have a curfew; when out on a weekend, if they have a curfew; if they will be late getting home, do they need to call home; do their parent(s) or guardian know their best friends by their first and last name; and whether their parent(s) or guardians can contact their friends, either by phone or by going to their house. The response options for 9 of the 11 questions were a 6-point Likert-type scale that was: (0) "never", (1) "almost never", (2) "sometimes", (3) "often", (4) "almost always", and (5) "always." For the two items asking about their friends names and if their parents knew how to contact them, the response options were a slightly revised 6-point Likert-type scale: (0) "none", (1) "almost none", (2) "a few", (3) "most", (4) "almost all", and (5) "all." In past research, the alpha coefficient for the Parental Monitoring Scale – Modified Version has been significant at .86 (Casey, 2002). Please refer to the other research completed for a more detailed description regarding the development, reliability, validity, and scoring for the original Parental Monitoring Scale (Fuligini & Eccles, 1993; Miller et al., 1997) and the Parental Monitoring Scale – Modified Version (Casey, 2002).

Adolescent respondents who participated at Wave 3 and 4 of the LLLP completed the 16-item **Loneliness and Social Dissatisfaction Scale – Modified Version** (Asher & Wheeler, 1985; Cassidy & Asher, 1992). The original Loneliness and Social Dissatisfaction Scale was designed by Asher, Hymel, and Renshaw (1984) and the modified version was completed Asher and Wheeler (1985). In the original and modified version of the Loneliness and Social Dissatisfaction Scale, the response options were limited to (1) "no", (2) "sometimes", or (3) "yes." Other researchers (Bos et al., 1999; Casey, 2002) felt these response options needed to be expanded to allow the respondent more options. Consequently, the original response options for each of these 16-items were changed to a 5-point Likert-type scale that was: (1) "not at all true", (2) "hardly ever true", (3) "sometimes true", (4) "true most of the time", and (5) "always true" (Bos et al., 1999; Casey, 2002).

Research has shown that the Loneliness and Social Dissatisfaction Scale – Modified Version has satisfactory internal consistency reliability, with the Cronbach alpha ranging between .61 and .84 (Cassidy & Asher, 1992) and research has shown that the self-report version of the scale correlates significantly with peer status derived from sociometric measures, and also with teacher report of child's social behaviour (Cassidy & Asher, 1992). A total of 10 of the questions are reverse coded, and when all 16 items are in the correct order, for the LLLP, a higher score indicates that the respondent has a higher satisfaction with their friendship. Please refer to the various researchers (Asher et al., 1984; Asher & Wheeler, 1985; Bos et al., 1999; Casey, 2002; Cassidy & Asher, 1992) for a more detailed description regarding the development, reliability, validity, and scoring for the original Loneliness and Social Dissatisfaction Scale – Modified Version and the version with the revised response options.

Adolescents participating in the LLLP at Wave 2 were asked about their participation in a variety of activities during the last 12 months. These questions were initially developed for the New Hope Project (Bos et al., 1999) and then further revised by Casey (2002). Specifically, adolescent participants were asked about: playing a sport or taking lessons with a coach or instructor; taking lessons such as dance, music, or arts and crafts; taking part in a club or youth group; going to Sunday school or religious services; going to recreation or community centers; spending time home alone without an adult; playing video games; using a computer, including the Internet; doing service or volunteer activities; working for money; going to a summer school or program to help with school work; and going to a day camp or summer camp. At Wave 3 of the LLLP, adolescents were asked 10 of these 12 questions regarding their participation in activities, with the questions regarding playing video games and using a computer being dropped due to the new questions focusing on video games and the computer (see below) that were added for Wave 3 and 4. For each of these four questions the Likert-type scale was (0) "never", (1) "less than once a month", (2) "about every month", (3) "about every week", and (4) "about every day."

At Wave 3 and 4 of the LLLP, adolescents were asked about their participation in video games and time spent on the computer. Specifically, adolescent participants were asked the following: "how often do you play video games using console, handheld, or PC devices?"; "how often do you play massive multiplayer online role-playing games?"; "how often do you spend time on social networking sites?"; and "how often do you use a computer, including the Internet?" For each of these four questions the Likert-type scale was (0) "never", (1) "less than once a month", (2) "about every month", (3) "about every week", and (4) "about every day." In cases where the respondent answered "about every week" they were asked a follow-up question about how many hours they were spending on this activity in a typical week. If a respondent answered "about every day" they were asked a follow-up question about how many hours they were spending on this activity in a typical day.

At Wave 3 and 4 of the LLLP, adolescent participants were asked some extra questions regarding their gambling. Since some individuals at Wave 3, and the vast majority of individuals at Wave 4, were now 18 the researchers decided to ask a few extra questions to determine if participant's patterns of gambling or alcohol consumption changed as the result of turning 18. Adolescent participants that were 18 years of age or older at Wave 3 and 4 were asked what time of day they tend to gamble, if they felt that Internet gambling advertisements had changed their gambling behaviour, if they felt that television gambling advertisements had changed their gambling behaviour, if the frequency of their gambling had increased since they turned 18, and if the frequency of their drinking had changed since they turned 18.

Appendix C: Tables

Table C1: Pattern of Adolescent Retention

	Survey Completions (A)	Ineligible Participants (Cumulative) (B)	Eligible Participants (C) (436 - B)	Retention Rate (A/C) x 100
Wave 1	436	-	436	100.0
Wave 2	350	0	436	80.3
Wave 3	312	0	436	71.6
Wave 4	313	0	436	**71.8**
Survey Completion Pattern		**Number**	**%**	**Cumulative %**
Survey 1 only		59	13.5	13.5
Surveys 1 and 2 only		29	6.7	20.2
Surveys 1 and 3 only		5	1.1	21.3
Surveys 1 and 4 only		5	1.1	22.4
Surveys 1, 2 and 3 only		30	6.9	29.3
Surveys 1, 2 and 4 only		31	7.1	36.4
Surveys 1, 3 and 4 only		17	3.9	40.3
All surveys: 1, 2, 3, 4		260	**59.6**	100.0

Table C2: Pattern of Retention for Adults and Adolescents Combined

Adults & Adolescents Combined	Survey Completions (A)	Ineligible Participants (Cumulative) (B)	Eligible Participants (C) (1808 - B)	Retention Rate (A/C) x 100
Wave 1	1808	-	1808	100
Wave 2	1495	2	1806	82.8
Wave 3	1316	14	1794	73.4
Wave 4	1343	20	1788	**75.1**
Survey Completion Pattern		**Number**	**%**	**Cumulative %**
Survey 1 only		239	13.2	13.2
Surveys 1 and 2 only		158	8.7	21.9
Surveys 1 and 3 only		9	0.5	22.4
Surveys 1 and 4 only		15	0.8	23.2
Surveys 1, 2 and 3 only		59	3.3	26.5
Surveys 1, 2 and 4 only		80	4.4	30.9
Surveys 1, 3 and 4 only		50	2.8	33.7
All surveys: 1, 2, 3, 4		1198	**66.3**	100.0

Table C3: Independent Variable Correlates of LLLP Non-Gamblers (NGs), Non-Problem Gamblers (NPGs), and PGSI 5+ Problem Gamblers (PG)

p < .05 (2 tail) *p < .01 (2 tail)*

		Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
		NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
		n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
DEMOGRAPHICS																
Male %		37.9	42.6	55.4	28.8	48.3	53.1	47.7	40.1	54.7	40.6	39.8	61.4	38.3	40.7	53.0
Age *M (SD)* (Baseline range[6]: 18-66)		39.0 (18.4)	41.6 (17.0)	39.2 (14.1)	37.2 (18.4)	38.2 (17.0)	34.2 (13.3)	37.1 (18.1)	41.5 (17.1)	40.7 (15.4)	40.5 (18.5)	43.3 (17.0)	41.1 (14.2)	42.0 (18.5)	44.7 (17.0)	42.6 (13.4)
Initial Age Category	18-20 %	27.6	21.5	24.0	27.6	21.5	24.0	--	--	--	--	--	--	--	--	--
	23-25 %	26.0	24.5	26.0	26.0	24.5	26.0	--	--	--	--	--	--	--	--	--
	43-45 %	19.9	31.5	44.0	19.9	31.5	44.0	--	--	--	--	--	--	--	--	--
	63-65 %	26.6	22.6	6.0	26.6	22.6	6.0	--	--	--	--	--	--	--	--	--
Immigrant %		14.6	10.1	6.5	14.4	9.7	6.0	13.8	10.4	6.4	14.9	9.9	5.4	15.4	10.4	8.8
Ethnicity (participants able to choose more than 1 category)	Aboriginal/Métis/Inuit %	4.8	6.0	6.0	4.8	6.0	6.0	--	--	--	--	--	--	--	--	--
	Canadian %	6.4	11.3	4.0	6.4	11.3	4.0	--	--	--	--	--	--	--	--	--
	African %	0.3	0.2	0	0.3	0.2	0	--	--	--	--	--	--	--	--	--
	Asian (Eastern) %	4.2	2.8	8.0	4.2	2.8	8.0	--	--	--	--	--	--	--	--	--
	Asian (Southern) %	3.2	1.8	2.0	3.2	1.8	2.0	--	--	--	--	--	--	--	--	--
	Asian (Western) %	1.6	0.6	0	1.6	0.6	0	--	--	--	--	--	--	--	--	--
	European (Northern) %	21.5	17.5	12.0	21.5	17.5	12.0	--	--	--	--	--	--	--	--	--
	European (Eastern) %	15.7	18.0	6.0	15.7	18.0	6.0	--	--	--	--	--	--	--	--	--
	European (Western) %	71.2	70.1	50.0	71.2	70.1	50.0	--	--	--	--	--	--	--	--	--
	Latin American %	0.3	0.2	0	0.3	0.2	0	--	--	--	--	--	--	--	--	--
	Other ethnicity %	3.2	2.6	0	3.2	2.6	0	--	--	--	--	--	--	--	--	--
Non-Caucasian %		10.5	8.4	16.8	10.9	9.1	16.0	12.0	7.8	17.4	10.4	7.6	16.2	8.2	8.8	17.6
Adopted %		3.0	2.7	7.1	3.5	2.8	8.0	2.8	2.8	6.4	2.3	2.8	5.4	3.4	2.2	8.8
Educational Attainment	< High school graduation %	6.7	6.9	13.1	8.0	8.8	16.0	6.5	7.0	12.8	7.8	5.6	13.5	3.8	5.5	8.8
	High school graduate %	12.9	12.5	14.3	19.2	19.7	22.0	9.7	10.3	12.8	9.6	8.8	8.1	10.1	9.1	11.8
	Some post-secondary %	31.8	27.7	28.5	33.0	32.1	26.0	39.2	28.4	34.0	28.2	26.6	29.7	26.0	22.0	23.5
	Completed vocational school or college %	14.7	22.4	20.2	12.8	17.1	24.0	13.4	24.9	19.1	14.6	24.0	18.9	18.8	25.1	17.6
	University Bachelor's degree %	22.5	22.1	21.4	17.6	16.4	10.0	20.7	21.1	19.1	26.5	26.2	24.3	27.4	26.9	38.2
	Graduate or professional degree %	11.5	8.4	2.4	9.3	5.9	2.0	10.6	8.3	2.1	13.2	8.8	5.4	13.9	11.4	0.0
Marital Status	Never married %	37.9	34.3	36.3	43.6	40.8	46.0	43.3	34.7	25.5	32.7	30.9	40.5	29.3	28.6	32.4
	Married %	44.0	42.4	29.2	36.5	39.0	18.0	41.9	42.0	36.2	47.7	45.6	27.0	53.4	44.5	38.2
	Living common-law %	6.6	10.9	16.1	7.4	9.5	16.0	6.5	10.2	17.0	6.4	11.3	18.9	5.8	13.0	11.8
	Separated or divorced %	10.0	9.1	17.3	11.2	7.8	20.0	7.4	9.8	19.2	11.4	9.0	10.8	9.6	9.9	17.7
	Widowed %	1.5	3.3	1.2	1.3	2.9	0	0.9	3.3	2.1	1.8	3.2	2.7	1.9	4.0	0
Employment Status	Unemployed %	38.5	28.4	31.0	35.3	28.4	30.0	36.9	28.9	27.7	39.1	28.1	40.5	44.4	28.3	26.5
	Employed part-time %	24.0	20.4	15.5	29.2	22.7	22.0	25.8	20.7	19.1	21.4	19.7	8.1	16.9	17.6	8.8

[6] Depending on the variable, range either represents observed minimum and maximum values or *potential* minimum and maximum values.

		Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
p < .05 (2 tail) *p < .01 (2 tail)*		NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
		n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
	Employed full-time %	37.5	51.2	53.6	35.6	48.9	48.0	37.3	50.4	53.2	39.5	52.2	51.4	38.6	54.0	64.7
	Attending school %	27.5	17.8	19.0	29.8	24.4	24.0	31.3	19.0	27.7	25.9	14.2	16.2	21.6	11.0	2.9
Household income	$0-$19,999 %	11.7	6.0	9.5	9.9	5.9	12.0	11.5	6.9	2.1	12.2	5.4	8.1	13.9	5.5	17.6
	$20,000-$29,999 %	6.5	5.6	9.5	6.4	5.2	10.0	6.9	6.0	6.4	6.3	5.8	16.2	6.3	5.5	5.9
	$30,000-$39,999 %	9.4	7.2	4.8	8.3	6.6	2.0	11.5	8.5	4.3	7.7	6.6	5.4	10.6	7.0	8.8
	$40,000-$49,999 %	7.7	8.2	7.1	5.8	8.2	8.0	8.8	8.2	6.4	8.1	8.8	5.4	9.1	7.7	8.8
	$50,000-$59,999 %	8.1	8.8	10.1	7.4	8.0	12.0	6.9	7.8	12.8	9.0	9.2	8.1	9.6	10.6	5.9
	$60,000-$79,999 %	16.7	16.5	14.3	18.9	15.0	12.0	18.4	18.4	23.4	15.4	15.4	8.1	13.0	17.3	11.8
	More than $80,000 %	39.9	47.7	44.6	43.3	51.1	44.0	35.9	44.2	44.7	41.2	48.8	48.6	37.5	46.4	41.2
Household debt ($) *M (SD)*		58242 (178238)	59404 (115897)	72858 (111354)	14109 (56366)	17727 (59375)	7281 (22966)	62762 (225461)	71746 (149792)	84835 (140415)	84484 (203655)	72162 (111490)	98741 (163999)	91845 (284773)	88032 (155567)	124574 (143872)
Location	Calgary %	43.8	42.5	53.0	45.2	40.8	48.0	45.6	43.2	57.4	41.2	43.4	51.4	42.8	43.0	55.9
	Edmonton %	27.6	30.5	30.4	29.8	29.5	28.0	27.2	30.9	27.7	26.7	31.0	35.1	25.5	31.0	32.4
	Grande Prairie %	10.3	12.5	5.3	8.3	14.0	6.0	11.5	11.8	2.1	12.2	12.0	10.8	10.1	12.0	2.9
	Lethbridge %	18.3	14.4	11.3	16.7	15.7	18.0	15.7	14.1	12.8	19.9	13.6	2.7	21.6	14.0	8.8
PHYSICAL HEALTH																
PHYSICAL FUNCTIONALITY	Perceptual, communicative, motor, or learning impairment %	23.0	21.7	36.3	23.4	22.3	36.0	23.0	22.0	31.9	22.6	20.8	37.8	22.6	21.5	41.2
HEALTH STATUS	Physical health rating *M* (*SD*) (Range: 1 - 6; 6 = excellent)	4.6 (1.1)	4.7 (1.0)	4.2 (1.2)	4.7 (1.0)	4.7 (1.0)	4.2 (1.1)	4.7 (1.2)	4.7 (1.1)	4.2 (1.2)	4.6 (1.2)	4.6 (1.0)	4.2 (1.2)	4.5 (1.2)	4.6 (1.1)	4.0 (1.2)
	Currently taking Rx medication %	45.9	48.3	49.3	--	--	--	--	--	--	45.7	48.6	56.8	46.2	48.1	41.2
GAMBLING																
GAMBLING ATTITUDES	Gambling Attitudes Measure *M* (*SD*) (Range: -4 to +4)	-1.0 (2.0)	0.5 (1.7)	0.2 (1.8)	-1.1 (2.0)	0.4 (1.7)	-0.6 (1.7)	-1.0 (2.1)	0.5 (1.7)	0.3 (2.0)	-1.0 (1.9)	0.6 (1.7)	0.8 (1.4)	-0.9 (2.0)	0.7 (1.7)	0.6 (1.9)
	Gambling Attitudes Questionnaire *M (SD)* (Range: 1-7; lower scores indicate belief gambling harmless)	4.4 (1.1)	4.0 (1.0)	4.0 (1.0)	4.2 (1.2)	3.9 (1.1)	3.7 (1.1)	4.4 (1.0)	4.1 (0.9)	4.1 (0.9)	4.4 (1.0)	4.1 (1.0)	4.2 (1.1)	4.5 (1.0)	4.0 (1.0)	4.0 (1.0)
LIFETIME GAMBLING	Age first gambled *M (SD)*	19.5 (9.1)	18.4 (7.3)	17.4 (7.9)	21.5 (11.0)	18.8 (8.0)	16.7 (6.8)	18.3 (8.2)	18.3 (6.8)	18.6 (9.0)	19.0 (8.2)	18.2 (7.1)	16.6 (7.5)	18.2 (8.2)	18.3 (7.3)	17.5 (8.3)
	Big win when first started gambling %	13.2	22.9	57.2	15.0	26.7	52.0	14.5	21.8	57.5	10.3	21.6	54.1	12.1	20.2	67.7
	Big loss when first started gambling %	7.5	10.0	35.7	8.3	11.2	40.0	8.4	9.7	36.2	6.5	10.4	24.3	6.4	8.6	41.2
	* Parent(s)/sibling(s) do/did gamble regularly [7] %	14.6	24.6	50.6	15.7	25.6	44.0	15.2	23.4	48.9	14.9	23.7	54.1	12.0	25.4	58.8
	* Parent(s) gambled with person when growing up %	14.8	30.8	45.8	11.6	32.7	46.0	14.9	30.2	44.7	16.8	29.7	48.6	17.3	30.1	44.1
	* Parent(s) are/were problem gambler(s) %	2.5	6.4	17.3	2.9	7.2	20.0	2.3	5.9	19.1	3.2	5.8	8.1	1.4	6.3	20.6
	* Siblings are/were problem gamblers	3.1	3.6	10.7	3.8	4.1	6.0	2.8	3.7	10.6	2.7	3.6	8.1	2.9	2.9	20.6

[7] Asterisks indicate question only asked to people losing >$365 in any year, betting >10 times in life, and endorsing at least one of 15 problems associated with gambling (survey questions 227.A-241.O).

p < .05 (2 tail) *p < .01 (2 tail)*

			Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
			NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
			n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
	%																
	Largest amount lost in one single year $ *M (SD)*		1067 (9985)	736 (5345)	7212 (12917)	96 (407)	294 (761)	1153 (1260)	491 (3033)	937 (10467)	5525 (8416)	729 (3649)	986 (4574)	8672 (18422)	3484 (38336)	849 (6229)	16866 (30292)
	Median		23	106	1804	20	100	1000	20	100	2000	30	100	2000	25	125	2500
PAST YEAR GAMBLING	Frequency of gambling *M (SD)* 1 = Not in past year 2 = 1-5/year 3 = 6-11/year 4 = 1/month 5 = 2-3/month 6 = 1/week 7 = 2-6/week 8 = daily (means and medians calculated for entire group, including individuals who did not engage in the format)	Lottery tickets	--	2.85 (1.77)	3.75 (2.11)	--	1.47 (1.3)	2.62 (2.4)	--	3.39 (2.0)	3.96 (2.2)	--	3.29 (2.0)	4.03 (1.8)	--	3.63 (1.9)	4.82 (1.9)
		Raffle or fund-raising tickets	--	2.49 (1.33)	2.40 (1.46)	--	1.99 (1.1)	1.88 (1.5)	--	2.08 (1.1)	2.17 (1.1)	--	1.93 (.92)	2.08 (1.1)	--	4.13 (2.3)	3.85 (2.3)
		Instant win tickets	--	2.07 (1.47)	2.90 (1.97)	--	2.28 (1.7)	2.44 (2.1)	--	2.12 (1.5)	3.04 (1.8)	--	1.90 (1.3)	3.19 (1.9)	--	1.88 (1.3)	3.09 (2.1)
		Bingo	--	1.16 (.69)	1.51 (1.3)	--	1.22 (.88)	1.62 (1.6)	--	1.16 (.63)	1.53 (1.3)	--	1.13 (.56)	1.41 (1.1)	--	1.12 (.61)	1.41 (1.1)
		EGMs	--	1.58 (1.01)	3.14 (1.93)	--	1.60 (1.1)	3.94 (2.2)	--	1.61 (1.0)	2.87 (1.8)	--	1.58 (1.0)	2.65 (1.7)	--	1.51 (.93)	2.85 (1.97)
		Casino table games	--	1.27 (.75)	2.33 (1.74)	--	1.32 (.87)	2.96 (2.2)	--	1.25 (.75)	1.98 (1.6)	--	1.19 (.55)	1.92 (1.5)	--	1.32 (.79)	2.32 (1.5)
		Private games for money	--	1.72 (1.3)	2.51 (1.77)	--	1.87 (1.5)	3.02 (2.2)	--	1.70 (1.3)	2.43 (1.8)	--	1.57 (1.15)	2.24 (1.6)	--	1.67 (1.2)	2.18 (1.3)
		Sport betting	--	1.35 (1.01)	2.14 (1.8)	--	1.36 (1.1)	2.78 (2.3)	--	1.29 (.89)	1.64 (1.5)	--	1.33 (.95)	1.86 (1.6)	--	1.42 (1.1)	2.21 (1.7)
		Horse races	--	1.11 (.43)	1.39 (1.04)	--	1.12 (.47)	1.46 (1.2)	--	1.11 (.43)	1.13 (.34)	--	1.08 (.4)	1.38 (1.1)	--	1.14 (.4)	1.65 (1.7)
		High risk stocks	--	1.28 (.80)	1.40 (.80)	--	1.16 (.76)	1.02 (.14)	--	1.12 (.57)	1.15 (.63)	--	1.13 (.61)	1.16 (.73)	--	1.77 (1.3)	2.57 (2.1)
		Casinos outside Alberta	--	1.18 (.50)	1.45 (.93)	--	1.13 (.43)	1.36 (.83)	--	1.18 (.43)	1.38 (.71)	--	1.24 (.67)	1.62 (1.2)	--	1.2 (.49)	1.5 (1.1)
	Frequency, all forms in past year *M (SD)* (Range: 0-30)		--	2.9 (4.9)	8.0 (7.8)	--	3.1 (5.7)	9.8 (9.1)	--	2.9 (4.3)	7.1 (6.8)	--	2.8 (4.5)	6.6 (7.4)	--	4.29 (1.47)	5.59 (1.50)
	Gambled on Internet in any form %		--	13.7	26.8	--	9.0	24.0	--	14.8	25.5	--	15.6	27.0	--	16.8	32.4
	# of types of gambling engaged in *M* (*SD*) (Range: 0-13)		--	3.2 (1.8)	5.2 (2.2)	--	2.7 (1.8)	4.8 (2.3)	--	3.7 (1.9)	5.3 (2.0)	--	3.4 (1.9)	5.6 (2.3)	--	3.2 (1.7)	5.1 (2.1)
	Gambling Expenditure $ (net win/loss in typical month) *M (SD)* (Note: actual values used in Assessments 1 and 2 and absolute values	Lottery tickets	--	-89.58 (834)	-56.30 (89)	--	missing data	missing data	--	-35.87 (129)	-65.63 (129)	--	-191.92 (2391)	-32.10 (40)	--	-54.41 (169)	-69.75 (88)
		Median	--	-14.76	-29.47	--	--	--	--	-10.00	-27.50	--	-15.00	-20.00	--	-20.00	-42.50
		Raffle or fund-raising tickets	--	-29.88 (421)	-22.12 (83.9)	--	-15.02 (50)	-21.42 (50)	--	-31.25 (1405)	-3.35 (172)	--	-40.16 (98)	-34.19 (50)	--	-38.14 (84)	-35.95 (49)
		Median	--	-8.51	-12.21	--	-5.00	-5.00	--	-10.00	-16.00	--	-10.00	-10.00	--	-10.00	-20.00
		Instant win tickets	--	-17.48 (70)	-42.18 (153)	--	-14.63 (81)	-3.71 (62)	--	-10.02 (55)	-34.23 (167)	--	-25.53 (78)	-44.77 (126)	--	-22.20 (64)	-106.92 (295)
		Median	--	-7.21	-17.16	--	-5.00	-5.50	--	-5.00	-20.00	--	-10.00	-17.50	--	-10.00	-30.00
		Bingo	--	-46.70 (111)	-93.96 (258)	--	-56.14 (108)	+3.33 (249)	--	-12.74 (114)	-127.50 (313)	--	-55.82 (118)	-103.75 (202)	--	-64.66 (103)	-180.00 (258)

p < .05 (2 tail) *p < .01 (2 tail)*

			Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
			NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
			n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
PAST YEAR GAMBLING	used in Assessments 3 and 4) (Means and medians only calculated for people participating in format)	*Median*	--	-21.16	-58.57	--	-25.00	-60.00	--	-10.00	-45.00	--	-20.00	-45.00	--	-30.00	-90.00
		EGMs	--	-55.22 (314)	-1076.70 (3874)	--	-48.96 (337)	-117.18 (1104)	--	-1.48 (336)	-1.66 (1165)	--	-92.59 (293)	-400.00 (851)	--	-89.80 (278)	-4710.27 (14981)
		Median	--	-17.40	-65.95	--	-20.00	-25.00	--	-10.00	-40.00	--	-20.00	-100.00	--	-20.00	-125.00
		Casino table games	--	-112.69 (810)	-206.87 (776)	--	-62.70 (132)	+72.59 (567)	--	+18.38 (394)	-77.89 (657)	--	-365.98 (2896)	-407.50 (636)	--	-89.30 (208)	-577.78 (1400)
		Median	--	-31.81	-78.57	--	-30.00	-75.00	--	-20.00	-50.00	--	-40.00	-100.00	--	-40.00	-100.00
		Private games for money	--	-27.16 (153)	-22.16 (197)	--	-55.89 (173)	-68.00 (110)	--	+32.85 (232)	+106.87 (434)	--	-39.05 (68)	-78.13 (109)	--	-47.02 (117)	-72.18 (91)
		Median	--	-14.79	-26.15	--	-20.00	-50.00	--	0	0	--	-20.00	-28.21	--	-20.00	-25.00
		Sport betting	--	-36.05 (155)	-149.06 (489)	--	-27.35 (68)	-123.76 (641)	--	+8.44 (140)	-21.36 (250)	--	-45.03 (105)	-99.69 (162)	--	-90.11 (335)	-416.54 (953)
		Median	--	-9.92	-31.37	--	-10.00	-25.00	--	-1.00	-10.00	--	-10.00	-50.00	--	-20.00	-50.00
		Horse races	--	-28.03 (62)	-116.37 (161)	--	-29.35 (63)	-30.75 (158)	--	-15.72 (73)	-135.00 (170)	--	-35.12 (77)	-40.83 (34)	--	-33.74 (35)	-298.75 (293)
		Median	--	-17.40	-84.60	--	-20.00	-7.50	--	-10.00	-62.50	--	-20.00	-35.00	--	-20.00	-282.50
		High risk stocks	--	-1224 (17121)	-10528 (4274)	--	-3293	Only 1 value	--	+2555 (19374)	-5750 (7365)	--	-6229.41 (11580)	Only 2 values	--	-5565.08 (14533)	-17133 (28468)
		Median	--	-485	-3695	--	--	--	--	+137.40	-5500	--	--	--	--	-1200.00	-1200.00
		Casinos outside Alberta	--	-132.09 (584)	-187.16 (500)	--	-177.08 (676)	-51.44 (164)	--	-9.76 (424)	-56.54 (850)	--	-152.80 (352)	-324.00 (484)	--	-193.74 (867)	-418.42 (529)
		Median	--	-31.15	-96.96	--	-24.00	-60.00	--	-20.00	-20.00	--	-40.00	-150.00	--	-45.00	-200.00
	Expenditure on all forms combined *M (SD)*		--	-597.27 (3968)	-2563.99 (7851)	--	-376.50 (2539)	-822.80 (1129)	--	-767.07 (5292)	-1635.14 (2880)	--	-735.81 (4253)	-3442.57 (16363)	--	-561.83 (4061)	-5452.47 (15343)
	Median		--	-62.36	-556.70	--	-33.00	-496.00	--	-100.00	-750.00	--	-60.00	-375.00	--	-60.00	-576.50
	Expenditure on all forms combined category (Range 0-7)		--	1.78 (1.41)	3.55 (1.76)	--	1.54 (1.26)	3.44 (1.57)	--	2.05 (1.48)	4.02 (1.80)	--	1.79 (1.48)	3.19 (1.83)	--	1.79 (1.48)	3.44 (1.93)
	Median		--	1.26	3.63	--	1	3.5	--	2	4	--	1	3	--	1	4
	Largest single day loss in past year ($) *M (SD)*		--	715 (5870)	1969 (4810)	--	653.76 (4242)	699.22 (746)	--	902.66 (8740)	1686.64 (4507)	--	736.43 (6562)	844.78 (1006)	--	561.83 (4061)	5452 (15343)
	Median		--	56	516	--	42.00	437.50	--	64.00	510.00	--	60.00	572.00	--	60.00	576.50
	Total time (minutes) on all types of gambling per occasion *M SD*		--	163.3 (231)	497.0 (408)	--	180.4 (254)	458.3 (337)	--	180.94 (244)	482.5 (378)	--	156.8 (239)	481.1 (345)	--	126.6 (180)	591.3 (621)
GAMBLING MOTIVATION[8] *M (SD)* (Range: 1-4; 1=a lot; 4=not at all)		For excitement	--	2.97 (.91)	1.93 (.94)	missing data	missing data	missing data	missing data	missing data	missing data	--	2.94 (.90)	1.86 (.95)	--	3.0 (.91)	2.0 (.92)
		To relax/have fun	--	2.61 (.99)	1.79 (.89)	missing data	missing data	missing data	missing data	missing data	missing data	--	2.60 (.98)	1.70 (.78)	--	2.61 (1.0)	1.88 (1.0)

[8] Respondents were asked to recall motivation in the year of their most frequent gambling. Response was limited to those losing > $365 in any year, betting > 10 times in lifetime, and endorsing at least one of 15 problems associated with gambling (survey questions 227.A-241.O).

p < .05 (2 tail) *p < .01 (2 tail)*

		Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
		NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
		n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
	To win money	--	2.48 (.99)	1.58 (.85)	missing data	missing data	missing data	missing data	missing data	missing data	--	2.48 (.98)	1.57 (.80)	--	2.47 (1.0)	1.59 (.89)
	To be with friends/make new friends	--	2.94 (1.1)	2.96 (1.1)	missing data	missing data	missing data	missing data	missing data	missing data	--	2.97 (1.1)	2.97 (1.0)	--	2.91 (1.1)	2.94 (1.1)
Drink alcohol or use drugs when gambling *M (SD)* (Range: 0-4; never to most of the time)		--	0.7 (1.1)	1.4 (1.4)	--	0.8 (1.2)	2.1 (1.6)	missing data	missing data	missing data	--	0.6 (1.0)	1.3 (1.3)	--	0.7 (1.1)	1.0 (1.2)
Dissociate when gambling *M (SD)* (Range: 1-4; 1= often, 4= never)	Lose track of time	--	3.48 (.77)	2.03 (1.0)	missing data	missing data	missing data	missing data	missing data	missing data	--	3.46 (.8)	2.14 (1.0)	--	3.5 (.74)	1.91 (.94)
	Go into trance-like state	--	3.89 (.40)	2.83 (1.3)	missing data	missing data	missing data	missing data	missing data	missing data	--	3.89 (.39)	2.78 (1.3)	--	3.89 (.4)	2.88 (1.2)
	Feel outside body as if watching self gamble	--	3.1 (.6)	3.1 (1.1)	missing data	missing data	missing data	missing data	missing data	missing data	--	2.14 (1.0)	2.78 (1.3)	--	3.98 (.16)	3.41 (.96)
GAMBLING SOCIAL EXPOSURE	Percentage of close friends that gamble regularly *M (SD)*	8.2 (13.1)	15.3 (23.5)	25.4 (27.9)	8.3 (15.9)	20.1 (27.0)	26.2 (29.7)	missing data	missing data	missing data	5.5 (12.5)	12.8 (22.0)	24.9 (23.7)	5.4 (12.3)	13.4 (22.1)	20.7 (28.7)
	Amount of gambling at work or school *M (SD)* (Range: 1-4; 1= a lot)	1.62 (.78)	1.80 (.76)	1.84 (.83)	1.66 (.84)	1.82 (.83)	1.98 (.91)	missing data	missing data	missing data	1.55 (.76)	1.74 (.74)	1.73 (.67)	1.64 (.75)	1.84 (.72)	1.80 (.91)
	Attended information session on problem gambling %	1.4	2.5	1.8	3.5	4.1	6.0	0	2.9	0	0.5	1.7	0	0.6	0.8	0
GAMBLING FALLACIES	Gambling Fallacies Measure *M* (*SD*) (Range: 0-10: 10 = no fallacies)	7.3 (1.3)	7.2 (1.4)	6.3 (1.7)	6.7 (1.5)	6.7 (1.6)	6.3 (1.9)	7.4 (1.5)	7.2 (1.4)	6.0 (1.7)	7.5 (1.2)	7.4 (1.3)	6.2 (1.8)	7.7 (1.1)	7.6 (1.3)	6.7 (1.5)
GAMBLING AVAILABILITY	Casino/racino density *M (SD)* (Range: 0-4; number within 5 km)	0.5 (0.8)	0.6 (0.9)	0.8 (0.8)	0.5 (0.9)	0.6 (0.9)	1.1 (1.2)	0.5 (0.8)	0.5 (0.8)	0.6 (0.9)	0.5 (0.8)	0.6 (0.8)	0.7 (1.2)	0.5 (0.8)	0.6 (0.9)	0.5 (1.0)
	Casino/racino driving distance (km) *M (SD)* (Range: 0.2-449.3)	17.0 (30.3)	15.5 (30.5)	20.2 (51.0)	15.9 (32.7)	15.8 (34.1)	17.7 (64.2)	18.7 (40.8)	15.1 (29.8)	20.0 (65.3)	16.9 (24.8)	15.4 (29.1)	21.9 (73.9)	17.0 (21.8)	15.6 (27.7)	22.1 (77.1)
PERSONALITY																
PERSONALITY TRAITS NEO-FFI/NEO-PI-R Raw Scores *M (SD)*	Neuroticism	74.6 (23.1)	74.6 (18.6)	89.6 (23.3)	75.4 (23.6)	74.9 (23.7)	94.1 (23.6)	74.4 (21.7)	74.5 (4.0)	86.2 (23.5)	74.0 (23.2)	74.4 (23.8)	90.4 (23.8)	74.3 (23.9)	74.7 (23.7)	86.9 (22.0)
	Depression	12.1 (6.0)	11.6 (5.9)	15.7 (6.3)	12.3 (6.1)	11.7 (5.9)	16.8 (6.6)	11.9 (5.7)	11.6 (6.0)	14.8 (6.2)	12.0 (6.0)	11.4 (5.9)	15.6 (6.2)	12.0 (6.2)	11.5 (5.9)	15.5 (6.2)
	Vulnerability	10.0 (4.2)	9.5 (4.3)	11.7 (4.2)	9.9 (4.2)	9.6 (4.3)	12.7 (4.4)	10.0 (4.2)	9.5 (4.3)	11.0 (4.1)	10.1 (4.2)	9.4 (4.3)	11.8 (4.1)	9.9 (4.2)	9.5 (4.3)	11.3 (4.1)
	Impulsivity	15.1 (4.7)	15.6 (4.6)	18.6 (4.9)	15.3 (4.8)	15.7 (4.6)	19.0 (4.9)	15.2 (4.6)	15.5 (4.6)	18.2 (4.9)	14.9 (4.7)	15.6 (4.6)	19.0 (4.8)	14.8 (4.6)	15.7 (4.6)	18.1 (5.3)
	Extraversion	112.8 (21.3)	116.9 (18.5)	114.2 (20.6)	112.5 (20.4)	118.0 (18.7)	113.4 (24.0)	114.5 (21.8)	116.5 (18.4)	113.6 (17.5)	112.5 (21.4)	116.4 (18.3)	114.7 (19.9)	111.8 (22.0)	116.6 (18.4)	115.5 (20.4)
	Excitement-seeking	16.4 (5.5)	18.5 (5.1)	20.1 (5.0)	16.5 (5.6)	18.9 (5.1)	20.9 (5.4)	16.7 (5.6)	18.3 (5.2)	19.7 (4.4)	16.3 (5.4)	18.3 (5.1)	19.4 (5.1)	16.1 (5.5)	18.3 (5.1)	20.2 (5.1)
	Openness	30.4 (6.4)	30.3 (6.2)	28.5 (6.2)	30.3 (6.5)	30.5 (6.1)	28.1 (6.3)	30.5 (6.4)	30.3 (6.2)	29.3 (6.1)	30.0 (6.5)	30.3 (6.2)	28.5 (6.1)	30.8 (6.3)	30.1 (6.2)	28.2 (6.3)
	Agreeableness	33.8 (5.6)	33.4 (5.6)	31.2 (5.8)	33.7 (5.9)	33.2 (5.6)	29.9 (5.7)	33.6 (5.6)	33.5 (5.6)	32.3 (6.1)	34.0 (5.4)	33.4 (5.6)	31.3 (5.5)	34.1 (5.5)	33.5 (5.6)	31.5 (5.7)

p < .05 (2 tail) *p* < .01 (2 tail)			Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
			NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
			n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
	Conscientiousness		34.0 (6.0)	33.6 (6.3)	31.3 (6.3)	34.0 (6.2)	33.5 (6.5)	29.5 (6.3)	34.3 (6.2)	33.7 (6.5)	32.3 (6.4)	34.0 (5.4)	33.4 (5.6)	31.3 (5.5)	33.9 (6.3)	33.9 (6.5)	32.6 (6.8)
STRESS																	
PAST YEAR STRESS	Life Events Scale *M (SD)* (Range: 0-42)[9]		7.2 (4.1)	7.1 (4.2)	9.1 (4.9)	14.5 (6.2)	15.2 (6.9)	18.6 (7.4)	4.2 (3.3)	3.9 (3.2)	5.1 (3.6)	3.5 (3.2)	3.5 (3.0)	5.5 (4.4)	3.3 (2.8)	3.3 (3.0)	4.5 (3.6)
	PAI Level of Stress *M (SD)*		5.6 (4.0)	5.6 (4.1)	9.1 (4.8)	5.6 (4.0)	5.6 (4.1)	9.1 (4.8)	--	--	--	--	--	--	--	--	--
Coping Inventory for Stressful Situations *M (SD)* (Range: 21-105; higher scores = more coping strategies)			61.0 (11.1)	60.1 (11.7)	63.6 (9.8)	--	--	--	62.9 (10.6)	61.5 (11.6)	66.8 (8.9)	59.2 (12.0)	59.4 (11.3)	62.4 (10.2)	60.9 (10.8)	59.0 (12.1)	60.6 (10.7)
WELL BEING	Happiness level *M* (*SD*) (Range: 0-10; higher scores = more happiness)		7.7 (2.2)	7.5 (2.1)	6.0 (2.3)	--	--	--	--	--	--	7.7 (2.2)	7.5 (2.1)	5.9 (2.4)	7.7 (2.2)	7.5 (2.1)	6.1 (2.2)
	Life satisfaction *M* (*SD*) (Range: 0-10)		7.7 (1.9)	7.6 (1.9)	6.0 (2.3)	--	--	--	--	--	--	7.7 (1.9)	7.5 (1.9)	5.9 (2.4)	7.7 (2.0)	7.6 (1.9)	6.1 (2.1)
	Personal Wellness Index *M (SD)* (Range: 0-100)		75.1 (17.6)	72.9 (16.5)	58.6 (18.4)	--	--	--	--	--	--	75.2 (17.6)	72.2 (16.4)	56.7 (19.8)	74.9 (17.6)	73.5 (16.5)	60.7 (16.9)
LIFETIME STRESS	Childhood Trauma Score *M (SD)*		35.8 (13.2)	36.7 (12.7)	44.1 (17.6)	36.2 (13.0)	37.1 (13.2)	44.5 (19.3)	35.6 (13.6)	36.7 (12.6)	43.2 (17.2)	35.8 (13.4)	36.2 (12.0)	46.2 (16.4)	35.5 (12.8)	36.8 (12.7)	42.5 (16.7)
MENTAL HEALTH																	
MENTAL DISORDERS	Major Depressive Disorder %		10.5	10.4	27.3	9.3	10.9	28.0	--	--	--	9.1	9.2	24.3	13.9	11.0	29.4
	Generalized Anxiety %		9.0	9.4	25.6	3.9	4.2	18.0	--	--	--	11.8	13.2	40.5	13.5	12.8	20.6
	Panic Attacks &/or Agoraphobia %		6.6	7.7	14.0	6.4	7.5	14.0	--	--	--	7.7	8.3	18.9	5.8	7.3	8.8
	Specific Phobias %		9.8	11.7	25.1	11.5	13.9	30.0	--	--	--	8.9	9.7	20.0	8.2	10.6	23.5
	Social Phobias %		3.5	3.6	10.0	3.9	3.5	16.0	--	--	--	4.6	3.8	11.1	1.9	3.7	0
	Obsessive Compulsive Disorder %		3.4	3.7	13.2	3.2	5.0	20.0	--	--	--	4.1	3.6	8.1	2.9	2.0	8.8
	Any Above CIDI Diagnosis %		29.0	33.4	45.1	27.9	29.9	60.0	--	--	--	29.4	29.9	48.7	30.3	41.2	19.1
	Attention Deficit Hyperactivity %		13.1	7.9	29.7	--	--	--	--	--	--	13.1	7.9	29.7	--	--	--
	Eating Disorders	Adult Eating Disorder Scale *M (SD)* (Range:0-5)	0.4 (0.8)	0.3 (0.7)	0.9 (1.3)	--	--	--	--	--	--	0.4 (0.8)	0.3 (0.7)	0.9 (1.3)	--	--	--
		Anorexia or Bulimia %	10.0	7.9	24.3	--	--	--	--	--	--	10.0	7.9	24.3	--	--	--
PAI Clinical Scales Raw Scores *M (SD)*	Somatic Complaints		11.1 (9.9)	11.5 (9.7)	17.9 (12.0)	11.4 (9.9)	11.5 (9.6)	17.5 (11.3)	11.2 (10.5)	11.8 (10.1)	17.7 (12.1)	--	--	--	10.4 (9.1)	11.0 (9.3)	18.7 (13.0)
	Anxiety		15.0 (10.6)	14.8 (9.8)	21.7 (11.6)	15.6 (10.7)	15.3 (9.8)	23.6 (10.5)	15.4 (10.3)	15.2 (10.2)	21.7 (12.0)	--	--	--	13.7 (10.8)	13.5 (9.3)	18.9 (12.6)
	Anxiety Related Disorders		17.5 (8.5)	17.1 (7.7)	22.7 (9.3)	18.6 (8.6)	17.8 (7.7)	24.2 (9.3)	17.9 (8.6)	17.8 (8.0)	23.2 (9.4)	--	--	--	15.3 (8.4)	15.3 (7.5)	19.7 (9.2)
	Depression		13.9 (9.8)	14.0 (9.4)	21.1 (12.0)	14.1 (9.6)	13.7 (9.1)	22.2 (11.7)	13.6 (9.6)	14.5 (9.9)	20.8 (12.8)	--	--	--	14.0 (10.4)	13.7 (9.3)	19.9 (11.4)
	Mania		22.7	22.9	25.0	24.1	24.5	27.3	23.6	23.4	24.1	--	--	--	19.5	20.1	23.0

[9] Different scoring system used in Assessment 1

p < .05 (2 tail) *p < .01 (2 tail)*

			Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
			NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
			n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
			(9.0)	(8.9)	(8.5)	(9.2)	(9.3)	(9.8)	(9.2)	(8.9)	(7.6)				(8.5)	(8.5)	(7.9)
		Paranoia	11.6 (6.6)	11.5 (6.1)	14.1 (6.4)	17.4 (8.5)	17.8 (8.3)	24.8 (9.0)	7.7 (5.6)	7.8 (4.9)	5.3 (4.4)	--	--	--	6.8 (4.7)	7.5 (4.7)	10.5 (5.2)
		Schizophrenia	8.8 (5.9)	8.2 (12.0)	12.0 (6.6)	14.4 (8.4)	13.8 (7.3)	20.0 (9.1)	5.2 (4.4)	5.3 (4.4)	7.7 (5.0)	--	--	--	4.0 (3.7)	4.0 (3.7)	6.1 (5.2)
		Borderline Features	16.7 (10.5)	17.6 (10.2)	25.7 (10.4)	18.1 (10.7)	18.8 (10.5)	29.8 (10.3)	16.9 (11.1)	17.9 (10.4)	23.9 (10.5)	--	--	--	14.3 (9.7)	15.6 (9.4)	22.2 (10.5)
		Aggression	12.4 (8.7)	14.0 (9.1)	19.4 (10.7)	11.5 (8.0)	13.5 (8.4)	18.1 (8.8)	13.7 (9.6)	14.5 (9.9)	20.8 (12.8)	--	--	--	--	--	--
		Suicidal Ideation	3.5 (5.1)	3.4 (4.9)	6.8 (6.7)	3.7 (5.3)	3.5 (4.8)	8.2 (7.5)	3.6 (5.2)	3.6 (5.3)	6.4 (6.7)	--	--	--	3.0 (4.7)	3.0 (4.4)	5.1 (5.4)
SUBSTANCE USE, ABUSE, AND DEPENDENCE		Tobacco user %	16.1	26.1	59.5	18.3	30.4	78.0	15.7	24.7	48.9	13.6	22.3	51.4	16.0	25.2	55.6
		Level of alcohol use *M SD* (Range 0 – 4; 0 = never)	2.09 (1.1)	2.65 (.70)	2.72 (.63)	2.06 (1.09)	2.64 (.69)	2.76 (.63)	2.06 (1.06)	2.59 (.75)	2.60 (.68)	2.30 (1.15)	2.80 (.65)	2.86 (.48)	1.95 (1.14)	2.57 (.72)	2.67 (.74)
		Illicit drug use %	18.3	25.1	34.5	20.2	29.7	52.0	19.4	24.3	25.5	18.6	22.7	27.0	13.9	22.2	29.4
		Alcohol dependence %	8.9	7.7	15.5	13.5	10.3	16.0	missing data	missing data	missing data	missing data	missing data	missing data	1.9	4.4	14.7
		Drug dependence (Illicit drugs; non-medical use of licit drugs) %	2.2	2.2	7.0	2.2	3.4	10.0	3.1	1.9	9.8	2.5	1.8	3.1	1.0	1.8	2.9
SOCIAL FUNCTIONING																	
Heterosexual %			95.5	94.4	95.6	96.2	93.5	100.0	96.3	94.0	90.2	93.5	96.8	93.9	95.7	93.7	100.0
SOCIAL FUNCTIONING AND SUPPORT		Marital satisfaction %	82.3	76.3	67.4	86.9	83.0	82.4	82.9	77.2	56.0	75.6	69.9	58.8	82.1	72.3	70.6
		PAI Social Non-Support raw score *M (SD)*	6.5 (3.3)	6.2 (2.8)	8.5 (4.0)	6.5 (3.3)	6.2 (2.8)	8.5 (4.0)	--	--	--	--	--	--	--	--	--
		Family Environment Scale *M (SD)* (Range: 22-76)	55.1 (8.6)	54.1 (8.2)	53.4 (8.6)	55.1 (8.6)	54.0 (7.9)	52.3 (9.4)	55.0 (8.3)	54.2 (8.2)	53.5 (9.0)	54.3 (8.6)	53.8 (8.3)	54.3 (7.1)	55.9 (8.3)	54.4 (8.3)	53.8 (8.6)
		Neighbourhood Cohesion Index *M (SD)* (Range: 2-10; higher scores = decreased cohesion)	5.3 (2.0)	5.4 (2.0)	5.9 (1.9)	5.3 (1.9)	5.4 (2.0)	6.2 (2.0)	5.6 (2.2)	5.5 (2.0)	5.9 (2.0)	5.1 (2.0)	5.2 (2.0)	5.9 (1.8)	5.4 (1.9)	5.3 (1.9)	5.4 (1.6)
		Social Networks Scale *M (SD)* (Range: 0-50; higher scores indicate decreased risk for isolation)	32.5 (7.3)	31.8 (6.7)	29.2 (5.6)	32.7 (7.4)	32.6 (6.3)	29.3 (8.7)	31.9 (7.0)	30.8 (6.8)	28.5 (7.8)	32.6 (7.6)	32.1 (7.0)	30.1 (7.2)	32.8 (7.0)	31.7 (7.0)	29.1 (7.0)
RELIGION	Religious affiliation	Catholic %	11.2	21.4	33.7	9.8	22.2	34.0	10.9	21.3	30.4	10.6	21.4	36.1	14.4	20.6	35.3
		Protestant %	29.7	30.1	22.6	29.3	28.5	14.9	29.9	30.5	23.9	31.7	30.5	22.2	27.9	31.5	32.4
		No religion %	22.2	27.2	21.5	23.1	27.9	25.5	21.8	27.8	15.2	22.5	26.8	16.7	20.9	26.1	29.4
		Other religion %	36.9	21.2	22.2	37.8	21.4	25.5	37.4	20.3	30.4	35.3	21.3	25.0	36.8	21.8	2.9
	Religiosity Scale *M (SD)* (Range: 0-26; higher scores indicate greater belief)		15.7 (8.9)	12.3 (7.4)	12.2 (6.6)	15.9 (8.4)	12.6 (7.2)	11.2 (6.2)	--	--	--	15.7 (9.1)	12.2 (7.4)	13.7 (6.7)	15.5 (9.3)	12.1 (7.6)	12.2 (7.2)
ILLEGAL BEHAVIOUR AND ANTISOCIALITY		Illegal activities in lifetime %	5.0	0.4	13.1	Only 2 values	0	15.6	22.2	0.6	13.3	0	0.7	10.8	0	0.5	11.8
		PAI Antisocial Features raw scores *M (SD)*	12.6 (8.7)	14.1 (9.2)	20.3 (11.6)	14.2 (9.2)	16.7 (10.5)	25.3 (13.6)	12.7 (8.8)	13.6 (9.0)	17.4 (10.1)	--	--	--	10.1 (7.8)	11.4 (7.7)	16.8 (10.7)

p < .05 (2 tail) *p < .01 (2 tail)*

		Average Data			Wave 1			Wave 2			Wave 3			Wave 4		
		NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs	NGs	NPGs	PGs
		n=240	*n*=846	*n*=42	*n*=312	*n*=1010	*n*=50	*n*=217	*n*=881	*n*=47	*n*=221	*n*=726	*n*=37	*n*=208	*n*=767	*n*=34
COGNITIVE FUNCTIONING																
Wechsler Abbreviated Scale of Intelligence	IQ *M (SD)*	111.9 (12.6)	110.3 (12.2)	101.8 (14.5)	111.9 (12.7)	109.3 (12.4)	99.9 (14.5)	110.9 (12.9)	110.7 (12.1)	103.4 (14.4)	112.1 (12.0)	110.9 (12.3)	103.2 (14.2)	112.6 (12.6)	110.7 (11.9)	100.8 (15.1)
	Above average %	58.9	51.8	18.0	58.9	51.8	18.0	--	--	--	--	--	--	--	--	--
	Average %	34.9	41.6	62.0	34.9	41.6	62.0	--	--	--	--	--	--	--	--	--
	Below average %	6.1	6.6	20.0	6.1	6.6	20.0	--	--	--	--	--	--	--	--	--
Wisconsin Card Sorting Task (> 16th percentile)	Total Errors %	76.3	79.6	66.0	76.3	79.6	66.0	--	--	--	--	--	--	--	--	--
	Perseverative Response %	86.2	84.2	84.0	86.2	84.2	84.0	--	--	--	--	--	--	--	--	--
	Perseverative Errors %	83.3	83.4	78.0	83.3	83.4	78.0	--	--	--	--	--	--	--	--	--
	Non-Perseverative Errors %	76.6	75.8	56.0	76.6	75.8	56.0	--	--	--	--	--	--	--	--	--

Table C4: Independent Variable Profile of People in LLLP who Became PGSI 5+ Problem Gamblers (PG) in the Next Assessment for the First Time versus People who Stayed Non-Problem Gamblers (NPG) in the Next Assessment

p < .05 (2 tail); p < .01 (2 tail)		Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
		Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
		n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
DEMOGRAPHICS									
Male %		51.1	40.7	57.1	41.2	50.0	40.3	28.6	40.4
Age *M (SD)* (Baseline range[10]: 18-66)		40.1 (16.9)	40.9 (17.4)	40.3 (16.3)	39.1 (17.4)	36.5 (16.7)	41.1 (17.4)	43.3 (19.6)	42.9 (17.4)
Initial Age Category	18-20 %	17.9	21.6	17.9	21.6	--	--	--	--
	23-25 %	17.9	23.0	17.9	23.0	--	--	--	--
	43-45 %	42.9	30.1	42.9	30.1	--	--	--	--
	63-65 %	21.4	25.3	21.4	25.3	--	--	--	--
Immigrant %		9.3	11.3	10.7	11.1	12.5	11.3	0	11.7
Ethnicity (participants able to choose more than one category)	Aboriginal/Métis/Inuit %	0	5.2	0	5.2	--	--	--	--
	Canadian %	3.6	9.8	3.6	9.8	--	--	--	--
	African %	0	0.3	0	0.3	--	--	--	--
	Asian (Eastern) %	10.7	3.1	10.7	3.1	--	--	--	--
	Asian (Southern) %	3.6	2.1	3.6	2.1	--	--	--	--
	Asian (Western) %	0	0.9	0	0.9	--	--	--	--
	European (Northern) %	17.9	18.0	17.9	18.0	--	--	--	--
	European (Eastern) %	7.1	17.6	7.1	17.6	--	--	--	--
	European (Western) %	64.3	71.0	64.3	71.0	--	--	--	--
	Latin American %	0	0.3	0	0.3	--	--	--	--
	Other ethnicity %	3.6	2.7	3.6	2.7	--	--	--	--
Non-Caucasian %		14.0	8.4	14.3	8.7	12.5	8.3	14.3	8.1
Adopted %		2.3	2.6	3.6	2.8	0	2.6	0	2.3
Educational Attainment	< High school graduation %	2.5	5.4	3.8	5.2	0	5.5	0	5.5
	High school graduate %	12.9	8.9	11.5	9.0	16.7	8.8	14.3	8.9
	Some post-secondary %	28.0	22.9	34.6	22.7	16.7	23.0	14.3	22.9
	Completed vocational school or college %	24.1	22.5	19.2	22.6	49.9	22.3	14.3	22.5
	University Bachelor's degree %	27.4	27.7	23.1	27.7	16.7	27.6	57.1	27.7
	Graduate or professional degree %	5.1	12.7	7.8	12.8	0	12.8	0	12.5
Marital Status	Never married %	39.5	35.7	35.7	40.0	62.5	34.5	28.6	31.3
	Married %	30.2	43.6	35.7	41.0	12.5	44.1	28.6	46.6
	Living common-law %	20.9	8.8	14.3	7.5	25.0	9.6	42.9	9.8
	Separated or divorced %	4.6	9.1	7.1	8.9	0	9.1	0	9.3
	Widowed %	4.6	2.8	7.1	2.6	0	2.7	0	3.0

[10] Depending on the variable, range either represents observed minimum and maximum values or *potential* minimum and maximum values.

		Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
p < .05 (2 tail); p < .01 (2 tail)		Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
		n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
Employment Status	Unemployed %	32.6	30.3	25.0	29.6	50.0	31.4	42.9	30.2
	Employed part-time %	16.3	22.3	17.9	24.4	0	21.6	28.6	20.4
	Employed full-time %	51.1	47.4	57.1	46.0	50.0	47.0	28.6	49.5
	Attending school %	21.5	16.3	10.7	25.8	25.0	21.0	28.6	16.3
Household income	$0-$19,999 %	4.7	6.7	0	6.2	25.0	7.9	0	6.2
	$20,000-$29,999 %	2.3	6.0	3.6	5.5	0	6.4	0	6.2
	$30,000-$39,999 %	2.3	7.2	3.6	6.6	0	8.1	0	6.9
	$40,000-$49,999 %	4.7	8.4	3.6	8.1	0	8.6	14.3	8.7
	$50,000-$59,999 %	7.0	8.2	10.7	7.6	0	7.7	0	9.4
	$60,000-$79,999 %	13.9	16.7	21.4	16.2	0	18.6	0	15.4
	More than $80,000 %	65.1	46.8	57.1	49.8	75.0	42.8	85.7	47.3
Household debt ($) *M (SD)*		55091 (89047)	52188 (122916)	40473 (77937)	17681 (61328)	26005 (47473)	70617 (179513)	146804 (181001)	77361 (142781)
Location	Calgary %	44.2	43.9	53.6	43.7	25.0	44.0	28.6	43.9
	Edmonton %	41.8	29.8	35.7	30.1	50.0	29.7	57.1	29.4
	Grande Prairie %	7.0	11.9	3.6	11.7	25.0	12.1	0	12.0
	Lethbridge %	7.0	14.4	7.1	14.5	0	14.2	14.3	14.6
PHYSICAL HEALTH									
PHYSICAL FUNCTIONALITY	Perceptual, communicative, motor, or learning impairment %	23.2	21.5	21.4	22.4	25.0	21.1	28.6	20.8
HEALTH STATUS	Physical health rating *M* (*SD*) (Range: 1 - 6; 6 = excellent)	4.4 (1.2)	4.7 (1.1)	4.4 (1.1)	4.7 (1.0)	4.1 (1.5)	4.7 (1.1)	4.6 (1.5)	4.6 (1.1)
	Currently taking Rx medication %	28.6	48.9	--	--	--	--	28.6	48.9
GAMBLING									
GAMBLING ATTITUDES	Gambling Attitudes Measure *M* (*SD*) (Range: -4 to +4)	0.4 (1.6)	0.2 (1.9)	0.3 (1.8)	0.2 (1.9)	0.1 (1.5)	0.2 (1.9)	1.1 (0.7)	0.3 (1.8)
	Gambling Attitudes Questionnaire *M (SD)* (Range: 1-7; lower scores indicate belief gambling harmless)	4.1 (1.0)	4.1 (1.0)	4.2 (1.2)	4.0 (1.1)	3.6 (0.7)	4.2 (0.9)	4.5 (0.8)	4.2 (1.0)
LIFETIME GAMBLING	Age first gambled *M (SD)*	17.6 (8.4)	18.7 (7.8)	18.3 (9.9)	19.4 (8.8)	16.9 (6.4)	18.2 (7.1)	15.3 (4.9)	18.3 (7.1)
	Big win when first started gambling %	55.0	20.1	63.0	21.2	37.5	20.4	42.9	18.3
	Big loss when first started gambling %	14.4	8.8	18.5	8.4	12.5	9.0	0	9.2
	*Parent(s)/sibling(s) do/did gamble regularly [11] %	46.5	21.0	46.4	21.6	62.5	20.3	28.6	21.0
	* Parent(s) gambled with person when growing up %	44.2	26.2	46.4	26.8	50.0	25.8	28.6	25.8
	* Parent(s) are/were problem	9.3	4.8	10.7	5.2	0	4.5	14.3	4.5

[11] Asterisks indicate question only asked to people losing >$365 in any year, betting >10 times in life, and endorsing at least one of 15 problems associated with gambling (survey questions 227.A-241.O).

			Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
p < .05 (2 tail); p < .01 (2 tail)			Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
			n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
	gambler(s) %									
	* Siblings are/were problem gamblers %		4.6	3.3	7.1	3.6	0	3.2	0	3.1
	Largest amount lost in one single year $ *M (SD)*		493 (674)	414 (1961)	541.46 (739)	237.77 (652)	380.00 (408)	532.90 (2811)	429.29 (715)	516.43 (2755)
	Median		255.81	80.69	275	50	150	100	100	100
PAST YEAR GAMBLING	Frequency of gambling in typical month *M (SD)* 1 = Not in past year 2 = 1-5/year 3 = 6-11/year 4 = 1/month 5 = 2-3/month 6 = 1/week 7 = 2-6/week 8 = daily (means and medians calculated for entire group, including individuals who did not engage in the format)	Lottery tickets	2.39 (1.80)	2.26 (1.69)	1.64 (1.6)	1.35 (1.2)	4.00 (1.9)	2.89 (2.0)	3.57 (2.5)	2.77 (2.0)
		Raffle or fund-raising tickets	2.12 (1.45)	1.79 1.0)	2.11 (1.4)	1.77 (1.1)	2.38 (1.6)	1.86 (1.0)	1.86 (1.5)	1.75 (.88)
		Instant win tickets	2.51 (1.78)	1.85 (1.42)	2.57 (2.0)	1.97 (1.6)	3.25 (2.1)	1.88 (1.4)	1.43 (.54)	1.67 (1.2)
		Bingo	1.46 (1.14)	1.12 (.61)	1.32 (1.1)	1.15 (.7)	1.87 (1.6)	1.13 (.6)	1.57 (.8)	1.07 (.5)
		EGMs	2.30 (1.67)	1.43 (.90)	2.43 (1.5)	1.40 (.9)	2.25 (1.7)	1.47 (.9)	1.86 (2.3)	1.43 (.9)
		Casino table games	1.70 (1.22)	1.18 (.64)	1.79 (1.5)	1.20 (.7)	2.00 (1.3)	1.19 (.7)	1.0 (0)	1.14 (.5)
		Private games for money	2.35 (1.89)	1.53 (1.17)	2.36 (1.8)	1.58 (1.3)	2.88 (2.2)	1.52 (1.16)	1.71 (1.9)	1.44 (1.0)
		Sport betting	1.42 (.84)	1.25 (.87)	1.39 (.9)	1.24 (.9)	1.75 (1.0)	1.23 (.8)	1.14 (.4)	1.27 (.9)
		Horse races	1.05 (.20)	1.08 (.37)	1.04 (.2)	1.09 (.4)	1.13 (.35)	1.09 (.35)	1.0 (0)	1.06 (.35)
		High risk stocks	1.30 (.72)	1.10 (.55)	1.46 (1.1)	1.11 (.6)	1.0 (0)	1.10 (.51)	1.0 (0)	1.09 (.53)
		Casinos outside Alberta	1.23 (.46)	1.14 (.46)	1.21 (.4)	1.10 (.4)	1.38 (.74)	1.15 (.4)	1.14 (.4)	1.19 (.6)
	Frequency, all forms in past year *M (SD)* (Range: 0-30)		5.90 (6.45)	2.42 (3.91)	7.2 (9.0)	2.6 (5.3)	3.3 (0.8)	2.3 (4.0)	3.7 (2.7)	2.3 (2.0)
	Gambled on Internet in any form %		16.26	9.78	21.4	6.5	12.5	11.9	0	11.8
	# of types of gambling engaged in *M* (*SD*) (Range: 0-13)		3.83 (2.67)	2.44 (2.02)	3.6 (3.0)	2.0 (1.8)	5.6 (2.1)	2.9 (2.2)	2.71 (1.98)	2.51 (2.1)
	Gambling Expenditure $ (net win/loss in typical month) *M (SD)* (Note: actual values used in Assessments 1	Lottery tickets	-45.71 (58)	-33.28 (128)	missing data	missing data	-45.71 (58)	-33.28 (128)	Insufficient data	--
		Median	-20	-10	--	--	-20.00	-10.00	--	--
		Raffle or fund-raising tickets	-30.7 (100)	-18.5 (89)	-38.56 (124)	-15.5 (47)	-3.33 (17)	-22.2 (141)	Insufficient data	--
		Median	-5.6	-7.2	-5.00	-5.00	-7.5	-10	--	--
		Instant win tickets	-59.3 (326)	-11.4 (51)	-59.3 (326)	-11.5 (47)	-37.83 (58)	-11.2 (55)	Insufficient data	--
		Median	-6.1	-5.0	-5	-5	-10	-5	--	--

				Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
p < .05 (2 tail); *p < .01 (2 tail)*				Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
				n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
PAST YEAR GAMBLING	and 2 and absolute values used in Assessments 3 and 4) (Means and medians only calculated for people participating in format)		Bingo	-55.6 (56)	-40.0 (90)	-60.0 (55.7)	-50.85 (103)	-40.00 (57)	-26.8 (73.2)	Insufficient data	--
			Median	-47.8	-18.3	-50	-25	-40	-10	--	--
			EGMs	-162.5 (633)	-28.9 (301)	-190.1 (742)	-44.2 (336)	-66.0 (251)	-10.1 (257)	Insufficient data	--
			Median	-35.6	-15.5	-40	-20	-20	-10	--	--
			Casino table games	-157.4 (284)	-55.4 (214)	-210.7 (278)	-62.4 (105)	+29.0 (306)	-46.9 (347)	Insufficient data	--
			Median	-57.8	-25.5	-80	-30	+20	-20	--	--
			Private games for money	-39.8 (136)	-11.3 (218)	-66.0 (126)	-51.9 (184)	+52.0 (169)	38.4 (259)	Insufficient data	--
			Median	-13.3	-11.0	-20	-20	+10	0	--	--
			Sport betting	-46.1 (82)	-12.8 (91)	-30.0 (69)	-24.5 (59)	-102.5 (127)	+1.49 (130)	Insufficient data	--
			Median	-19.4	-4.6	-5	-10	-70	+2	--	--
			Horse races	Insufficient data	--	Insufficient data	-24.7 (38)	Insufficient data	+18.9 (74)	Insufficient data	--
			Median	--	--	--	--	--	--	--	--
			High risk stocks	-3490 (6754)	2183 (4953)	-3490 (6754)	2183 (4953)	Insufficient data	-3881 (18487)	Insufficient data	--
			Median	-200	-500	-200	-500	--	-175	--	--
			Casinos outside Alberta	-672 (1652)	-161 (627)	-672 (1652)	-161 (627)	Insufficient data	+25.68	Insufficient data	--
			Median	90	20	90	20	--	+20.0	--	--
	Expenditure on all forms combined *M (SD)*			-951.6 (3085)	-434.3 (3085)	-1299 (4587)	-214 (1279)	-489 (463)	-585.9 (4634)	-90.7 (73.1)	-559 (3784)
	Median			-145	-31.5	-122.5	-15	-272.5	-53	-90	-30
	Expenditure on all forms combined category (Range 0-7)			2.2 (1.7)	1.4 (1.4)	2.29 (1.98)	1.13 (1.22)	2.88 (1.45)	1.63 (1.56)	1.14 (.90)	1.36 (1.49)
	Median			1.9	1.0	2.0	1.0	2.5	1.0	1.0	1.0
	Largest single day loss in past year ($) *M (SD)*			1310 (3243)	539 (4897)	1879.7 (4784)	453 (3567)	273.25 (304)	612.0 (5413)	213.7 (436)	572 (6073)
	Median			145	27	170	20	143	33	50	30
	Total time (minutes) on all types of gambling per occasion *M SD*			303.7 (316)	127.4 (219)	309.4 (346)	127.2 (224)	342.0 (258)	138.1 (226)	237.0 (260)	116.2 (205)
GAMBLING MOTIVATION *M (SD)* (Range: 1-4; 1=a lot; 4=not at all)		For excitement		2.7 (1.0)	3.0 (.9)	missing data	missing data	missing data	missing data	2.7 (1.0)	3.0 (.9)
		To relax/have fun		2.9 (.9)	2.7 (1.0)	missing data	missing data	missing data	missing data	2.9 (.9)	2.7 (1.0)
		To win money		2.1	2.6	missing data	missing data	missing data	missing data	2.1	2.6

p < .05 (2 tail); p < .01 (2 tail)		Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
		Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
		n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
		(.9)	(1.0)					(.9)	(1.0)
	To be with friends/make new friends	3.1 (1.1)	3.0 (1.1)	missing data	missing data	missing data	missing data	3.1 (1.1)	3.0 (1.1)
Drink alcohol or use drugs when gambling *M (SD)* (Range: 1-5; never to most of the time)		1.7 (1.2)	1.6 (1.0)	1.7 (1.2)	1.6 (1.1)	missing data	missing data	1.9 (1.2)	1.5 (.96)
Dissociate when gambling *M (SD)* (Range: 1-4; 1= often, 4= never)	Lose track of time	2.7 (1.1)	3.5 (.8)	missing data	missing data	missing data	missing data	2.7 (1.1)	3.5 (.8)
	Go into trance-like state	3.4 (1.0)	3.9 (.4)	missing data	missing data	missing data	missing data	3.4 (1.0)	3.9 (.4)
	Feel outside body as if watching self gamble	3.6 (.8)	4.0 (.2)	missing data	missing data	missing data	missing data	3.6 (.8)	4.0 (.2)
GAMBLING SOCIAL EXPOSURE	Percentage of close friends that gamble regularly *M (SD)*	22.6 (30)	14.2 (23)	23.9 (28.2)	16.5 (25.0)	missing data	missing data	18.1 (36.2)	11.4 (20.4)
	Amount of gambling at work or *school M (SD)* (Range: 1-4; 1= a lot)	1.7 (.7)	1.7 (.8)	1.8 (.74)	1.8 (.83)	missing data	missing data	1.4 (.55)	1.7 (.74)
	Attended information session on problem gambling %	0	2.2	0	3.4	0	1.5	0	1.5
GAMBLING FALLACIES	Gambling Fallacies Measure *M* (*SD*) (Range: 0-10: 10 = no fallacies)	6.0 (1.7)	7.1 (1.4)	6.1 (1.7)	6.8 (1.6)	5.6 (2.1)	7.3 (1.4)	5.9 (1.3)	7.4 (1.2)
GAMBLING AVAILABILITY	Casino/racino density *M (SD)* (Range: 0-4; number within 5 km)	0.4 (0.7)	0.5 (0.8)	0.5 (0.8)	0.6 (0.9)	0.3 (0.5)	0.5 (0.8)	0.3 (0.5)	0.5 (0.8)
	Casino/racino driving distance (km) *M (SD)* (Range: 0.2-449.3)	10.0 (11.4)	15.8 (31.1)	11.3 (15.3)	15.5 (33.0)	7.7 (3.7)	15.7 (30.4)	7.2 (4.4)	16.2 (29.4)
PERSONALITY									
PERSONALITY TRAITS NEO-FFI/NEO-PI-R Raw Scores *M (SD)*	Neuroticism	79.8 (22.4)	74.2 (23.6)	79.5 (21.4)	74.3 (23.5)	85.1 (23.9)	74.1 (23.6)	75.0 (24.5)	74.1 (23.6)
	Depression	13.0 (5.9)	11.5 (5.9)	12.6 (5.7)	11.6 (5.9)	14.6 (6.4)	11.5 (5.9)	12.9 (6.4)	11.5 (5.9)
	Vulnerability	10.2 (3.6)	9.5 (4.3)	9.9 (3.9)	9.6 (4.3)	11.1 (2.9)	9.5 (4.3)	10.4 (3.4)	9.5 (4.3)
	Impulsivity	17.1 (4.9)	15.4 (4.6)	17.3 (4.6)	15.4 (4.6)	17.8 (5.2)	15.4 (4.6)	15.6 (5.8)	15.4 (4.6)
	Extraversion	116.2 (16.3)	115.7 (19.0)	116.9 (15.5)	116 (19)	115.6 (16.9)	115.6 (19.0)	114.3 (18.8)	115.5 (19.1)
	Excitement-seeking	19.3 (4.9)	17.8 (5.2)	20.0 (3.9)	18.0 (5.3)	17.4 (5.9)	17.8 (5.2)	18.6 (8.0)	17.7 (5.2)
	Openness	30.0 (5.8)	30.3 (6.3)	30.1 (5.5)	30.4 (6.2)	27.6 (6.1)	30.3 (6.3)	32.1 (6.8)	30.3 (6.3)
	Agreeableness	33.0	33.6	33.0	33.5	33.1	33.6	33.1	33.6

p < .05 (2 tail); p < .01 (2 tail)			Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
			Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
			n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
			(6.2)	(5.5)	(6.3)	(5.6)	(5.2)	(5.5)	(6.9)	(5.5)
		Conscientiousness	32.6 (7.6)	34.0 (6.4)	33.6 (6.7)	33.8 (6.4)	28.5 (9.8)	34.0 (6.4)	33.1 (8.9)	34.1 (6.4)
STRESS										
PAST YEAR STRESS	Life Events Scale *M (SD)* (Range: 0-42) [12]		11.6 (5.4)	7.8 (4.4)	15.5 (6.5)	14.5 (6.4)	5.4 (4.3)	3.8 (3.2)	3.1 (2.5)	3.5 (3.0)
	PAI Clinical Levels of Stress raw score *M (SD)*		5.7 (4.1)	5.3 (4.0)	5.7 (4.1)	5.3 (4.0)	--	--	--	--
Coping Inventory for Stressful Situations *M (SD)* (Range: 21-105; higher scores = more coping strategies)			61.8 (14.0)	60.6 (11.4)	--	--	62.6 (12.4)	61.9 (11.3)	60.8 (15.8)	59.3 (11.5)
WELL BEING	Happiness level *M* (*SD*) (Range: 0-10; higher scores = more happiness)		7.9 (2.3)	7.6 (2.1)	--	--	--	--	7.9 (2.3)	7.6 (2.1)
	Life satisfaction *M* (*SD*) (Range: 0-10)		7.3 (1.4)	7.6 (1.9)	--	--	--	--	7.3 (1.4)	7.6 (1.9)
	Personal Wellness Index *M (SD)* (Range: 0-100)		75.7 (16.4)	73.1 (16.4)	--	--	--	--	75.7 (16.4)	73.1 (16.4)
LIFETIME STRESS	Childhood Trauma Score *M (SD)*		40.2 (14.4)	36.2 (12.4)	40.1 (16.0)	36.5 (12.9)	44.1 (13.1)	36.0 (12.1)	36.3 (9.2)	36.0 (12.1)
MENTAL HEALTH										
MENTAL DISORDERS	Major Depressive Disorder %		17.2	9.6	17.9	9.7	--	--	14.3	9.5
	Generalized Anxiety %		8.5	7.6	7.1	3.5	--	--	14.3	12.8
	Panic Attacks &/or Agoraphobia %		11.4	7.2	10.7	6.9	--	--	14.3	7.5
	Specific Phobias %		22.9	11.3	25.0	12.7	--	--	14.3	9.4
	Social Phobias %		2.9	3.8	3.6	3.6	--	--	0	4.0
	Obsessive Compulsive Disorder %		8.6	3.9	10.7	4.1	--	--	0	3.7
	Any Above CIDI Diagnosis %		42.9	28.6	50.0	27.9	--	--	14.3	29.4
	Attention Deficit Hyperactivity Disorder %		14.3	8.3	--	--	--	--	14.3	8.3
	Eating Disorders	Adult Eating Disorder Scale *M (SD)* (Range:0-5)	0.14 (0.38)	0.35 (0.74)	--	--	--	--	0.14 (0.38)	0.35 (0.74)
		Anorexia Nervosa or Bulimia %	0	8.0	--	--	--	--	0	8.0
PAI Clinical Scales Raw Scores *M (SD)*	Somatic Complaints		15.0 (9.4)	12.2 (9.8)	15.0 (8.5)	11.2 (9.9)	15.1 (12.4)	11.3 (9.7)	--	--
	Anxiety		17.4 (9.3)	15.0 (9.0)	17.7 (9.2)	15.0 (9.9)	16.3 (9.5)	15.1 (7.9)	--	--
	Anxiety Related Disorders		19.5 (6.6)	17.7 (7.9)	19.8 (6.4)	17.6 (7.9)	18.4 (7.2)	17.9 (7.9)	--	--
	Depression		15.6	13.7	15.2	13.5	17.0	14.0	--	--

[12] Different scoring system used in Assessment 1

p < .05 (2 tail); *p* < .01 (2 tail)			Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
			Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
			n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
			(9.0)	(9.3)	(9.2)	(9.1)	(8.2)	(9.5)		
	Mania		22.8 (7.7)	23.6 (8.9)	23.6 (7.6)	24.0 (9.0)	19.9 (7.9)	23.2 (8.7)	--	--
	Paranoia		17.1 (7.1)	12.8 (6.6)	19.0 (8.1)	17.1 (8.1)	10.6 (3.8)	7.5 (4.8)	--	--
	Schizophrenia		11.9 (5.7)	9.8 (5.9)	14.1 (6.6)	13.6 (7.2)	4.1 (2.6)	5.2 (4.3)	--	--
	Borderline Features		20.4 (9.7)	17.6 (10.2)	19.2 (9.4)	17.9 (10.1)	24.6 (10.6)	17.2 (10.4)	--	--
	Aggression		14.1 (7.9)	12.2 (7.7)	12.4 (7.73)	12.6 (7.9)	19.9 (8.7)	11.8 (7.5)	--	--
	Suicidal Ideation		3.5 (4.0)	3.4 (4.9)	3.4 (4.3)	3.4 (4.8)	3.8 (2.8)	3.4 (5.0)	--	--
SUBSTANCE USE, ABUSE, AND DEPENDENCE	Tobacco user %		37.2	22.2	35.7	24.6	50.0	21.7	28.6	19.5
	Level of alcohol use *M SD* (Range 0 – 4; 0 = never)		2.65 (.62)	2.56 (.83)	2.61 (.74)	2.52 (.83)	2.50 (.76)	2.48 (.86)	3.00 (0)	2.69 (.80)
	Illicit drug use %		32.6	22.5	35.7	24.5	37.5	20.9	14.3	21.7
	Alcohol dependence %		10.7	10.6	10.7	10.6	missing data	missing data	missing data	missing data
	Drug dependence (Illicit drugs; non-medical use of licit drugs) %		2.3	2.3	3.6	3.0	0	1.9	0	1.7
SOCIAL FUNCTIONING										
Heterosexual %			90.0	94.2	84.6	94.4	100.0	94.1	100.0	94.0
SOCIAL FUNCTIONING AND SUPPORT	Marital satisfaction %		65.6	78.7	71.4	85.2	66.7	77.8	40.0	71.4
	PAI Social Non-Support raw score *M (SD)*		6.6 (3.9)	6.1 (3.9)	6.6 (3.9)	6.1 (3.9)	--	--	--	--
	Family Environment Scale *M (SD)* (Range: 22-76)		55.6 (8.8)	54.3 (8.2)	56.8 (8.6)	54.4 (7.9)	55.5 (10.6)	54.4 (8.2)	51.0 (7.8)	54.0 (8.5)
	Neighbourhood Cohesion Index *M (SD)* (Range: 2-10; higher scores = decreased cohesion)		5.5 (1.9)	5.3 (2.0)	5.5 (2.2)	5.3 (2.0)	5.8 0.7	5.4 (2.0)	5.0 (1.9)	5.1 (2.0)
	Social Networks Scale *M (SD)* (Range: 0-50; higher scores indicate decreased risk for isolation)		31.9 (7.1)	32.0 (6.8)	31.9 (7.6)	32.6 (6.5)	31.8 (5.6)	31.2 (6.8)	32.3 (7.0)	32.2 (7.1)
RELIGION	Religious affiliation	Catholic %	26.3	19.1	29.6	19.0	25.0	19.0	14.3	19.4
		Other Christian religion %	28.6	31.0	29.6	30.6	12.5	31.1	42.9	31.4
		No religion %	13.5	31.2	7.4	26.6	25.0	25.7	24.8	42.9
		Other religion %	32.6	16.8	33.3	23.7	37.5	24.1	24.0	0
	Religiosity Scale *M (SD)* (Range: 0-26;		14.1	13.3	15.4	13.4	--	--	9.1	13.1

p < .05 (2 tail); p < .01 (2 tail)		Average		Wave 1 IV Profile		Wave 2 IV Profile		Wave 3 IV Profile	
		Became PG next Assessment	Stayed NPG next Assessment	Became PG in Assessment 2	Stayed NPG in Assessment 2	Became PG in Assessment 3	Stayed NPG in Assessment 3	Became PG in Assessment 4	Stayed NPG in Assessment 4
		n = 21	*n* = 951	*n* = 28	*n* = 1087	*n* = 8	*n* = 888	*n* = 7	*n* = 840
	higher scores indicate greater belief)	(6.8)	(7.8)	(6.6)	(7.7)			(7.4)	(8.0)
ILLEGAL BEHAVIOUR AND ANTISOCIALITY	Illegal activities in lifetime %	0	0.6	0	0	0	1.5	0	0.4
	PAI Antisocial Features raw score *M (SD)*	17.4 (10.9)	14.3 (9.2)	17.4 (11.0)	15.3 (9.6)	17.4 (10.4)	13.0 (8.6)	--	--
COGNITIVE FUNCTIONING									
Wechsler Abbreviated Scale of Intelligence	IQ *M (SD)*	107.2 (13.1)	111.1 (12.3)	107.0 (13.3)	110.8 (12.3)	108.1 (9.7)	111.3 (12.3)	107.0 (16.4)	111.4 (12.2)
	Above average %	53.6	56.2	53.6	56.2	--	--	--	--
	Average %	32.1	38.6	32.1	38.6	--	--	--	--
	Below average %	14.3	5.3	14.3	5.3	--	--	--	--
Wisconsin Card Sorting Task (> 16th percentile)	Total Errors %	71.4	78.6	71.4	78.6	--	--	--	--
	Perseverative Response %	85.7	84.6	85.7	84.6	--	--	--	--
	Perseverative Errors %	85.7	83.1	85.7	83.1	--	--	--	--
	Non-Perseverative Errors %	67.9	75.8	67.9	75.8	--	--	--	--

Appendix D: Introduction to Latent Variable Structural Equation Models

Latent variable structural equation models subsume both confirmatory factor analysis and longitudinal structural equation models. These types of models allow for the possibility that important concepts may not be measured perfectly for each individual but may instead contain various amounts of imprecision or measurement error.

These models attempt to fit data by postulating relationships, generally causal ones, among and between manifest (measured, observed) variables and latent (unmeasured, unobserved, underlying, conceptual) variables. These are typically indicated in graphical representations of structural models as squares for manifest variables and circles for latent variables. The arrows which connect them are usually one-directional arrows drawn between circles and squares or circles and circles (less often between squares and squares in any model where circles are included). These indicate a postulated direction of causation. A connection can also be postulated and drawn as a bi-directional arrow indicating that a relationship exists but without specifying a direction of causality. Relationships of this type are of considerable importance when a series of variables are being considered as covariates or exogenous causes, and the focus is not, at least initially, upon the relationships among those exogenous variables. Many of the analyses reported here include relationships of this type. Examples of these elements are shown in Figure 14.

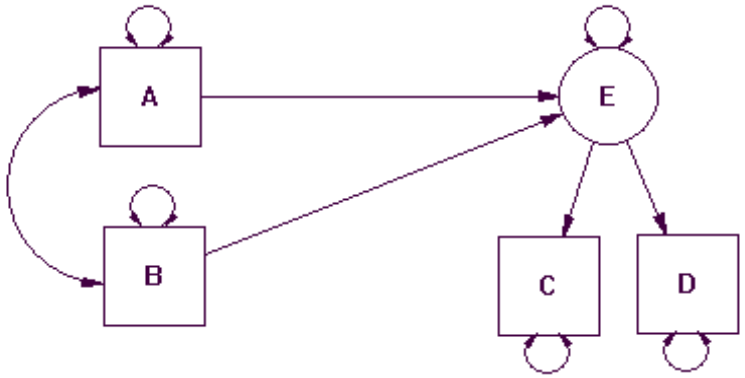


Figure 14: Elements of a Structural Equation Model

Here boxes are present for variables A, B, C, and D which would be manifest variables reflecting actual measurements taken on a sample of individuals. A circle is present for variable E which is represented as a latent variable, one for which no exact score is known for particular individuals. The one-directional arrows between A and E and between B and E indicate that changes in variable A will lead to changes in variable E, and that changes in variable B will also lead to changes in variable E. Similarly, the arrows between variable E and variable C and between variable E and variable D indicate that changes in variable E will lead to changes in variables C and D. There is a double headed arrow between variables A and B which represents

a degree of relationship between these variables, but one for which no causal direction has been postulated.

Finally, all of the double headed arrows that fold back upon themselves to and from each variable represent the variability that is not influenced (or controlled) by other variables within the model. Because such variability is typically not zero, the models allow for some measurement uncertainty or error.

Numerical estimates of the strength of influence can be assigned to all of the links. One headed arrows are understood as regression weights (especially when they emanate from a manifest variable; when they emanate from a latent variable towards a manifest variable they are also often called factor loadings). Double-headed arrows between variables are understood as covariances, and double-headed arrows pointing to no variable (i.e., to and from the same variable) are understood as variances (see Figure 14). (With an extended set of graphic elements, means can also be fit).

In general, the strengths of the links are reported as standardized values analogous to standardized beta weights in linear regression (or, oversimplifying somewhat, to correlations). Along a unidirectional arrow these standardized values can generally be interpreted as the amount of change in a standard score that would be expected in the variable that is 'pointed to' as the causal result of a one standard score increase in the variable 'pointed from', if everything else were to remain unchanged. Alternatively, one could say that an individual who is one standard score point above the mean on the variable 'pointed from' will on average be different on the mean on the variable 'pointed to' by an amount in standard score points indicated by the size of the link. Direction of change in a variable is signaled by positive or negative signs, and strength of change is signaled by higher absolutes values on the number assigned to the link. In general, these values will range between -1 and +1 in standardized models. Of course, we are seldom in a position to manipulate a single variable while keeping all of the others at a constant value, so these models attempt to show how all variables will come to change as the result of a change in an exogenous variable; that is, a variable that has no arrow pointing to it from other variables in the model. When presented in standardized form, double-headed arrows between variables will be correlations, and numbers assigned to double-headed arrows to/from a single variable represent the proportion of the variability that is uncontrolled by the links in the model.

Models are fit by asking if the relationships observed in data collected on manifest variables could have arisen from the postulated structure of relationships between manifest and latent variables along the postulated arrows or links. More specifically, the observed pattern of variable covariances (and perhaps means) is explicitly compared to the pattern that would have been observed if the postulated relationships had been responsible for producing these covariances. If the differences are too large (according to statistical fit indices), the model of the postulated relationships is rejected, or potentially adjusted to improve the fit. It should also be noted that the analyst can allow the model fit algorithm to choose the magnitude of the numbers assigned to the elements in a manner to maximize the degree of fit, or the analyst can

impose various constraints on these numbers, including most simply, postulating a specific number, or setting two or more values to be identical.

A model is called a confirmatory factor analysis model when it is primarily concerned with the relationships between a latent variable and multiple manifest variables, but not generally with the relationships between latent variables. For example, in Figure 14 the sub-model involving just variables E, C, D and the arrows between them would be a confirmatory factor analysis model. A model is generally called a structural equation model when it includes in addition, one-headed arrows from manifest variables to latent variables or between latent variables. For example in Figure 14 the variables A, B, E and the arrows from A and B to E make the whole a structural equation model. The earliest theoretical frameworks distinguished these parts of the model as the measurement model and as the structural model respectively, and this distinction is still in use. Kline (2011) provides an accessible introduction to the mathematical and statistical details of developing structural equation models.

In longitudinal studies, the same variables are measured at different points in time on the same individuals, and therefore the model may include multiple instances of the same variables differing only in the time at which they were measured. In models of this type, relationships between the same variables measured at different times become an important focus. Even more important perhaps is the possibility that temporal order between variables that caused and variables that are caused may be meaningfully unraveled. Little and Card (2013) present a detailed discussion of longitudinal structural equation models. Many caveats are appropriate, but the most important ones to note here are that:

1. There is a limit to the complexity of the model that can be adequately fit; technically by the number of observed variables included in the model, and perhaps more importantly, conceptually by the challenge in theorizing complete causal networks; and
2. That there are potentially many models that can fit a given set of data. Therefore, the final model a researcher reports must be considered to be a hypothetical structure, in short a theory, rather than an absolute demonstration of causality. Variables important to the causal network may not have been measured and/or a different model may fit equally well. It may also be the case that a model that does not fit the data perfectly may have substantial theoretical value, especially in cases where the deviation of the model from the data is small (as will often be the case when models are based on very large sets of data).

Appendix E: LLLP Publications List

Aleksandrova, L. R., Souza, R. P., Bagby, R. M., Casey, D. M., Hodgins, D. C., Smith, G. J., Williams, R. J., Schopflocher, D. P., Wood, R. T., el-Guebaly, N., Kennedy, J. L., & Lobo, D. S. S. (2012). Genetic underpinnings of neuroticism: A replication study. *Journal of Addiction Research and Therapy, 3*(119). doi:10.4172/2155-6105.1000119

Casey, D. M., Williams, R. J., Mossiere, A. M., Schopflocher, D. P., el-Guebaly, N., Hodgins, D. C., Smith, G. J., & Wood, R. T. (2011). The role of family, religiosity, and behaviour in adolescent gambling. *Journal of Adolescence*, *34*, 841-851.

Currie, S. R., Hodgins, D. C., & Casey, D. M. (2012). Validity of the problem gambling severity index interpretive categories. *Journal of Gambling Studies*, doi: 10.1007/s10899-012-9300-6.

Currie, S. R., Hodgins, D. C., Casey, D. M., el-Guebaly, N., Smith, G. J., Williams, R. J., Schopflocher, D. P., & Wood, R. T. (2011). Examining the predictive validity of the low risk gambling limits using longitudinal data. *Addiction,* 107, 400-406

el-Guebaly, N., Casey, D. M., Hodgins, D. C., Smith, G. J., Williams, R. J., Schopflocher, D. P., & Wood, R. T. (2008). Designing a longitudinal cohort study of gambling in Alberta: Rationale, methods, and challenges. *Journal of Gambling Studies, 24*, 479-504.

Farstad, S., von Ranson, K. M., Hodgins, D. C., el-Guebaly, N., Casey, D. M., & Schopflocher, D. P. (In Press). The influence of impulsiveness on binge eating and problem gambling: a prospective study of gender differences in Canadian adults. *Psychology of Addictive Behaviors.*

Hodgins, D. C., Schopflocher, D. P., el-Guebaly, N., Casey, D. M., Smith, G. J., Williams, R. J., & Wood, R. T. (2010). The association between childhood maltreatment and gambling problems in a community sample of adult men and women. *Psychology of Addictive Behaviours, 24* (3), 548-554.

Hodgins, D. C., Schopflocher, D. P., Martin, C. R., el-Guebaly, N., Casey, D. M., Currie, S. R., Smith, G. J., & Williams, R. J. (2012). Disordered gambling among higher frequency gamblers: Who is at risk? *Psychological Medicine, 1*(1), 1-12.

Lobo, D. S. S., Souza, R. P., Tong, R. P., Casey, D. M., Hodgins, D. C., Smith, G. J., Williams, R. J., Schopflocher, D. P., Wood, R. T., el-Guebaly, N., & Kennedy, J. L. (2010). Association of functional variants in the dopamine D2-like receptors with risk for gambling behaviour in healthy Caucasian subjects. *Biological Psychology, 85*, 33-37.

Smith, G. J., Schopflocher, D. P., el-Guebaly, N., Casey, D. M., Hodgins, D. C., Williams, R. J., & Wood, R. (2011). Community attitudes toward legalised gambling in Alberta. *International Gambling Studies, 11*, 57-79.

Quigley, L., Yakovenko, I., Hodgins, D. C., Dobson, K. S., el-Guebaly, N., Casey, D. C., Currie, S. R., Smith G. J., Williams, R. J., & Schopflocher, D. P. (2014). Comorbid Problem Gambling and Major Depression in a Community Sample. *Journal of Gambling Studies,* 1-18.