THE VICTORIAN GAMBLING STUDY

A LONGITUDINAL STUDY OF GAMBLING AND HEALTH IN VICTORIA 2008–2012

TECHNICAL REPORT THREE

SOCIAL DETERMINANTS AND CO-MORBIDITIES: MULTIVARIATE MODELS OF TRAUMA AND SOCIAL CAPITAL

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January 2016

Victorian **Responsible Gambling** Foundation

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To cite this report

Stone, C, Yeung, K & Billi, R 2016, *The Victorian Gambling Study: a longitudinal study of gambling and health in Victoria 2008-2012, Technical report three - Social determinants and co-morbidities: multivariate models of trauma and social capital*, Victorian Responsible Gambling Foundation, Melbourne

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Our vision: A Victoria free from gambling-related harm

Contents

Summary

A series of secondary analyses were undertaken from *The Victorian Gambling Study- A longitudinal study of gambling and health 2008-2012* (*The Victorian Gambling Study*) (Billi, Stone, Abbott and Yeung 2014; Billi, Stone, Marden and Yeung 2014). This paper is the third of a series of technical reports. The focus of this paper is on the interplay between social determinants, trauma and life events, social capital, and the level of gambling problems (PGSI score) in gamblers. Non-gamblers were excluded from the analysis. The purpose was to investigate a range of possible determinants (for example – trauma in life and upbringing, stressful life events, social capital and socio-demographics) to indicate which showed the strongest association with levels of gambling problems. The analysis is underpinned by a public health approach which views problem gambling as part of a gambling continuum and explores the broader personal, social, economic and environmental as well as biological determinants of gambling problems.

This multivariate analysis investigated which characteristics of the determinants were associated with an increase (more gambling problems) or a decrease (less gambling problems) in the PGSI score, having taken into account other important determinants. Determinants that best explain the level of gambling problems are identified as well as the size of the effect of different characteristics.

Models were developed with logical groupings of determinants before the final model was developed. The logical groupings included:

- Socio-demographics multivariate model

- Trauma and life events multivariate model

- Social capital multivariate model

- Final trauma and social capital multivariate model

Overall lifetime trauma and life events showed the strongest relationship with gambling problems. The social capital measures showed a moderate relationship and the socio-demographic determinants the weakest relationship with gambling problems.

Final Multivariate models

Two final models were developed. The first model explored which individual life events were associated with a higher level of gambling problems. The second model explored the effects of the number of life events for two reasons. Firstly, this determinant was the most important determinant based on the model fit statistics and secondly, it is a determinant that has been used in other studies.

In model one, gambling problems (PGSI score) were best explained by a model consisting of

- Life events of:

    o 'an increase in arguments with someone close', IRR 2.45 (1.94, 3.10)

    o 'a major change in financial situation', IRR 1.46 (1.22, 1.74) and

    o 'major injury or illness to themselves or someone close', IRR 1.43 (1.21, 1.68)

- 'trauma, hardship and problems in life and upbringing', IRR 1.58 (1.34, 1.87) and

- A social capital measure; 'being able to get help', IRR (not able) 2.37 (1.69, 3.34) compared with being able to get help.

In model two, gambling problems (PGSI score) were best explained by a model consisting of

- the number of life events identified, an IRR 1.16 (1.10, 1.22) for each unit increase in number of life events

- 'an increase in arguments with someone close', IRR 1.99 (1.55, 2.56)

- 'trauma, hardship and problems in life and upbringing', IRR 1.60 (1.35, 1.89) and

- A social capital measure 'being able to get help', IRR (not able) 2.32 (1.65, 3.26) compared with being able to get help.

Both models were improved by addition of gender and LOTE but not age or educational achievement. In both models the effects of trauma but not life events on gambling problems was moderated by 'being able to get help'. This was demonstrated by a reduction of the IRR for trauma by 9 per cent and 8 per cent for models one and two respectively when social capital was added to the models.

Implications: When considering the implications of the findings it is important to consider also the timespan implied in the survey questions. The reported life events are those that occurred over the previous twelve months and are therefore concurrent with the gambling problems. The question on trauma, hardship and problems in life and upbringing captures events over a much longer time span. The social capital questions are asked in the present tense so suggest current perceptions. They are not limited to any time span so may extend beyond the previous twelve months.

In both models, those who considered themselves to be someone who has had trauma, hardship and problems in their life and upbringing have more gambling problems than those who did not. This finding is indicative of the early origins of vulnerability to developing gambling problems. Childhood trauma and stressful life events have been reported in the literature as a potential risk factor for the development of gambling problems, particularly linked with coping styles and resilience. Stressful life events such as 'increasing arguments' and 'changing financial situation' are potential stressors while also being symptoms of gambling problems. It is interesting that the effects of trauma, hardship and problems in life and upbringing were shown to be moderated by one of the social capital measures – being able to get help from family, friends and neighbours. These findings have implications for prevention and treatment of gambling problems.

1. Introduction

Technical Report Three describes a detailed analysis of the complex interplay between social determinants, trauma and life events, and social capital, and the PGSI score in gamblers. The secondary analysis of *The Victorian Gambling Study- A longitudinal study of gambling and health 2008-2012* (*The Victorian Gambling Study*) (Billi, Stone, Abbott and Yeung 2014; Billi, Stone, Marden and Yeung 2014) was conducted with the aim of building on the current knowledge and understanding of the relationship between these factors. It uses a public health approach by treating problem gambling as part of a continuum and explores the broader personal, social, economic and environmental as well as biological determinants of gambling problems. In this case the determinants studied are social determinants, trauma and life events, and social capital.

The findings from the secondary analyses may vary from the literature as a result of the approach to the analysis and reporting. Firstly, this analysis treats the PGSI score as count data. This choice enables the use of the full range of the score from 0 to 27 rather than condensing to four or five risk categories. Much of the literature contains findings from analyses that compare the pathological or problem gambling group with the non-problem gamblers. Others convert the data to binary and compare the pathological or problem gambling group with the rest of the population i.e. the non-pathological or non-problem gambling group. Sometimes the highest risk groups are combined to achieve sufficient numbers and then comparative analyses are conducted.

Secondly, these cross sectional analyses indicate which determinants are the most important explanatory factors for the level of gambling problems. The model fit statistics are used to indicate which individual determinants best explain the variations in the PGSI score. The descriptive analyses of a single determinants and PGSI score are reported in the Technical Report Two. This importance or strength of association is rarely reported in the literature.

Finally, multivariate analyses were conducted to enable identification of the independent effects of determinants after taking into account other important determinants. Various models were explored to build a picture of the more important determinants from each group of determinants. These models were then combined. Often only descriptive analyses are reported with proportions and odds ratios only.

Technical report series

This report is part of a series of technical reports commissioned by the Victorian Responsible Gambling Foundation.

The Victorian Gambling Study: a longitudinal study of gambling and health in Victoria 2008–2012, Technical report one – Social determinants and co-morbidities: social determinants and co-morbidities of gamblers and non-gamblers. The first technical report describes a secondary analysis of *The Victorian Gambling Study- A longitudinal study of gambling and health 2008-2012* (*The Victorian Gambling Study*) (Billi, Stone, Abbott and Yeung 2014; Billi, Stone, Marden and Yeung 2014) which compares the social determinants, trauma and life events, social capital, and comorbidities between gamblers and non-gamblers over the four years of *The Victorian Gambling Study*.

The Victorian Gambling Study: a longitudinal study of gambling and health in Victoria 2008–2012, Technical report two – Social determinants and co-morbidities: univariate analysis of gamblers. The second technical report describes a secondary analysis of gamblers from the first year of *The Victorian Gambling Study*. Each of the variables describing the social determinants, trauma and life

events, social capital, and comorbidities were explored to determine which have the best or strongest individual association with the PGSI score. It investigated which characteristics of the determinants were associated with an increase (more gambling problems) or a decrease (less gambling problems) in the PGSI score.

The Victorian Gambling Study: a longitudinal study of gambling and health in Victoria 2008–2012, Technical report three – Social determinants and co-morbidities: multivariate models of trauma and social capital. The third technical report describes a secondary analysis of *The Victorian Gambling Study* which examined in detail the complex interplay between social determinants, trauma and life events, and social capital, and their association with the PGSI score in gamblers. This multivariate analysis indicated which determinants best explain the PGSI score after having taken into account other important determinants.

The Victorian Gambling Study: a longitudinal study of gambling and health in Victoria 2008–2012, Technical report four – Social determinants and co-morbidities: multivariate models of co-morbidities. The fourth technical report describes a secondary analysis of *The Victorian Gambling Study* which examined in detail the complex interplay between social determinants and comorbidities, and their association with the PGSI score in gamblers. This multivariate analysis indicated which determinants best explain the PGSI score after having taken into account other important determinants.

Structure of the report

Technical Report Three describes a more comprehensive exploration of trauma, life events and social capital, adjusted for socio-demographics, and their relationship with the PGSI score in gamblers. Multivariate models were developed for each logical grouping of determinants, socio-demographics model, trauma and life events model, social capital model. Two comprehensive models containing the most important factors were found to best describe the relationship between these factors and the PGSI score. The report is divided into twelve sections.

Summary

The summary section outlines the key findings of the report.

1. Introduction

The introduction describes the approach to this secondary analysis of the data from *The Victorian Gambling Study* and how it differs from the traditional approach. The aim of the study is to add to the understanding of the complex interplay between gambling problems and comorbidities taking into account the social determinants.

2. Materials and methods

Materials and methods section details the analytical approach and how to interpret the results.

3. Socio-demographics multivariate model

This section describes the multivariate modelling of the socio-demographic determinants of gambling problems.

4. Trauma and life events multivariate model

This section describes the multivariate modelling of trauma, hardship and problems in life and upbringing as well as stressful life events adjusted for the important socio-demographic determinants of gambling problems.

5. Social capital multivariate model

This section describes the multivariate modelling of the social capital measures adjusted for the important socio-demographic determinants of gambling problems.

6. Trauma, life events and social capital multivariate model

This section describes the final multivariate modelling of the trauma and life events adjusted for social capital measures as well as for the important socio-demographic determinants of gambling problems.

7. Discussion and implications

This section outlines the key findings of the various multivariate models and their relationship with the literature. It outlines the strengths and weaknesses, what the study adds and the implications of the findings.

Appendix One

This section consists of tables of results of analysis of single factors adjusted for socio-demographics.

Appendix Two

This section contains some of the relevant questions from the CATI survey

Appendix Three: Glossary

This section provides a glossary of the key terms in the document.

Appendix Four: References

This section consists of the references used.

2.   Materials and methods

This section describes the materials and methods used to conduct the analyses for this technical report three. The aim of this work was to explore in detail the relationship between social determinants, trauma and life events and social capital, and gambling problems. The Problem Gambling Severity Index (PGSI) score was used to define the level of gambling problems. A public health approach was applied to the analysis. Rather than treat problem gambling as the only outcome of interest, the analytical technique in this study uses the full range of the PGSI score to explore the relationship between the parameters of interest and the level of gambling problems.

Study design

The study design was a cross sectional observational study using data on all gamblers (n=4,677) from the first year of the Longitudinal Study of Gambling and Health in Victoria 2008-2012 (Billi, Stone, Abbott and Yeung 2014). Briefly this Study collected information from a representative sample (n=15,000) of the Victorian adult population (18 years and older) using computer assisted telephone interviewing (CATI) in 2008. Areas with higher electronic gaming machine expenditure were oversampled in order to enrich for participants with higher risk gambling.

Gambling problems measure

The PGSI consists of the nine questions from the Canadian Problem Gambling Index (CPGI) which are scored. The Queensland modification of the PGSI (Queensland Treasury 2001; Billi, Stone, Abbott and Yeung 2014) was used to measure problem gambling. This modification of the item response scale uses five-points (never, rarely, sometimes, often and always) rather than the original four-point scale (never, sometimes, often, almost always). Responses of 'rarely' and 'sometimes' were combined and given a score of 1, so that the range of scores remained from 0 to 27 as in the original PGSI. Cut-points for the total PGSI score were: 0, non-problem gamblers; 1-2, low-risk gamblers; 3-7, moderate-risk gamblers; and ≥8, problem gamblers.

The PGSI score is an indicator of gambling problems. The questions are listed in Appendix One. Gamblers score 0 on the PGSI measure when they respond 'never' to each question in the series of 9 questions on gambling behaviour or consequences of gambling. A higher PGSI score can occur in two ways: a gambler responds to one or more of the questions (more problems) and/or responds more frequently (problems are experienced more often).

Determinants or correlates of gambling problems

The determinants of gambling problems that were studied were those that described the person's socio-demographics, experience of trauma, hardship and problems in life and upbringing, life events over the previous 12 months and individual social capital. Most are indicative of current status or over the previous 12 months so are concurrent with the measure of gambling problems, the PGSI. Measures of area level socio-economic status, the ABS SEIFA, were merged into the database using the postcode of residence which was collected in the first wave of the study.

Analytical technique

The relationship between traumatic experience, social capital items, socio-demographic variables and PGSI score was modelled using the negative binomial regression. These analyses were conducted

using STATA SE 12 and were unweighted because the model fit statistics could not be applied to weighted data.

The negative binomial was chosen for a number of reasons. Firstly it treats the PGSI score as a count variable in contrast to the usual reduction to four or five PGSI categories using the currently recognised cut-points. It makes use of the information from the full range of the score from 0 to 27 rather than reduction to the usual four categories which provides for a more statistically robust analysis. It is not limited by the low numbers of problem gamblers in the sample. Frequently, because of the low prevalence of problem gamblers, studies combine the problem gamblers with the moderate-risk gamblers to achieve sufficient numbers for a statistically robust analysis of the determinants of problem gambling (Crockford, Quickfall, Currie, Furtado et al. 2008; Afifi, Cox, Martens, Sareen et al. 2010b). In spite of evidence that indicates moderate-risk and problem gamblers are quite distinct groups and that original cut-points between moderate and low risk are in need of revision (Currie, Hodgins and Casey 2013).

In addition, this technique identified which factors were associated with a higher (or lower) PGSI score and therefore more (or less) gambling problems. The most frequent analytical technique of logistic regression depends on conversion of the PGSI score to categories and then to dichotomous variable of problem gambling (yes/no). This is a more clinical 'case finding' method rather than a public health approach which considers increasing levels of problems. Finally the distribution of the PGSI scores is over-dispersed i.e. the variance is greater than the mean. Use of a Poisson regression, the usual model for count data, would result in standard errors that are biased downwards (Long and Freese 2006). The results are reported as the incidence rate ratios (IRR), the p-value and BIC'.

How to interpret the IRR, p-value and the BIC'

We report the incidence rate ratios (IRR) from the negative binomial regression to indicate the **size of the effect**. For example an IRR of 2.0 for gender indicates that the PGSI score increased by a rate of 2 times for males when compared to females. IRRs less than one indicate a decrease in score. For example an IRR of 0.5 indicates that the PGSI score decreases by a rate of 0.5 times (or a half) for females when compared to males

The 95% confidence interval (CI) of the IRR demonstrates the precision of the model estimation at a traditional p-value of 0.05, the narrower the CI the more precise the estimation. The p-value indicates the certainty of the IRR estimation, the likelihood that the estimation is not mere chance.

In these analyses model fit statistics are used to identify the most **important determinants** and the **best models** for each logical group of variables. Model fit was determined using the Bayesian information criteria (BIC) calculated by the *fitstat* (Long and Freese 2000) post-estimation command. Concern has been raised over the use of p-values particularly in large samples (Raftery 1995). Conventionally p-values are set at 0.05, however in large samples a p-value at this level results in many significant associations. Lowering the p-value is recommended but is not totally satisfactory. BIC allows the comparison between models with different samples or non-nested samples and considers uncertainty in measuring the overall fit of a regression model (Raftery, 1995).

There are two versions of Bayesian information criteria, BIC and BIC'. BIC is the value returned when the current model is compared with a baseline model that is fully saturated. Whereas BIC' is the value returned when the current model is compared with a baseline model that is a null model i.e. it has no variables in it at all. If the BIC' is positive then the null model is preferred. The more negative the BIC' the better overall fit the model. The guidelines for the strength of evidence of overall model fit between two models based on a difference in BIC' are: an absolute difference of 0-2 indicates weak evidence,

a difference of 2-6 indicates positive evidence, 6-10 indicates strong and more than 10 indicates very strong evidence (Raftery 1995).

Model development

Model development was based on the findings from the analyses reported in technical report two. Individual models were developed for each group of determinants. A social determinants model was developed first. Determinants were added to the model one by one, starting with the strongest predictors of the social determinants group, until the model fit was optimised. That is the model that had the lowest or most negative BIC'. Preference was given to the more parsimonious model. This formed the baseline model. Similarly a trauma and life events model including social determinants, and a social capital model including social determinants were developed. Finally the full model was developed to investigate whether there was evidence that the effects of trauma and life events were modified by social capital. Modification of effect was demonstrated by a change in the IRR when a social capital measure was added to the trauma and life events model.

3.   Socio-demographics multivariate model

Exploration of **socio-demographic variables** of gamblers to predict PGSI score using the negative binomial regression showed that the important socio-demographic variables were age as a continuous variable, gender, only speaking English at home and educational level. The results are shown in Table 1.

The IRR of 0.99 [CI 0.99, 1.00] indicates that the PGSI score decreased by a rate of 0.99 times for each increase in age of one year. The IRR of 1.44 [CI 1.24, 1.66] indicates that the PGSI score was increased by a rate of 1.44 times for male gamblers compared with females. The IRR of 0.56 [CI 0.46, 0.69] indicates that the PGSI score almost halved in gamblers who report only English language at home when compared with those who speak a language other than English at home. Compared with the PGSI score of those with a post graduate degree, those having completed year 12 have 1.50 times score and those who have schooling to year 10 or less have 1.92 times score.

In other words, all things being equal, being male or having a lower educational level was associated with a higher PGSI score whereas being older or speaking only the English language at home tend to decrease the PGSI.

Occupation was the only determinant that was significant in the univariate analysis but did not add any explanatory value to the multivariate model after age, gender, LOTE and educational achievement were taken into account.

The other socio-demographic determinants investigated were a poor fit in the univariate models. The determinants that were investigated included age as a categorical variable, migration in past five years, Number of dependent children, Internet type, household type, employment status, household income, personal income, EGM spend band, SEIFA (socioeconomic advantage and disadvantage) ABS, SEIFA (socioeconomic disadvantage) ABS, SEIFA (economic resources) ABS, SEIFA (education and occupation) ABS, Metro/rural area of residence. Based on the BIC's, there were no evidence to support adding extra social demographic variables would improve the model fit.

Table 1 Regression model for important socio demographic variables

Socio-demographic	Final multivariate model		
	IRR	p-value	Model BIC'
Male gender	1.44 (1.24,1.66)	0.000	-47.7
Age 2008 in years	0.99 (0.98,0.99)	0.000	
Not speaking LOTE at home	0.56 (0.46,0.69)	0.000	
Education			
Post-graduate degree	ref		
Bachelor's degree	0.92 (0.67,1.26)	0.608	
Advanced diploma/diploma/ certificate/TAFE	1.31 (0.97,1.77)	0.080	
Completed year 12	1.50 (1.11,2.02)	0.008	
Schooling year 10 or less	1.92 (1.45,2.55)	0.000	
Don't know or refused	1.82 (0.94,3.55)	0.077	

4.   Trauma and life events multivariate model

Respondents were asked 'thinking of your personal background, would you say you are someone who has had 1) no really major problems, hardships and traumas in your life or upbringing or 2) a lot of trauma, hardship and problems in their life or upbringing?'

Respondents were also asked to consider 'things that happened in your life during the past 12mths. Which of the following life events did you experience in the past 12mths?'

1. Death of someone close to you
2. Divorce
3. Legal difficulties
4. Major injury or illness to either yourself or someone close to you
5. Marriage or finding a relationship partner
6. Troubles with your work, boss, or superiors
7. Retirement
8. Pregnancy or new family additions
9. Major change to your financial situation
10. Taking on a mortgage, loan or making a big purchase
11. Increase in the number of arguments with someone you are close to
12. Major change in living or work conditions (e.g. renovations, new job)

The trauma and life events model was developed by exploration of individual measures of trauma and life events, and their effect on the socio-demographic model. The model was then built by additional of other measures in order of importance until the model fit shows no further improvement. Two models showed good fit statistics.

Model one

Model One consisted of trauma and three life events: Increase in the number of arguments with someone you are close to; Major change to your financial situation; and Major injury or illness to either yourself or someone close to you. The PGSI score tended to increase by 2.49 (1.96, 3.15) times in those who report 'An increase in the number of arguments with someone you are close to', by 1.74 (1.47, 2.05) times for those reporting 'trauma', by 1.48 (1.24, 1.77) times for those reporting a 'Major change to your financial situation' and by 1.43 (1.22, 1.68) times for those reporting 'Major injury or illness to either yourself or someone close to you'.

Table 2 Final regression model 1 for the relationship between PGSI score and trauma and life events

Variables	IRR* (CI)	p-value	Model BIC'
			-250.2
Trauma	1.74 (1.47,2.05)	0.000	
Major injury or illness to either yourself or someone close to you	1.74 (1.47,2.05)	0.000	
Major change to your financial situation	1.48 (1.24,1.77)	0.000	
Increase in the number of arguments with someone you are close to	2.49 (1.96,3.15)	0.000	

*adjusted for age, gender, LOTE, educational achievement

Model two

Model Two consisted in trauma, number of life events and Increase in the number of arguments with someone you are close to. In this second model, the PGSI score tended to increase by 1.17 (1.11, 1.23) times for each unit increase in number of life events, by 2.00 (1.55, 2.58) times in those who report 'An increase in the number of arguments with someone you are close to' and by 1.74 (1.48, 2.05) times for those reporting 'trauma'.

Table 3 Final regression model 2 for the relationship between PGSI score and trauma and life events

Variables	IRR* (CI)	p-value	Model BIC'
			-256.7
Trauma	1.74 (1.48,2.05)	0.000	
Increase in the number of arguments with someone you are close to	2.00 (1.55,2.58)	0.000	
Number of life events	1.17 (1.11,1.23)	0.000	

*adjusted for age, gender, LOTE, educational achievement

Other life events

There were life events that were significant in the univariate analysis but did not add any explanatory value to the multivariate models. These included 'Death of someone close to you', 'Divorce', 'Legal difficulties', 'Marriage or finding a relationship partner', 'Troubles with your work, boss, or superiors', 'Taking on a mortgage, loan or making a big purchase' and 'Major change in living or work conditions (e.g. renovations, new job)'.

Life events that were a poor fit in the univariate model were 'Retirement' and 'Pregnancy or new family additions'.

5. Social capital multivariate model

Respondents were asked four social capital questions in the first wave. The questions and scoring are reported in Appendix Two. Briefly they were asked how they felt about the community they lived in.

1. Can you get help from friends, family or neighbours when you need it?
2. Are you a member of an organised group such as a sports or church group or another community group including those over the internet?
3. Do you like living in your community?
4. How would you rate the overall quality of services, facilities and "things to do" in your community?

The social capital model was developed by exploration of individual measures of social capital and their effect on the socio-demographic model. The model was then built by additional of other measures in order of importance until the model fit shows no further improvement.

The best summary model for the relationship between PGSI score and social capital consisted of the 'like living in their community' and 'being able to get help' measures of social capital. The PGSI score is increased by 1.58 (1.24, 2.01) times, by 1.94 (1.12, 3.34) times and by 2.91 (1.79,4.72) times when response to 'like living in the community' varies from 'sometimes' to 'no – not at all' to 'no feeling about it' when compared to 'yes, definitely' and by 1.30 (1.01, 1.67) times and 2.50 (1.73, 3.60) times when response to 'able to get help' varies from 'sometimes' to 'no' when compared with 'yes'.

Table 4 Final regression model for the relationship between PGSI score and social capital

Variables	IRR* (CI)	p-value	Model BIC'
			-91.5
Like living in their community			
definitely	ref		
sometimes	1.58 (1.24,2.01)	0.000	
no - not at all	1.94 (1.12,3.34)	0.016	
no feeling about it	2.91 (1.79,4.72)	0.000	
DK/Refused	1.42 (0.28,7.09)	0.663	
Able to get help from family, friends and neighbours			
yes	ref		
sometimes	1.30 (1.01,1.67)	0.041	
No	2.50 (1.73,3.60)	0.000	
DK/Refused	1.06 (0.31,3.60)	0.920	

*adjusted for age, gender, LOTE, educational achievement

Being a member of an organised group such as a sports or church group or another community group including those over the internet was significant in the univariate analysis but did not add any explanatory value to the multivariate models.

How respondents rated the overall quality of services, facilities and "things to do" in their community was a poor model fit in the univariate analysis.

6. Trauma and life events, and social capital multivariate models

These models were developed by exploration of individual measures of social capital and their effect on the trauma and life events models which have been adjusted for socio-demographic parameters. The model was then built by additional of social capital measures in order of importance until the model fit shows no further improvement.

In the final models, gambling problems (PGSI score) were best described by two models of trauma and life events moderated by one social capital parameter, 'being able to get help from family, friends or neighbours', after taking into account the socio-demographic parameters. In other words only the social capital parameter, being able to get help, improved the trauma and life events models whereas the parameter, like living in their community, did not.

Trauma and life events model one and social capital

In model one, on average, the PGSI score was increased by 2.45 (1.94, 3.10) times in those who report 'An increase in the number of arguments with someone you are close to', by 1.58 (1.34, 1.87) times for those reporting 'trauma, hardship and problems in life', by 1.46 (1.22, 1.74) times for those reporting a 'Major change to your financial situation' and by 1.43 (1.21, 1.68) times for those reporting 'Major injury or illness to either yourself or someone close to you' and by 2.37 (1.69, 3.34) times when response to 'able to get help' is 'no' when compared with 'yes'.

Table 5 Relationship between PGSI score and trauma and life events model one and social capital

Variables	IRR* (CI)	p-value	Model BIC'
			-255.1
Trauma	1.58 (1.34,1.87)	0.000	
Major injury or illness to either yourself or someone close to you	1.43 (1.21,1.68)	0.000	
Major change to your financial situation	1.46 (1.22,1.74)	0.000	
Increase in the number of arguments with someone you are close to	2.45 (1.94,3.10)	0.000	
Able to get help from family, friends and neighbours			
yes	ref		
sometimes	1.22 (0.96,1.56)	0.095	
No	2.37 (1.69,3.34)	0.000	
DK/Refused	1.20 (0.37,3.85)	0.751	

*adjusted for age, gender, LOTE, educational achievement

Trauma and life events model two and social capital

In model two, on average, the PGSI score was increased by 1.16 (1.10, 1.22) times for each unit increase in number of life events, by 1.99 (1.55, 2.56) times in those who report 'An increase in the number of arguments with someone you are close to' and by 1.60 (1.35, 1.89) times for those reporting 'trauma, hardship and problems in life', and by 2.32 (1.65, 3.26) times when response to 'able to get help' is 'no' when compared with 'yes'.

Table 6 Relationship between PGSI score and trauma and life events model two and social capital

Variables	IRR* (CI)	p-value	Model BIC'
			-260.0
Trauma	1.60 (1.35,1.89)	0.000	
Increase in the number of arguments with someone you are close to	1.99 (1.55,2.56)	0.000	
Number of life events	1.16 (1.10,1.22)	0.000	
Able to get help from family, friends and neighbours			
yes	ref		
sometimes	1.20 (0.94,1.53)	0.127	
No	2.32 (1.65,3.26)	0.000	
DK/Refused	1.07 (0.33,3.43)	0.907	

*adjusted for age, gender, LOTE, educational achievement

Modification of trauma effects by social capital

The effect of 'trauma, hardship and problems in life' was moderated by the ability to get help whereas the life events parameters were not.

Table 7 Modification of trauma effects by social capital

	IRRs		
Model 1	Trauma model	Trauma model plus able to get help	% change
Trauma	1.74 (1.47,2.05)	1.58 (1.34,1.87)	9.2
Increase in the number of arguments with someone you are close to	2.49 (1.96,3.15)	2.45 (1.94,3.10)	1.6
Major change to your financial situation	1.48 (1.24,1.77)	1.46 (1.22,1.74)	1.4
Major injury or illness to either yourself or someone close to you	1.43 (1.22,1.68)	1.43 (1.21,1.68)	0.0
BIC'	-250.2	-255.1	
Model 2			
Trauma	1.74 (1.47,2.05)	1.60 (1.35,1.89)	8.0
Number of life events	1.17 (1.11,1.23)	1.16 (1.10,1.22)	0.9
Increase in the number of arguments with someone you are close to	2.00 (1.55,2.58)	1.99 (1.55,2.56)	0.5
BIC'	-256.7	-260.0	

7. Discussion and implications

The focus of this paper is on the interplay between social determinants, experience of trauma and life events, social capital and the level of gambling problems (PGSI score) in gamblers. Non-gamblers were excluded from the analysis. The purpose was to investigate a range of possible determinants (for example – trauma, hardship and problems during life or upbringing, stressful life events, presence of social capital and socio-demographics) to indicate which showed the strongest association with levels of gambling problems. The analysis is underpinned by a public health approach which views problem gambling as part of a gambling continuum and explores the broader personal, social, economic and environmental as well as biological determinants of gambling problems.

This Technical Report Three builds on the findings from the previous two reports. It describes the detailed multivariate analysis of the relationship between gambling problems (PGSI score) and the determinants of socio-demographics, trauma, life events and social capital. Many of these determinants are inter-related. It is important to understand which determinants best describe the association with gambling problems. These cross-sectional analyses were performed on the responses from gamblers only. Non-gamblers were excluded. Assumptions were not made about temporality between the determinants and gambling problems. However some determinants were obviously concurrent with the gambling problems as their occurrence was over the same time span while others were not. For example, both the PGSI and the life events questions occurred over the previous twelve months whereas the trauma, hardship and problems were across a broader timespan of over life and upbringing.

This multivariate analysis investigated which characteristics of the determinants were associated with an increase (more gambling problems) or a decrease (less gambling problems) in the PGSI score, having taken into account other important determinants. Determinants that best explain the level of gambling problems are identified as well as the size of the effect of different characteristics.

Models were developed with logical groupings of determinants before the final model was developed. The logical groupings included:

- Socio-demographics multivariate model

- Trauma and life events multivariate model

- Social capital multivariate model

- Final model multivariate model

Socio-demographics model

Socio-demographic determinants were not the best determinants of gambling problems. In the existing literature many socio-demographic determinants have been linked with problem gambling. Socio-demographics are probably the most frequently collected variables across all gambling studies. This is particularly true for prevalence studies, in which basic demographic details are used in population prevalence studies to weight the sample to the population. The frequency of their collection and reporting has resulted in their domination of the risk factor list, out of proportion to their real contribution to gambling problems. In the univariate analysis of *The Victorian Gambling Study* reported in Technical Report Two, the model fit statistics indicate that the PGSI score was better explained by the variation in other determinants such as mental health, number of life events and

some individual life events, self-reported health, smoking and alcohol, and some social capital indicators than the socio-demographic determinants.

The determinants of age, gender, whether a language other than English (LOTE) is spoken at home and educational attainment produced the best socio-demographic model for gambling problems. While many determinants were tested in the univariate analysis only age, gender, LOTE and occupation showed model fit statistics that were better than the null model. In the multivariate model it was educational attainment rather than occupation that proved to be an improvement to the age, gender and LOTE model. Model fit statistics showed a BIC' of -47.7.

The gambling problems risk factors of male gender, low educational attainment younger age are frequently reported in the literature although other age groups have been identified. The results for ethnicity or racial identity as risk factors are more varied in Australia and elsewhere. The 2003 Victorian prevalence study found problem gamblers were more often male, of low educational attainment and those whose main language at home was not English however the age group at risk was 39 to 64 years. Recent Australian studies have all found that male gender and lower educational attainment are linked with problem gambling (Davidson and Rodgers 2009; Department of Justice and Attorney-General 2012; Sproston, Hing and Palankay 2012; Office for Problem Gambling 2013). Younger age group was identified as a determinant in NSW (Sproston, Hing and Palankay 2012), in Queensland (Department of Justice and Attorney-General 2012) and the ACT (Davidson and Rodgers 2009) but not in South Australia (Office for Problem Gambling 2013). Being Australian born was identified as a risk factor in the ACT (Davidson and Rodgers 2009) but not in NSW (Sproston, Hing and Palankay 2012), Queensland (Department of Justice and Attorney-General 2012) or South Australia (Office for Problem Gambling 2013).

Male gender followed by younger age are the most frequently identified risk factors for problem gambling (Williams, Volberg and Stevens 2012). The same review of 202 studies reported minority or immigrant groups (25) and lower education than average (65) as risk factors. Recent prevalence studies from Sweden and New Zealand, using multivariate analysis, found being male, of younger age group, with low level of education and belonging to an ethnic group or being born outside Sweden as predictors of problem gambling (Abbott, Romild and Volberg 2013; Abbott, Bellringer, Garrett and Mundy-McPherson 2014). In Canada the LLLP study found male gender to be a risk factor however the QLS study did not (el-Guebaly, Casey, Currie, Hodgins et al. 2015; Williams, Hann, Schopflocher, West et al. 2015). Both Canadian studies found that being non-Caucasian was a correlate of problem gambling in the univariate analysis. In New Zealand, the New Zealand deprivation index, religion and labour force statistics were linked to problem gambling. Sweden found big city residence and civic status (household composition) as risk factors.

Trauma and life events model

The association between trauma or life events and problem gambling is well reported in the literature. In *The Victorian Gambling Study* respondents were asked if they were someone who has had a lot of trauma, hardship and problems in their life or upbringing or has not. They were also asked which of 12 nominated life events they have experienced in the past 12 months. Experience of trauma and many of the 12 life events experienced over the last 12 months (except for retirement and pregnancy) showed some association with gambling problems in the univariate analysis. The multivariate analysis resulted in two models.

In the first model the individual life events experienced over the last 12 months were explored for their association with the PGSI score as well having had trauma, hardship and problems in their life or upbringing. This model had slightly lower model fit than the second model however the most

important individual life events could be explored better in a model that did not include the number of life events (used in model two). Addition of three life events; Increase in arguments with someone close, major change in financial situation and major injury or illness to either yourself or someone close to you as well as trauma were a strong improvement on the model with the important socio-demographics of age, gender, LOTE and educational attainment. The model fit statistics improved greatly from a BIC' of -47.7 to -250.

In the second model the number of life events experienced, and the individual life events experienced over the last 12 months were explored for their association with the PGSI score as well having had trauma, hardship and problems in their life or upbringing (trauma). Addition of the number of life events, an Increase in arguments with someone close, as well as trauma were a strong improvement on the model with the important socio-demographics of age, gender, LOTE and educational attainment. The model fit statistics improved greatly from a BIC' of -47.7 to -256.

These analyses show that those who considered themselves as someone who has had a lot of trauma, hardship and problems in their life or upbringing tended to have PGSI score of 1.74 (1.48, 2.05) times those who did not. This finding is independent of the number and type of life events experienced over the last 12 months. Pathological gamblers in treatment programs have a more frequent past history of trauma (Taber, McCormick and Ramirez 1987; Kausch, Rugle and Rowland 2006) and for many the trauma occurred in childhood (Kausch, Rugle and Rowland 2006; Hodgins, Schopflocher, el-Guebaly, Casey et al. 2010). In a community sample, the multivariate analysis demonstrated that childhood maltreatment was associated with severity of gambling problems and frequency of gambling independent of other individual and social factors such as alcohol and other drug use disorders, family environment, psychological distress, and symptoms of antisocial disorder (Hodgins, Schopflocher, el-Guebaly, Casey et al. 2010). Childhood trauma was linked with the development of gambling problems in both Canadian longitudinal studies (el-Guebaly, Casey, Currie, Hodgins et al. 2015; Williams, Hann, Schopflocher, West et al. 2015).

The number of life events over the last twelve months was found to be the strongest risk factor for gambling problems of this group of risk factors. Note that the time span of over the last twelve months for the life events is concurrent with the experience of gambling problems. For each additional life event the PGSI score increased by 1.17 (1.11, 1.23) times after adjusting for trauma, increase in arguments with someone close and the important socio-demographic factors. Using similar questions the number of life events was associated with problem gambling in New Zealand (Abbott, Bellringer, Garrett and Mundy-McPherson 2014). The Canadian longitudinal studies using the Life Events Questionnaire (Vuchinich, Tucker and Harllee 1986) found the number of stressful events to be linked with concurrent and future problem gambling (el-Guebaly, Casey, Currie, Hodgins et al. 2015; Williams, Hann, Schopflocher, West et al. 2015). Other studies using a variety of measures of current and past stressors have found they are linked with gambling urges (Elman, Tschibelu and Borsook 2010), and gambling frequency in adolescents (Lee, Storr, Ialongo and Martins 2012; Storr, Lee, Derevensky, Ialongo et al. 2012).

Individual life events have been associated with gambling problems but few have been tested in a multivariate analysis. In Australia problem gambling is described as being 'characterised by difficulties in limiting money and/or time spent on gambling which leads to adverse consequences for the gambler, others or for the community' (Neal, Delfabbro and O'Neil 2005). It is no surprise that the financial consequences, crime and legal difficulties, relationship problems, work-related issues and housing concerns are some of the major harms that occur as a result of problem gambling.

Increase in arguments with someone close was found to be a risk factor for gambling problems independent of the number and type of life events experienced over the last 12 months, as well as experience of trauma. Those who had arguments with someone close tended to have PGSI score of

2.49 (1.96, 3.15 in model one) times or 2.00 (1.55, 2.58 in model two) times those who did not. Relationship concerns including increased conflict within relationships, including separation and divorce, are linked with problem gambling (Holdsworth, Nuske and Hing 2013). Prevalence of an increase in arguments with someone close was particularly high in Victoria 42% (Hare 2009), New Zealand 38[1]% (Abbott, Bellringer, Garrett and Mundy-McPherson 2014) and Queensland 37% (Department of Justice and Attorney-General 2012). Divorce or separation was higher in Victoria (9% divorce only) (Hare 2009) and in Queensland (18%) (Department of Justice and Attorney-General 2012) but not in New Zealand (Abbott, Bellringer, Garrett and Mundy-McPherson 2014).

Conflicts in the workplace and within relationships are linked with problem gambling (Holdsworth, Nuske and Hing 2013) and predict development of problem gambling. The 2003 Victorian prevalence study demonstrated a link between problem gambling and problems at work as well as relationship breakdown (The Centre for Gambling Research: Australian National University 2004). Prevalence rates of troubles with work, boss or superiors in problem gamblers are in the order of 20% (Hare 2009), 20[2]% (Abbott, Bellringer, Garrett and Mundy-McPherson 2014) and combined moderate and problem gamblers 22% (Department of Justice and Attorney-General 2012).

A major change in financial situation was found to be a risk factor for gambling problems, independent of the experience of trauma and an increase in arguments with someone close, but not when the total number of life events was taken into consideration. Those with a major change tended to have PGSI score of 1.48 (1.24, 1.77) times those who did not. Financial difficulties including debt and bankruptcy are linked with problem gambling (Holdsworth, Nuske and Hing 2013) and tend to be the most common type of harm (The Centre for Gambling Research: Australian National University 2004; Productivity Commission: Australia 2010; Department of Justice and Attorney-General 2012; Abbott, Bellringer, Garrett and Mundy-McPherson 2014). Prevalence rates of financial difficulties (major change in financial situation) in problem gamblers are in the order of 46% (Hare 2009), 57% (Abbott, Bellringer, Garrett and Mundy-McPherson 2014) and 46% (Department of Justice and Attorney-General 2012). The 2003 Victorian prevalence study demonstrated a link between problem gambling and filed for bankruptcy as well as committed crime to obtain money (The Centre for Gambling Research: Australian National University 2004).

A major injury or illness to either yourself or someone close to you was found to be a risk factor for gambling problems, independent of the experience of trauma and an increase in arguments with someone close, but not when the total number of life events was taken into consideration. Those reporting a major injury or illness tended to have PGSI score of 1.43 (1.22, 1.68) times those who did not. Major injury or illness is linked with problem gambling (Holdsworth, Nuske and Hing 2013). Prevalence rates in Victoria were 45% (Hare 2009) and New Zealand 28% (Abbott, Bellringer, Garrett and Mundy-McPherson 2014) for problem gamblers, and Queensland 33% for combined moderate and problem gamblers (Department of Justice and Attorney-General 2012). There was no evidence to suggest that retirement, or pregnancy or new family additions was linked with problem gambling in Victoria or New Zealand (Hare 2009; Abbott, Bellringer, Garrett and Mundy-McPherson 2014).

Social capital model

Theoretically, social capital and social supports are protective factors whereas social isolation and disconnectedness are risk or triggering factors for problem gambling. The social capital measures in *The Victorian Gambling Study* were chosen for their comparability to major Victorian population surveys: The Victorian Department of Health's Victorian Population Health Survey and the

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[1] Not significantly different to non-problem gamblers
[2] Not significantly different to non-problem gamblers

Department of Victorian Communities Indicators of Community Strength. To our knowledge these indicators have not been used in other gambling surveys. They gauge the social networks and attitudes of the individual to varying levels of their networks: family, friends and neighbours; organised groups; community; and institutions. Further description of these indicators can be found in Appendix Two.

The four social capital questions asked in 2008 were:

1. Can you get help from friends, family or neighbours when you need it?
2. Are you a member of an organised group such as a sports or church group or another community group including those over the internet?
3. Do you like living in your community?
4. How would you rate the overall quality of services, facilities and "things to do" in your community?

Three of these social capital measures individually showed an improvement over the sociodemographic model with positive to strong association with the PGSI score. Only addition of the variable 'being a member of an organised group' showed no improvement.

In the social capital multivariate model addition of two items, being able to get help from friends, family and neighbours when needed, and like living in their community showed improvement on the model with the important socio-demographics of age, gender, LOTE and educational attainment. The model fit statistics improved from a BIC' of -47.7 to -91.

As the social capital decreased the PGSI score increased. The PGSI score is increased by 1.58 (1.24, 2.01) times, by 1.94 (1.12, 3.34) times and by 2.91 (1.79,4.72) times when response to 'like living in the community' varies from 'sometimes' to 'no – not at all' to 'no feeling about it' when compared to 'yes, definitely' and by 1.30 (1.01, 1.67) times and 2.50 (1.73, 3.60) times when response to 'able to get help' varies from 'sometimes' to 'no' when compared with 'yes'.

There is a wealth of evidence that links social capital and health outcomes (Baum 2003; Kawachi, Subramanian and Kim 2008; Lin, Smith and Fawkes 2014), and mental health (De Silva, McKenzie, Harpham and Huttly 2005). Social capital can be determined at the individual or at the community level. The evidence is stronger for the effect of social capital at the individual level rather than at the community level. How social capital is associated with gambling problems is less well studied. Studies conducted tend to be of an informal social supports or loneliness at the individual level rather than multidimensional or of area level social capital. Current evidence indicates that social supports or lack of social supports can trigger gambling problems, may play a part in the success of treatment and prevent relapse. None of the studies have used the same measures as *The Victorian Gambling Study*.

The Canadian studies using Lubben Social Network Scale, found that lower social support was a correlate of problem gambling but not a predictor of future problem gambling (el-Guebaly, Casey, Currie, Hodgins et al. 2015; Williams, Hann, Schopflocher, West et al. 2015). Using the Social Support Scale, social support was shown to be important for treatment success (Petry and Weiss 2009). Social support is important for reducing relapse in substance abuse and gambling abstinence (Galea, Nandi and Vlahov 2004; Oei and Gordon 2008). Using the UCLA Loneliness Scale, the level of loneliness was associated with gambling problems (McQuade and Gill 2012). Most recreational gamblers had strong social support networks and resilience (Holdsworth, Nuske and Hing 2014). Social isolation, disconnectedness, socio-cultural ambivalence and the need to participate in acceptable recreational activities were frequently identified as factors for triggering gambling related problems in a study conducted in the ACT (McMillen, Marshall, Murphy, Lorenzen et al. 2004).

Combined trauma, life events and social capital model

The final multivariate models explored the combined effects of trauma, life events and social capital adjusted for the important socio-demographics. Only the addition of being able to get help improved the model fit of the trauma and life events models. The model fit statistics improved from a BIC' of -250 to -255 (Model 1) and -256 to – 260 (model 2). In addition the effects of trauma but not the life events are modified by consideration of the social capital measure of being able to get help. This is demonstrated by a reduction in the IRR of trauma by 8% and 9% for model 1 and 2 respectively.

The additional finding in these final models is that the effect of trauma (those who considered themselves as someone who has had a lot of trauma, hardship and problems in their life or upbringing) was modified by an ability to get help from family, friends and neighbours. This finding reinforces the important moderating effects of social supports and social networks, particularly the close informal social networks.

The relationship between gambling problems and life events has been shown to be further compounded by coping styles in adolescents (Bergevin, Gupta, Derevensky and Kaufman 2006; Afifi, Cox, Martens, Sareen et al. 2010a; Shead, Derevensky and Gupta 2010). However, this moderating effect was not seen for the key life events over the last twelve months (Increase in arguments with someone close, a major change in financial situation or a major injury or illness to either yourself or someone close to you). It may be that the life events described in these studies of adolescents have more in common with a life or upbringing of trauma, hardship and problems rather than concurrent life events as measured in our study.

Strengths and weaknesses

The strength of the report is that *The Victorian Gambling Study* is a large jurisdiction prevalence study that was well conducted.

A limitation of the study is those of most jurisdiction-wide gambling surveys. They are population based but miss subgroups who may be at greater risk of problem gambling, such as those who are homeless or in prisons, hospital and mental health institutions.

This is a cross sectional study design and therefore demonstrates association rather than indicate causality.

Using the selected analytical method, which treats the PGSI score as count data, is both a strength and a weakness. The strength is that it uses the full array of information from the PGSI score rather than reduce the score to four or five categories. The limitation is that there is an assumption that an increase at the lower end of the scale is equivalent to an increase in the higher end of the scale.

This study is limited by the measures of socio-demographics, trauma, life events and social capital as collected in the CATI survey of Victorian Gambling Study. Any lack of evidence of association may be the result of an inappropriate or poor measure.

What does this study add?

Further analysis of the relationship between gambling problems and determinants of socio-demographics, trauma, life events and social capital was conducted. This multivariate analysis identified which of these determinants were associated with gambling problems and the strength of that association after having adjusted for other determinants.

Gambling problems were associated with socio-demographic determinants of younger age, male gender and lower educational achievement however this association was not as strong as with trauma, life events and social capital.

Individuals who report they were someone who has had a lot of trauma, hardship and problems in their life or upbringing were more likely to have gambling problems. This relationship was strong.

Exploration of individual life events over the previous twelve months, rather than number of life events, showed that three life events were strongly linked with gambling problems: increase in arguments with someone close; major change in financial situation; and major injury or illness to either the individual or someone close.

The number of life events experienced over the previous twelve months showed the strongest association with gambling problems out of the determinants tested; socio-demographics, trauma, individual life events and social capital. Those who experienced an increase in arguments with someone close showed a similarly very strong association with gambling problems. This effect was additional to the effect of number of life events.

Social capital or lack of it was moderately associated with gambling problems. Those who reported either of the two social capital measures: being able to get help from family, friends and neighbours, and like living in their community showed some reduction in gambling problems. Those who reported not being able to get help from family friends and neighbours, or did not like living in their community showed increased gambling problems.

Only addition of one of the social capital measures, being able to get help from family, friends or neighbours and not like living in their community, improved the trauma and life events model. Furthermore, the ability to get help from family, friends or neighbours moderated the effects of a life or upbringing with a lot of trauma, hardship or problems but not life events over the previous twelve months.

Implications

When considering the implications of the findings it is important to consider also the timespan implied in the survey questions. The reported life events are those that occurred over the previous twelve months and are therefore concurrent with the gambling problems. The question on trauma, hardship and problems in life and upbringing captures events over a much longer time span. The social capital questions are asked in the present tense so suggest current perceptions. They are not limited to any time span so may extend beyond the previous twelve months.

In both models, those who considered themselves to be someone who has had trauma, hardship and problems in their life and upbringing have more gambling problems than those who did not. This finding is indicative of the early origins of vulnerability to developing gambling problems. Childhood trauma and stressful life events have been reported in the literature as a potential risk factor for the development of gambling problems, particularly linked with coping styles and resilience. Stressful life events such as 'increasing arguments' and 'changing financial situation' are potential stressors while also being symptoms of gambling problems. It is interesting that the effects of trauma, hardship and problems in life and upbringing were shown to be moderated by one of the social capital measures – being able to get help from family, friends and neighbours. These findings have implications for prevention and treatment of gambling problems.

Appendix One: Single parameters adjusted for socio-demographics

In the Technical Report One, the findings from negative binomial regressions conducted on all individual parameters are reported. This appendix reports on the results of the negative binomial regressions conducted on individual trauma and life events and social capital measures this time adjusted for the important socio-demographic parameters of age, gender, LOTE and educational achievement.

Trauma and life events – single parameters adjusted for socio-demographics

Exploration of trauma and life events to predict PGSI score using the negative binomial regression showed that trauma and all life events are associated with PGSI scores. After adjustment for age, gender, LOTE and educational achievement, and in order of strength of the association, the PGSI score is increased by 1.31 (1.25, 1.37) times for each unit increase in number of life events; by 3.44 (2.72, 4.35) times for an 'Increase in the number of arguments with someone you are close to'; by 2.35 (2.00, 2.75) times for 'Trauma, hardship and problems in life'; by 2.01 (1.72, 2.36) times for any life event; by 2.12 (1.77, 2.53 times for 'Major change to your financial situation'; by 1.84 (1.56, 2.17) times for 'Major injury or illness to either yourself or someone close to you'; by 2.25 (1.63, 3.09) times for 'Legal difficulties'; by 1.74 (1.36, 2.21) times for 'Troubles with your work, boss, or superiors'; by 1.47 (1.22, 1.77) times for 'Major change in living or work conditions (e.g. renovations, new job)'; by 1.32 (1.13, 1.55) times for 'Death of someone close to you'; by 1.92 (1.29, 2.87) times for 'Divorce'; by 1.62 (1.23, 2.15) times for 'Marriage or finding a relationship partner'; by 1.56 (1.26, 1.93) times for 'Taking on a mortgage, loan or making a big purchase'. There is no evidence to support an association with 'Retirement' or 'Pregnancy or new family additions'. In fact addition of these variables to the socio-demographic model (BIC'= -47.7) results in a reduction in the model fit.

Table 8 Regressions of trauma and life events

	Adjusted model *		
PGSI2008	**IRR* (CI)**	**p-value**	**BIC'**
Trauma, hardship and problems in life	2.35 (2.00,2.75)	0.000	-145.6
1. Death of someone close to you	1.32 (1.13,1.55)	0.000	-51.9
2. Divorce	1.92 (1.29,2.87)	0.001	-51.1
3. Legal difficulties	2.20 (1.60,3.02)	0.000	-67.2
4. Major injury or illness to either yourself or someone close to you	1.84 (1.56,2.17)	0.000	-95.7
5. Marriage or finding a relationship partner	1.62 (1.23,2.15)	0.001	-51.8
6. Troubles with your work, boss, or superiors	1.74 (1.36,2.21)	0.000	-61.0
7. Retirement	1.47 (1.07,2.02)	0.016	-45.4
8. Pregnancy or new family additions	1.32 (1.05,1.67)	0.015	-45.4
9. Major change to your financial situation	2.12 (1.77,2.53)	0.000	-112.6
10. Taking on a mortgage, loan or making a big purchase	1.56 (1.26,1.93)	0.000	-57.3
11. Increase in the number of arguments with someone you are close to	3.44 (2.72,4.35)	0.000	-167.2

PGSI2008	Adjusted model *		
	IRR* (CI)	p-value	BIC'
12. Major change in living or work conditions (e.g. renovations, new job)	1.47 (1.22,1.77)	0.000	-56.9
Any life event (1 to 12)	2.01 (1.72,2.36)	0.000	-110.9
Number of life events count	1.31 (1.25,1.37)	0.000	-198.4

*adjusted for age, gender, LOTE, educational achievement

Social capital – single parameters adjusted for socio-demographics

Exploration of social capital to predict PGSI score using the negative binomial regression showed that decreasing social capital is associated with increased PGSI scores. After adjustment for age, gender, LOTE and educational attainment, there is no evidence to suggest that 'being a member of an organised group' is associated with gambling problems. However there is an association was demonstrated with the other social capital measures. In order of strength of the association, the PGSI score is

- increased by 1.50 (1.17, 1.93) times and 3.35 (2.35, 4.77) times when response to 'able to get help' varies from 'sometimes' to 'no' when compared with 'yes';
- increased by 1.82 (1.43,2.31) times, by 2.88 (1.70, 4.89) times and by 3.61 (2.22, 5.85) when response to 'like living in the community' varies from 'sometimes' to 'no – not at all' to 'no feeling about it' when compared to 'definitely';
- decreased by 0.46 (0.28, 0.75) times and by 0.44 (0.27, 0.72) times when response to 'overall rating of community services' varies from 'good' and 'very good' when compared with 'very poor'.

Table 9 Regression models for social capital

PGSI2008	Adjusted model		
	IRR* (CI)	p-value	BIC'
Able to get help from family, friends and neighbours			-87.0
yes	ref		
sometimes	1.50 (1.17,1.93)	0.001	
No	3.35 (2.35,4.77)	0.000	
DK/Refused	1.06 (0.31,3.63)	0.923	
Member of an organised group			-37.0
No	ref		
Yes	0.83 (0.72,0.96)	0.017	
DK/Refused	1.91 (0.24,14.7)	0.532	
Like living in their community			-86.3
definitely	ref		
sometimes	1.82 (1.43,2.31)	0.000	
no - not at all	2.88 (1.70,4.89)	0.000	
no feeling about it	3.61 (2.22,5.85)	0.000	
DK/Refused	1.40 (0.28,7.02)	0.679	
Rating of community services			-55.5

PGSI2008	Adjusted model		
	IRR* (CI)	p-value	BIC'
Very poor	ref		
poor	0.95 (0.54,1.66)	0.877	
ok	0.69 (0.42,1.14)	0.152	
good	0.46 (0.28,0.75)	0.002	
very good	0.44 (0.27,0.72)	0.001	
DK/Refused	0.63 (0.32,1.24)	0.190	

*adjusted for age, gender, LOTE, educational achievement

Appendix Two: Social capital questions, scores and description

Questions and scores

Respondents were asked four social capital questions in the first wave. They were asked how they felt about the community they lived in:

1. Can you get help from friends, family or neighbours when you need it? (Score 1. Yes definitely; 2. Sometimes; 3. Not at all; 98. Don't know; 99. Refused)
2. Are you a member of an organised group such as a sports or church group or another community group including those over the internet? (Score 1. Yes; 2. No; Don't know; 99. Refused)
3. Do you like living in your community? (score 1. Definitely; 2. Sometimes; 3. No - Not at all; 4. No feeling about it; 98. Don't know; 99. Refused)
4. How would you rate the overall quality of services, facilities and "things to do" in your community? (Score 1. Very poor; 2. Poor; 3. OK; 4. Good; 5. Very good; 98. DK; 99. Refused)

Descriptions of social capital indicators

1) People who can get help from friends, family or neighbours when needed

This indicator is designed to measure an individual's perceived ability to get help. It gauges whether an individual is part of an informal **social network**, and that there are benefits in the form of reciprocity (giving and taking) from that network. It is also an important indicator of social exclusion. (Community Indicators Victoria ; Victorian Government Department of Human Services 2003; Australian Bureau of Statistics 2004)

2) Are you a member of an organised group such as a sports or church group or another community group including those over the internet?

This indicator is designed to measure an individual's level of informal social participation in a community. It gauges whether an individual is welcomed into a community, made to feel accepted and included, and has the potential to benefit from integration within that community. Benefits may include introductions to channels of information, which may include social norms and moral codes. (Victorian Government Department of Human Services 2003; Australian Bureau of Statistics 2004)

3) Do you like living in your community?

This indicator is designed to measure social attitudes and trust at the community level. It gauges the individual's attitude and trust towards strangers and casual acquaintances, and to institutions in their communities. It also measures their integration into the community and sense of friendliness and acceptance. (Community Indicators Victoria ; Victorian Government Department of Human Services 2003; Australian Bureau of Statistics 2004)

4) How would you rate the overall quality of services, facilities and "things to do" in your community?

This indicator is designed to measure social attitudes and trust of the formal community. It gauges the individual's attitude and trust towards the broader community, public services, facilities and institutions. It also measures their integration into the community, ability to access services and

information. (Community Indicators Victoria ; Victorian Government Department of Human Services 2003; Australian Bureau of Statistics 2004)

'It is believed that when community members have access to the services they need, when they need them, they are more likely to have feelings of civic engagement and well-being. Not having access to such services can place vulnerable groups at greater disadvantage and signal pockets of social isolation' (Bastian, 2000 cited in (Community Indicators Victoria)).

Appendix Three: Glossary

ABS
Australian Bureau of Statistics

Alcohol use and abuse
An alcohol use and abuse variable was derived by combining the alcohol over previous twelve months and the CAGE questions. This produced a variable consisting of three categories: No alcohol use over previous twelve months; alcohol use and no signs of abuse; and alcohol use with signs of abuse or dependence. See *CAGE*.

Association
Association refers to the statistical dependence between two variables, that is, the degree to which the rate of disease in persons with a specific exposure is either higher or lower than the rate of disease among those without that exposure. (Hennekens, Buring and Mayrent 1987) In statistical analysis, association is measured by correlation coefficient. See *correlate*.

BIC (Bayesian Information Criterion)
A model fit statistics using saturated model as a point of comparison. See *saturated model* and *model fit statistics*.

BIC'
An alternative form of Bayesian Information Criterion using null model with no independent variables as a point of comparison. See *null model* and *model fit statistics*.

BMI (Body Mass Index)
It is defined as the body mass divided by the square of the body height and is expressed in units of kg/m2. The BMI is usually use as an indicator of obesity or anorexia in population research.

CAGE
A brief screening tool for alcohol use and disorder. It measures patterns of drinking that results in harm to one's health, relationship problems or inability to perform work functions. See *Alcohol use and abuse*.

Case finding
Case finding in this document refers to the tendency to concentrate on the small number of 'cases' of problem gambling and ignore the impact of the large number of gamblers with lower levels of problems.

CATI (Computer Assisted Telephone Interviews)
CATI is a telephone surveying tool where telephone interviews are supported by a computer application. The interviewers follow a script promoted by an application and input the responses obtained into the application.

Cohort
A group of persons followed or traced over time.

Comorbidity
Condition(s) or disease(s) that exist in a study participant in addition to the index condition that is the subject of study (i.e. gambling). (Last 2001)

Confidence interval (CI)
A computed interval with a given probability (usually 95%) that the true value of the variable of interest (e.g. a mean, proportion or rate) is contained within that interval.

Confounders or confounding variables
A variable that can cause or prevent the outcome of interest, is not an intermediate variable and is associated with the factor under investigation (Last 2001).

Correlate
Two variables (for example, variable x and variable y) are correlated or associated when the two variables change according to each other. Negative correlation means x decreases when y increase and a positive correlation means x increase when y increase. A correlation coefficient (r) ranges from -1 to 1. While r = 0 indicates no correlation, r = -1 indicates perfect negative correlation and r = 1 indicates perfect positive correlation. Note that correlation detected in observed data can be a completely random observation and correlation does not imply causal relationship. See *association*.

Count data continuum
Count data is a form of numerical discrete data. All values consist of whole numbers. In the case of the PGSI score, the only possible values are whole numbers along the continuum between 0 and 27. Therefore only 28 values are possible.

Decile
One-tenth (e.g. of a population)

Determinants
A factor which decisively affects the nature or outcome of something (Oxford University Press 2015). Whether people are healthy or not, is determined by many factors relating to their circumstances and their environment. These factors have many names including determinants, indicators, risk factors, predictors and influencers.

Dichotomous
Dichotomous variables are nominal variables which have only two categories or levels. For example, if we were looking at gender, we would most probably categorize somebody as either "male" or "female".

DK/refused
Don't know/Refused

DSM-IV (Diagnostic and Statistical Manual of Mental disorders, fourth edition)
DSM-IV is a manual published by the American Psychiatric Association (APA) in 1994, describing all recognised mental health disorders at the time of publication. It is regarded as a handbook for mental health professionals to identify the features of a given mental disorder and distinguished the disorder from similar problems. The latest manual is DSM-V published in 2013.

EGM (Electronic gaming machine)
A slot machine that has three or more reels that spin when a button is pushed. Often referred to 'poker machines' or 'pokies' (Australia), 'the slots' (Canada) or 'fruit machines' (United Kingdom).

Epidemiology
The study of the distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems.

Factor
A factor is an influence/effect that contributes to a health outcome.

GAD (Generalised Anxiety Disorder)

A psychological disorder that describe a disproportionate anxiety about several aspects of life, such as work, relationships, health and financial matters for a long period of time (Beyond Blue 2015a).

Gambling continuum

Gambling is considered a continuum disorder. The continuum varies from occasional non-problematic gambling to extreme over-involvement resulting in problems or harms for the gambler, and their family, friends and community.

HILDA

The Household, Income and Labour Dynamics in Australia (HILDA) Survey is a household-based panel study which began in 2001. It is a large longitudinal study.

IRR (Incidence Rate Ratio)

In regression analysis, IRR refers to the marginal change of the outcome variable in relation to a unit of change in a given exposure variable. For binary exposure variable, IRR refers the marginal change of the outcome variable in relation to the present of the exposure variable compared to the absence of the exposure variable.

Item response scale

Response options to questions or items can be designed so that the options describe variations in intensity or frequency of a characteristic along an increasing or decreasing scale.

Kessler Psychological Distress Scale (K10)

A measure of distress based on 10 questions about the anxiety and depression an individual has experienced in the previous four weeks (Kessler, Andrews, Colpe, Hiripi et al. 2002).

Life events

A list of significant events (e.g. death, marriage, divorce, new employment and others) used in *The Victorian Gambling Study*

LLLP (Leisure, Lifestyle, Life Cycle Project)

LLLP is a Canadian population longitudinal study conducted in Alberta, Canada between 2006 and 2011. The study aimed to 1) identify the normal patterns of continuity and discontinuity in gambling and problem gambling behaviours; 2) identify biopsychosocial variables and behaviour patterns that predict current and future problem gambling and 3) identify an etiological model of problem gambling that is best supported by the longitudinal findings. QLS was a very similar to a study conducted in the Quinte region of Ontario, Canada during the same time period. With overlapping of researchers involved in QLS and LLLP, a set of parallel analyses were conducted in both the studies for comparison. See *Quinte Study*.

LOTE (Language Other Than English)

In population surveys, the question "Do you speak a language other than English at home?" is usually used to identify people from a culturally and linguistically diverse (CALD) background.

Logistic regression

Statistical method for analysing data used when the outcome/dependent variable is dichotomous (e.g. yes/no, true/false).

- univariable: logistic regression using only one exposure/independent variable and a dichotomous outcome variable
- multiple: logistic regression using multiple exposure/independent variables and a dichotomous outcome variable

Longitudinal

A study that involves repeated observations of a population over a long period of time (usually years).

Meta-analysis

A meta-analysis is the use of statistical methods to summarise the results of systematic reviews by contrasting and combining results from different studies to identify patterns among study results

Model

In statistical analysis, a theoretical model is used to describe the observed data. A theoretical model usually features a specific distribution and a selection of criteria.

Model fit statistics

A collection of statistic indicators for models comparison. The indicators provide information on whether a model better describes the observed data when compared to another model. BIC' (Bayesian Information Criterion) was used as the model fit statistic in this report. See *BIC* and *BIC'*.

NCS-R (National Comorbidity Survey Replication)

A National Comorbidity Survey (NCS) was conducted in 1990-92 in order to assess the prevalence and correlates of DSM-III-R disorders in America. Ten years later, respondents of the NCS were reinterviewed in NCS-2. The NCS-2 conducted in 2001-02 aimed to study the patterns and predictors of the course of mental and substance use disorders and to evaluate the effects of primary mental disorders in predicting the onset and course of secondary substance disorders. (Harvard Medical School 2005)

Negative binomial regression

The negative binomial regression is a statistical method for analysing data when the outcome/dependent variable is count data (i.e. discrete and positive number). Negative binomial regression model assumes variances increases with means and therefore better describes over-dispersed data. (See *over-dispersed* and *Poisson regression*)

- univariate: negative binomial regression using only one exposure/independent variable and a count outcome variable
- multiple: negative binomial regression using multiple exposure/independent variables

NESARC (National Epidemiological Survey on Alcohol and Related Conditions)

The NESARC in a longitudinal study and the first wave of the study was conducted in 2001-02 by the National Institute on Alcohol Abuse and Alcoholism (NIAAA) in America. The second wave of the study was conducted in 2004-05. The study included questions on past and current alcohol consumption, and the use of alcohol treatment services. It also asked the respondents questions on tobacco and illicit drug use as well as mental wellbeing. (National Institute on Alcohol Abuse and Alcoholism 2006).

Null model

A null model is a model without any independent/exposure variables apart from the intercept. It is usually used in model fit statistics to compare between models with and without fitted independent variables. This is to find out whether the fitted variables improve the model in describing the observed data compared to the intercept only model. See *BIC* and *model fit statistics*.

OCD (Obsessive Compulsive Disorder)

OCD is an anxiety disorder and people who suffer from the disorder feel the necessity to perform an obsession or compulsion to release their anxiety. (Beyond Blue 2015b)

OECD (Organisation for Economic Co-operation and Development)

The OECD was officially established on 30 September 1961 to facilitate the co-operation between countries, addressing the challenges facing global economy. There are 34 OECE member countries worldwide in 2015. (OECD 2015)

Outcome

In epidemiology the outcome variable is the main variable of interest in the study. It is also called the dependent variable whose presence or absence, or level of severity may be 'dependent' on a particular exposure or circumstance which are often referred to as independent variables. In this report the outcome of interest was the PGSI score and its level of severity was dependent on socio-demographics variables, comorbidities, and trauma and life events.

Over-dispersed

The observed the data is over-dispersed when the variance observed is greater than the mean in the theoretical model that used to describe the data. See *Poisson regression* and *negative binomial regression*.

Parameter

Parameter is usually unknown and is estimated from observed data through statistical method.

Poisson regression

The Poisson regression is a statistical method for analysing data which is used when the outcome/dependent variable is count data (i.e. a discrete and positive number). Poisson regression model assumes that the mean equals the variance. See *over-dispersed* and *negative binominal regression*.

P-value

Probability value, represented by *P*. The probability that a test statistic would be as extreme as or more extreme than observed if the null hypothesis were true (Last, 2001). See *Statistical significance*.

Predicting

In regression analysis, a selection of exposure/independent variables are fitted in a model to describe the outcome/dependent variable. In statistical terms, the independent variable "predicts" the dependent variable. However, this does not imply any causal relationship.

Problem Gambling Severity Index (PGSI) score

A score based on nine questions, from the Canadian Problem Gambling Index, which can be used to estimate an individual's gambling risk status in the preceding 12 months.

Psychological distress

Negative emotional states that impact on a person's level of functioning. In this study general psychological distress was measured using the 10 questions that make up the Kessler 10. See also *Kessler Psychological Distress Scale*.

Public health approach

This approach views problem gambling as part of a gambling continuum. It recognises that vulnerability to gambling problems are due to complex interplay between personal, social, economic and environmental as well as biological factors. It is a practice which focuses on improving the health of populations, that is, the health of groups or sub groups, rather than the health of individuals.

QLS (Quinte Longitudinal Study)

The QLS is a longitudinal prospective study of gambling and problem gambling conducted in the Quinte region of Ontario, Canada from 2006 to 2011. The study aimed to investigate the patterns of

continuity and discontinuity in gambling and problem gambling over time, identify individual, social, and structural variables mediating the development of responsible gambling and problem gambling and examine the etiological model of gambling and problem gambling based on the study. The study also explored the implications of the study findings in the prevention of problem gambling. LLLP was a very similar study conducted in Alberta during the same time period. With overlapping of researchers involved in QLS and LLLP, a set of parallel analyses were conducted in both the studies for comparison. See *LLLP.*

Saturated model

A saturated model is a model with all the selected independent/exposure variables fitted. It is usually used in model fit statistics to compare between models with and without fitted independent variables. This is to find out whether the fitted variables improve the model in describing the observed data. See *null model* and *BIC.*

SEIFA (Australian Bureau of Statistics four indices of SocioEconomic Indexes For Areas)

SEIFA was developed by the ABS in order to rank areas in Australia according to relative socio-economic advantage and disadvantage, based on the five-yearly Census. The latest version of SEIFA 2011 consisted of four indexes: 1) Index of Socioeconomic Advantage and Disadvantage (IAD); 2) Index of Education and Occupation (IEO); 3) Index of Economic Resources (IER) and 4) Index of Socioeconomic Disadvantage (IRSD). Each index summarise a different subset of Census variables and focuses on a different aspect of socio-economic advantage and disadvantage. It is used in public health research, usually to examine the relationship between socio-economic disadvantage and various health and educational outcomes at the area rather than at the individual level. (Australian Bureau of Statistics 2013)

SEIFA IAD

Index of Socioeconomic advantage and Disadvantage. See *SEIFA.*

SEIFA IEO

Index of Education and Occupation. See *SEIFA.*

SEIFA IER

Index of Economic Resources. See *SEIFA.*

SEIFA IRSD

Index of Socioeconomic Disadvantage. See *SEIFA.*

Size of the effect

The magnitude of the difference between points of comparison in relation to an exposure or intervention.

Secondary analysis

Analysis undertaken on data from an existing database

Social capital

Social capital has been defined in many ways. It frequently refers to the features of social structures that make resources, advantages and opportunities available to individuals, and that can facilitate collective action. Most definitions of social capital are common in that they focus on networks among people that lead to cooperation and beneficial outcomes for all. Social capital affects health risk behaviour and, inversely, a lack of social capital can impair health. The association between strong social networks as a buffer to morbidity and mortality has been widely reported (Baum 2003; Lin, Smith and Fawkes 2014).

Social determinants of health

The social determinants of health (SDH) are the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems. (World Health Organisation 2015)

Socio demographics

Socio-demographics in this study individual characteristics such as education, occupation, income, household type and area level characteristics such as residence in urban or rural regional areas or areas with high or low socioeconomic status.

South Oaks Gambling Screen (SOGS)

A self-administered screen that contains 20 questions based on DSM-III criteria for pathological gambling (Lesieur and Blume 1987).

STATA/SE 12

A statistical software to compute statistical analysis developed and licensed by StataCorp. (StataCorp 2011)

Statistical significance

A mathematical technique to measure whether the results of a study are likely to be true. Statistical significance is calculated as probability that an effect observed in a research study is occurring because of chance. Statistical significance is usually expressed as a P-value. The smaller the P-value, the less likely that the results are due to chance (and more likely that the results are true). Researchers generally believe the results are probably true if the statistical significance is a P-value less than 0.05 (P<.05).

Statistical test

A procedure that is intended to determine whether a hypotheses about the distribution of one or more variables should be rejected or accepted.

Swelogs (Swedish Longitudinal Study)

Swelogs is a prospective study of Swedish citizens aged 16-84 years at baseline in 2008 and who were follow for a further three waves. The main objective of this study was to estimate prevalence and incidence of problem and at-risk gambling. (Romild, Volberg and Abbott 2014)

Systematic review

A systematic review answers a defined research question by collecting and summarising all empirical evidence that fits pre-specified eligibility criteria. It is a critical assessment and evaluation of all research studies that address a particular clinical issue.

TAFE (Technical and Further Education)

TAFE refers to tertiary education providing vocational education and training in Australia.

Temporal

Relating to, or denoting, time

Variable

In statistical analysis, a variable refers to some unknown quantity fitted in a model. A model is used to describe and/or estimate the unknown quantities based on observed data. See model.

Variance

In statistics, variance refers to the variation between individual observations within a sample.

Weighted/unweighted

Adjustments or weightings are applied to the data to make it more representative of a broader population (such as the Victorian adult population). They are based on the combined probabilities of a person being selected in the survey. In *The Victorian Gambling Study*, the household selection probability, the intraregional selection probability and the population benchmark selection probability.

WHO HPR/HEP

World Health Organisation Division of Health Promotion, Education and Communications (WHO HPR/HEP 1998)

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