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Prevent crime and save money: Return-on-investment models in Australia

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Executive Summary

Adolescent antisocial behaviour, such as violence, is both a serious and costly issue in Australia and known to peak during adolescence. Depending on how adolescent antisocial behaviour is defined and measured rates of this behaviour vary, however in Australia are generally between 5 and 20%. The cost of crime in Australia is estimated to be $47.6 billion per year with rates of crime highest in the age 15-24 group. Adolescent antisocial behaviour has important implications for feelings of safety within the community and community members' enjoyment of their local environments. Thus, finding effective ways to reduce the developmental pathways to youth antisocial behaviour is important. An area of increasing importance is demonstration of the costs and benefits of effective approaches to reducing adolescent antisocial behaviour (so-called return-on-investment analyses).

This report presents new analyses from the *International Youth Development Study (IYDS)*, an ongoing longitudinal study of antisocial behaviour in Victorian young people which began in 2002, designed to demonstrate the feasibility of combining Australian longitudinal cohort data with prevention strategy investment data to reduce crime versus expenditure on prisons in Australia. The project investigates rates and predictors of antisocial behaviour and violence from the early waves of the IYDS (age 11 years) to young adulthood (age 25 years) to estimate the return-on-investment in Victoria achievable with a $150 million investment in a mix of 6 evidence-based prevention strategies. The aims of the current project were to:

1. Report population rates in the Victorian context of different forms of antisocial outcomes at different points in the life-course;
2. Estimate effect sizes for modifiable risk factors; and
3. Estimate the return-on-investment in Victoria a $150 million investment would have in a mix of 6 evidence-based strategies.

To investigate these aims data from 2,884 IYDS participants was used to estimate the reduction in incarceration and intimate partner violence achievable in the State of Victoria by investing $150 million in a mix of evidence-based prevention strategies. Baseline data were obtained in the IYDS at average age 15 from a sample recruited in 2002 to be state-representative of students in Victoria. Follow-up data were obtained at average age 25 in 2014/15. Evidence-based prevention strategies included: Nurse Family Partnerships, Triple P Universal and Triple P Level 4 groups, Secondary School Age Alcohol Supply Reduction, Tutoring by Peers and Screening and Brief Intervention for young adult alcohol problems.

Based on the IYDS in 2014/15, findings showed, for those of average age 25 (range 21 to 29) the annual incarceration rate (any police or court apprehension) was estimated at 3.5% (1.0% for 1-day or more) and involvement in intimate partner violence involving physical force was 8.5% (causing physical injury was 3.0%). Multivariate regression analyses were used to identify the effect of age 15 risk factors (socioeconomic disadvantage, family problems, child behaviour problems, substance [including alcohol] use and school problems) and age 21 alcohol problems on age 25 incarcerations and intimate partner violence involving physical assault. Analyses revealed the 10-year lag effect of having invested an extra $150 million would have been a reduction in 2015 of 1,624 cases of incarceration (5% reduction) and 3,034 cases of intimate partner violence involving physical force (10% reduction). In addition to these estimated 1-year effects, benefits would also have been observed in each of the prior nine years and in subsequent years. The prevention strategy investment mix investigated in this report was: Nurse Family Partnership for low income

($35 M), Triple P Universal ($34 M), Triple P Level 4 groups ($51 M), Secondary School Age Alcohol Supply Reduction (SAASR; $14 M), Tutoring by Peers ($9 M) and Screening and Brief Intervention for young adult alcohol problems ($7 M). The net return from the $150 million prevention strategy investment was conservatively estimated at $191 million.

Project findings demonstrate several modifiable factors for antisocial behaviour that could be targeted in early intervention and prevention programs to reduce the developmental pathways that lead to youth perpetration of intimate partner violence and incarceration. The results of the current study demonstrate the importance of considering childhood and adolescent family and school-based problems/risk factors, as well as youth substance (including alcohol) use and previous engagement in antisocial behaviour. The present analysis reveals there is sound data to perform return-on-prevention investment analyses in Victoria suggesting it is feasible and cost-effective to prevent problems such as intimate partner violence, while also reducing incarceration rates. Together, project findings can be used to inform policy in Australia about financially viable and effective programs to reduce crime and antisocial behaviour. This project will contribute to understanding that imprisonment and family violence are preventable and that there are significant economic benefits in implementing evidence-based prevention and early intervention approaches.

Project Background

Introduction

Crimes such as violence, theft and dealing in illegal drugs are serious and costly issues internationally, including in developed countries such as Australia and the United States (Hemphill & Smith 2010; Hemphill et al. 2009). These behaviours peak during adolescence and early adulthood (Baker 1998; Bond et al. 2000; Rutter & Giller 1983). Estimates of the rates of adolescent antisocial behaviour vary depending on how it is defined and measured; however, they are generally between five and 20 percent (Hemphill et al. 2006; Vassallo et al. 2002) with similar rates in the United States, the United Kingdom (Costello et al. 2003; Sawyer et al. 2001) and Australia (Vassallo et al. 2002). The cost of crime in Australia is estimated to be $47.6 billion per year, or 3.4 percent of gross domestic product (Smith et al. 2014) and rates of crime are highest among those aged 15 to 24 years (Australian Institute of Criminology 2013). The occurrence of crime impacts greatly on community members' feelings of safety and enjoyment of their local environments (Australian Institute of Criminology 2013).

Finding effective ways to reduce the developmental pathways to youth antisocial behaviour is important. There is a detailed literature on the factors that predict engagement in antisocial behaviour (i.e., risk factors) and those that reduce the likelihood of engagement in antisocial behaviour (i.e., protective factors). In addition, there is an evidence-base regarding what does and does not work to prevent adolescent antisocial behaviour. An area of increasing importance is demonstration of the costs and benefits of effective approaches to reducing adolescent antisocial behaviour (so-called return-on-investment analyses). Return-on-investment analyses suggest that investment in prevention and early intervention strategies is more cost-effective than tertiary interventions such as incarceration (Aos et al. 2011). It is important that information of this kind is available to policy-makers to guide their decision-making about government spending. This project was designed to demonstrate the feasibility of combining data from a 12-year Australian longitudinal study (N=2,885) with prevention strategy investment data to estimate potential returns, including a reduction in intimate partner violence and prison entry. The project investigated the return on investment achievable in Victoria with a $150 million investment in a mix of six evidence-based prevention strategies (Nurse Family Partnerships; Triple P Universal; Triple P Level 4 Groups; Secondary School Age Alcohol Supply Reduction; Tutoring by Peers; and Brief Alcohol Screening and Intervention for College Students).

Risk and protective factors for adolescent antisocial behaviour

A range of predictors for adolescent antisocial behaviour (referred to here as risk and protective factors) have been identified in the research literature. A risk factor increases the likelihood of a person developing problematic behaviours such as antisocial behaviour (Hawkins et al. 1992; National Crime Prevention Unit 1999). Protective factors reduce the likelihood of problematic behaviours or moderate the effects of risk factors on behaviour (Hawkins et al. 1992; National Crime Prevention Unit 1999). Risk and protective factors relate to the social context of the young person, including the peer group, family, school, community, and characteristics of the young person (Catalano et al. 2011).

Extant research has confirmed a wide range of risk and protective factors for youth antisocial behaviour (Catalano et al. 2011; Hemphill et al. 2009; Hemphill et al. 2006; Stiglitz 2012). The sections that follow describe evidence that the following risk factors for youth violent behaviour (Toumbourou et al. 2013; Toumbourou et al. 2015) have been increasing in Australia in recent decades: socio-economic inequality, family problems, school problems, and alcohol availability and early age alcohol use. The increase in these risk factors has been posited as part of the explanation for the increasing levels of violent behaviour among youth in Australia in recent decades (Toumbourou et al. 2015; Toumbourou et al. 2013).

Socioeconomic inequality. International studies have demonstrated that violence and crime tend to be more common in societies with larger income differences (Stiglitz 2012). Williams et al. (2009) demonstrated in a large Australian study that rates of youth violence were significantly higher in disadvantaged communities. In longitudinal research, community disorganisation, perceived availability of drugs and peer antisocial involvement (all indicators of community disadvantage) have each been shown to predict future antisocial behaviour in adolescents and young adults (Hemphill et al. 2009; Hemphill et al. 2006). Income inequality has increased in Australia in recent decades (Organisation for Economic Co-operation and Development 2015) and is reflected in location differences whereby some suburbs and neighbourhoods have high numbers of disadvantaged families living in close proximity (Williams et al. 2009). Growing up in these neighbourhoods can increase the likelihood of children experiencing a number of predictors of antisocial behaviour, including low social cohesion, witnessing and experiencing violence and being in situations with low environmental security and where there are high rates of alcohol and drug use. The schools that serve disadvantaged communities often have relatively lower school completion rates (see school risk factors below).

Family problems are known to contribute to youth antisocial and violent behaviour (Hawkins et al. 2000; Herrenkohl et al. 2000). Rates of child neglect and abuse notifications and substantiations have been steadily rising in most Australian jurisdictions in recent decades (Australian Institute of Health and Welfare 2012). Longitudinal research shows that both family conflict and early adolescent antisocial behaviour are cross-nationally stable risk factors that predict future youth violence (Hemphill et al. 2009; Hemphill et al. 2006). Early family risk factors are particularly important in early-onset antisocial pathways (Moffitt 1993) and in this way, predict increased antisocial behaviour.

School problems have increased among students in disadvantaged communities in recent decades and this may also contribute to youth antisocial behaviour. For example, many Australian schools use suspension to address student behavioural problems, with rates higher in disadvantaged communities (Hemphill et al. 2010). School suspension has been found in longitudinal research to be a unique and cross-nationally stable predictor of future youth antisocial behaviour (Hemphill et al. 2009; Hemphill et al. 2006). Important geographic trends in Australian schools are that the lowest rates of school completions are in non-metropolitan areas, and lower rates of school completions occur in schools in outer ring compared to middle ring suburbs (Access Economics 2008). Risk factors such as disengagement from school, suspension and exclusion can increase both early- and late-onset antisocial pathways and in this way, predict increased antisocial and violent behaviour (e.g. Hemphill et al. 2006).

Alcohol availability and early age alcohol use have increased in Australia and are known risk factors for youth antisocial behaviour. Alcohol outlet densities have increased in recent decades, which helps explain the increasing rates of alcohol-related harm and violence (Livingston et al. 2007). Williams et al. (2009) found that early adolescent alcohol use was strongly associated with adolescent violence. Hemphill et al. (2009)

found community norms favourable to alcohol and drug use increased the risk of future youth violent behaviour. According to the National Drug Strategy Household Survey report in 2010, there were statistically significant increases between 2007 and 2010 in the proportion of victims of physical abuse whose abuse was alcohol-related, from 4.5 percent to 8.1 percent (Australian Institute of Health and Welfare 2011a). Early age alcohol use (including fetal alcohol symptoms) can impair neurological development, increase early- and late-onset antisocial pathways and increase antisocial behaviour. In addition, poorly organised alcohol use environments can increase situational influences for aggression and violence.

Evidence-based prevention approaches

Finding effective ways to reduce the developmental pathways to youth antisocial behaviour is important. An area of increasing importance relates to the costs and benefits of effective crime prevention models. Return-on-investment analyses suggest that investment in prevention and early intervention strategies is cost-effective and can reduce crime and incarceration (Aos et al. 2011). It is important that information of this kind is available to policymakers to guide their decision-making about government spending.

Several primary and secondary prevention strategies have been shown to be effective or promising in reducing one or more of the abovementioned risk factors and in preventing youth antisocial behaviour. These strategies are supported for Australian implementation and are summarised below.

Nurse-Family Partnerships are secondary (selective targeted) prevention programs that offer assistance pre- and post-birth to young mothers to reduce the risks to children of unskilled parenting and socio-economic disadvantage. Professional home visitors are trained to build a trusted relationship to support parents to access services and ensure problems can be dealt with early. A randomised community trial with disadvantaged mothers in Sydney found improvements in the early family environment and the length of breastfeeding (Kemp et al. 2011), similar to those reported in the initial US trials (Olds et al. 1997). Using return-on-investment analysis (Aos et al. 2011) estimated this strategy returns $US20,905 per client.

Triple – P Positive Parenting Program is a primary prevention parent education program that aims to reduce family and child behaviour problems by enhancing parents' family management skills using interventions based on cognitive-behavioural and social learning theories. There are five levels of the program provided at different intensities to accommodate the differing levels of severity in disrupted family functioning or child behaviour problems. Randomised trials consistently find the program to improve parenting behaviours, and lower rates of child behaviour problems (e.g. Bodenmann et al. 2008; Prinz et al. 2009; Sanders et al. 2007). In a trial in South Carolina, Prinz et al., (2009) found the program resulted in population reductions in indicators of child violence (substantiated child maltreatment, out-of-home placements and child hospitalisations and emergency room visits resulting from child maltreatment). The program has been identified as an excellent investment returning $US5,447 per $US1,790 cost per client at the most intensive level (Aos et al. 2011).

Tutoring by peers is a prevention approach that aims to reduce school risk factors. Youths and adults are trained to tutor students experiencing learning difficulties or school adjustment problems. Randomised trials have shown that this program is effective at improving student outcomes and in reducing behavioural problems (Rimm-Kaufman et al. 1999; Rodick & Henggeler 1980) and returns above $US5,200 per client (Aos et al. 2011).

Drug and alcohol reduction strategies. Strategies to reduce alcohol and drug availability, early age alcohol use and heavy young adult alcohol use include approaches such as volumetric alcohol taxation, alcohol industry regulation, community mobilisation and alcohol sales monitoring, legislated age restrictions on alcohol use and purchase, interventions in entertainment precincts (Stockwell et al. 2005, Hemphill & Smith 2010) and screening and brief interventions with young adults (Tanner-Smith & Lipsey 2014). There is evidence that a number of these strategies can reduce early age and frequent adolescent alcohol use, progression to illicit drug use and alcohol-related violence among young adults (Toumbourou et al 2013; 2015). The analyses to be presented below also draw on prior analyses that have modelled the economic returns of policies to reduce alcohol use in Australia (Magnus et al. 2012; Vos et al. 2010).

Return-on-investment

The costs associated with youth antisocial behaviour and crime are extensive and include costs related to physical and mental health services for young offenders, law enforcement, and youth justice services (Hemphill 1996; Smith et al. 2014), as well as costs related to the criminal justice system, victim assistance and security services (Smith et al. 2014). Given that prevention efforts can take time to demonstrate effects, the most effective strategies for reducing antisocial behaviour are often unpopular, while less effective strategies are more readily implemented (Toumbourou et al. 2015; Toumbourou et al. 2013). The use of systematic literature reviews and economic modelling can encourage key constituencies to adopt evidence-based approaches that may require long-term political will to implement effectively. Economic modelling offers the advantage that the relative monetary benefits of different combinations of programs and policies can be compared. An example of economic modelling being used effectively occurred in Washington state in the USA, where a unique return-on-investment model was developed to estimate the economic returns of various policy options. Using this model, a complex range of scientific information has been synthesised in a form that is comprehensible to non-expert audiences within the Washington state legislature. A major achievement has been the steady reduction in Washington state's crime rate over recent decades and the reduction in incarceration. The use of the return-on-investment economic modelling work convinced the legislature in 2005 not to build a $USD 250 million prison that had been planned to address crime. The funds were used instead to invest in effective early intervention and prevention programs (Washington State Institute for Public Policy 2004).

Benefits and national significance of crime prevention

The total cost of crime in Australia is estimated to be $47.6 billion per year or 3.4% of the gross domestic product (Smith et al. 2014) and the rates of crime are highest in the age 15-24 group (Australian Institute of Criminology 2013). Finding effective ways to reduce antisocial and violent behaviour is of paramount importance to reduce the associated human and economic costs. There is already much known about evidence-based approaches to reducing antisocial behaviour. However, often the more effective approaches such as supporting vulnerable parents and raising taxation for alcohol are not as popular as less effective options such as educating people on moderate alcohol use. Therefore, inclusion of the economic benefits of evidence-based approaches is one way of improving the attractiveness of evidence-based approaches that are also cost-effective.

Research Aims

This report presents new analyses from the Victorian IYDS cohort, designed to demonstrate the feasibility of combining Australian longitudinal data with prevention strategy investment data to specify investment options to prevent intimate partner violence and incarceration in Australia. The aims of the current project are:

- to report population rates in Victoria of different forms of antisocial outcomes at different points in the life course, with a specific focus on rates of young adult incarceration and intimate partner violence;
- to estimate effect sizes for modifiable risk factors for young adult incarceration and intimate partner violence;
- to estimate the return on investment in Victoria of a $150 million investment in a mix of six evidence-based prevention strategies; and
- through the above steps, to pilot a new method for prevention investment modelling that integrates longitudinal data with return-on-investment estimates.

Baseline data were obtained in the Victorian IYDS as each cohort reached average age 15. Follow-up data were obtained at ages 23 and 25 in 2012–13 and 2014–15 respectively. The evidence-based prevention strategies modelled were: Nurse Family Partnerships, Triple P Universal and Triple P Level 4 groups, Secondary School Age Alcohol Supply Reduction, Tutoring by Peers and Brief Alcohol Screening and Intervention of College Students (BASICS) for young adult alcohol problems.

General methodology

Data in this project were drawn from the International Youth Development Study (IYDS). The IYDS is a longitudinal, cross-national study that aims to investigate the development of adolescent behaviours, including antisocial behaviour and substance use, as well as the influence on these behaviours of risk and protective factors within the adolescents' individual, peer, family, school and community domains (Hemphill et al. 2006). The states were selected for cross-national comparison as they were similar in terms of population size, urbanicity, having higher than national levels of educational participation, and in having low proportions of residents living in poverty, at the time that the study was designed and the sample recruited(McMorris et al. 2007). Data analysed in this project comprised only the Victorian sample, a state-representative sample of 2,884 Victorian students recruited in 2002 into the IYDS.

Original sampling and recruitment.

Original sampling and recruitment for the IYDS used a two-stage cluster sampling approach. Prior to recruitment of the Year 5, 7 and 9 cohorts in 2002, a probability proportionate to grade-level size sampling procedure was used to select relevant public and private schools. To achieve a desired sample of approximately 1,000 students in each cohort, 60 classes of approximately 22 students were chosen at random from the sampled schools. An average of 50 classes agreed to participate in the study. Students were recruited after their parent or guardian provided signed informed consent. The Year 5, 7 and 9 cohorts recruited in 2002 were composed almost entirely of 11-, 13- and 15-year-olds, respectively. Males and females were near equally represented. In Victoria, high baseline response rates were achieved (76%) (McMorris et al. 2007). There was 98% retention of all cohorts across the first 3 years of follow-up enabling school-age experiences and predictors of antisocial behaviour (e.g. family problems, early crime and substance use) to be comprehensively assessed. The high baseline participation and retention together with the large state-representative cohort recruited enables IYDS analyses to be reweighted to provide accurate state population estimates of specific sub-groups (e.g. antisocial behaviour and violence). Data collection for the IYDS has been funded through the National Institutes of Health (USA), and the ARC and the NHMRC (Australia).

Participants

The sample in this project consisted of 2,884 Victorian students who were first surveyed in 2002 when they were in Year 5, 7, and 9 (approximately 1,000 students per Year level). Students in the Year 5 cohort have been reassessed (resurveyed) in 2003-4, 2006-2008, 2010-2011, 2012-2013 and 2014-15. Participants in the Year 7 cohort were resurveyed in 2003-4, 2010-2011, 2012-2013 and 2014-15 and those in the Year 9 cohort in 2003 and 2010-2011, 2012-2013 and 2014-15. Retention rates have remained high with 85% retention in 2008, 84% in 2010-2011, 83% in 2012-2013 and 87% in 2014-2015. Table 1 presents the sample size and retention rates across the assessment periods.

TABLE 1. SAMPLE SIZE AND RETENTION RATES IN VICTORIA

	Year 5 cohort	**Year 7 cohort**	**Year 9 cohort**
Wave 1 (2002)	*Age* = 11 years *n*=927	*Age* = 13 years *n*=984	*Age* = 15 years *n*=943
Wave 2 (2003)	*Age* = 12 years *n*=916; 99%	*Age* = 14 years *n*=970; 99%	*Age* = 16 years *n*=936; 99%
Wave 3 (2004)	*Age* = 13 years *n*=907; 98%	*Age* = 15 years *n*=955; 97%	*Age* = 17 years *n*=932; 99%
Young adult (2010/11)	*Age* = 19 years *n*=809; 87%	*Age* = 21 years *n*=826; 84%	*Age* = 23 years *n*=788; 81%
Young adult (2012/13)	*Age* = 21 years *n*=787, 85%	*Age* = 23 years *n*=817, 83%	*Age* = 25 years *n*=795, 82%
Young adult (2014/15)	*Age* = 23 years *n*=828, 89%	*Age* = 25 years *n*=866, 88%%	*Age* = 27 years *n*=826, 86%

Note. For the Year 5 cohort, data were collected from 2006-2008, and 2010-2011. For the Year 7 and 9 cohorts, data were also collected from 2010-2011.

Survey administration.

Through the school years surveys were administered to participants in class groupings, within the school setting, and took approximately 50-60 minutes to complete. To ensure seasonal equivalence, surveys were conducted between February and June in Washington State, and May and November in Victoria. Trained survey staff at both sites used a single survey administration protocol, explained how to complete the survey and answered any questions. The self-report survey was voluntary and completed by participants independently (without any interaction or collaboration with peers) and the desks were arranged such that students could answer the questions in privacy and with confidentiality. The survey included instructions on how to answer the questions (e.g. place a clear 'X' inside the box) and further assurances of confidentiality. All instructions and assurances were presented to participants prior to survey administration, by survey staff. Trained school personnel conducted the survey with participants absent on the day of the survey, and a small percentage of surveys were completed by mail or by telephone. For students who no longer attended school, research staff administered the survey over the telephone or face-to-face (comprising less than 4% of surveys in each study year). Following the completion of formal schooling, participants were contacted by mail, email, and/or telephone and asked to complete the survey online and in some cases by phone or face-

to-face, after providing informed consent. After completion of each survey, participants received a small gift as reimbursement for their time.

Measures

The IYDS survey was adapted from the *Communities That Care* self-report youth survey (Arthur et al. 2002; Glaser et al. 2005). The survey includes measures of antisocial behaviour and risk and protective factors for youth that previous research has shown to be valid and reliable when administered to students in sixth to twelfth grades in the US (Arthur et al. 2002) and in Victoria (Hemphill et al. 2011). Table 1 presents the descriptive statistics for all measures utilised in the analyses for this study. The risk factors described below were selected because they were measured in the IYDS and targeted by the strategies outlined in the literature review. To enable the present report to use intervention effect size estimates reported by Aos et al. (2011), the IYDS scales were coded to reflect the domains assessed in their report.

Incarceration and Intimate Partner Violence. Incarceration and intimate partner violence, measured at age 25 years, were assessed based on categories of principal offences (i.e. offences committed by an individual offender during a specific reference period) recorded by the Australian Bureau of Statistics (2015).

Having spent time in jail (*incarceration*) was examined using the item 'Over the past year… What is the total amount of time you have been detained in a prison or a correctional facility?' measured on a 5-point scale ranging from none (1) to more than 3 months (5). Due to the skewed distribution of data on the item, incarceration scores were recoded for the regression analysis to form a dichotomous measure, never been incarcerated (0) and been incarcerated once or more (1).

Perpetration of *intimate partner violence* was examined using three scales comprised of items from the Conflict Tactics Scale (CTS; Straus et al. 1996). Perpetration of *psychological aggression* was examined using three items (e.g. 'I insulted, swore, or yelled at my partner'). *Physical assault* of one's partner was measured using the item 'I pushed, grabbed, slapped, shoved my partner, or threw something at my partner that could hurt'. The item 'My partner had a physical injury, sprain, bruise, or small cut because of a fight with me' was used to examine acts causing *physical injury*. Subtypes of intimate partner violence were rated on an 8-point scale ranging from this has never happened (1) to more than 20 times in the past year (8), and recoded to form the dichotomous measure of 'this has never happened/this has happened but not in the past year' (0) to 'once in the past year or more' (1) (Straus et al. 1996). Participants who reported not being in an intimate relationship were coded as: 'this has never happened/this has happened but not in the past year' (0). It is noted that although perpetration of intimate partner violence is examined in this report, intimate partner violence perpetration and victimization are highly intertwined and items comprising the CTS do not account for the context in which intimate partner violence is perpetrated by either males or females.

Antisocial behaviour. Due to space limitations the present report focuses on the two above behaviours, however a range of other antisocial behaviours were also measured and examined in a series of sensitivity analyses (see Appendices). Minor subtypes of antisocial behaviour (e.g. acts intended to cause injury, theft), measured from ages 10-25 years, were formed based on categories of principal offences (i.e., offences committed by an individual offender during a specific reference period) recorded by the Australian Bureau of Statistics (2015).

Acts intended to cause physical injury were measured from ages 10-25 years using two items (e.g. 'Beat up someone so badly that they probably needed to see a doctor or nurse?'). The item 'Have you ever had sex with someone against their will?' was used to assess sexual assault from age 18-25 years. Engagement in *theft* was measured using two items from ages 10-17, examining theft of money or a motor vehicle (e.g., 'How many times in the past year (12 months) have you: stolen something worth more than $5/10?'). Three items examined the same construct among participants 18-25 years (e.g. 'Have you ever stolen something worth more than $50?'). Four items were used to examine aspects of *fraud and deception* among participants 18-25 years including using counterfeit money, someone else's credit card without permission, obtaining government benefits or compensation to which one was not entitled (e.g. youth allowance), illegal copying of computer software (or related materials) for the purpose of obtaining money, and illegal access of a computer network (e.g., 'Have you ever illegally accessed a computer network, system or files?').

Illicit drug offences, for participants 12-25 years, were examined using the item 'Have you ever sold illegal drugs such as marijuana, cocaine, LSD, or heroin?' Engagement in *carrying or using prohibited or regulated weapons* were examined among participants in each age group. Participants were asked if they had ever carried a weapon (ages 10-17 years), carried a knife or taken a handgun to school (ages 12-15), threatened someone with a weapon (ages 13-17), or carried a handgun or knife (ages 18-25). One item, 'Have you ever purposely damaged or destroyed property or things that did not belong to you?' examined *property damage* among participants aged 18-25 years. Engagement in *public order offences* was examined using the item 'Have you ever got into physical fights with other people?' for participants 12-25 years.

Contact with law enforcement was examined using several measures. The item 'Have you ever been cautioned by police?' was used to examine having been *cautioned by the police* among 18-25-year olds. Also, for this age group, to assess having been *charged by the police* participants were asked the question 'Have you ever been charged by police?' The item, 'Have you ever been arrested?' was used to examine *arrests* for participants aged 10-17 years. One item, 'Have you ever appeared in court as an offender?' examined having *appeared in court* among 15-25-year olds.

Items for subtypes of antisocial behaviour including acts intended to cause injury, theft, illicit drug offences, public order offences, and arrests were rated on an 8-point scale, ranging from never (1) to 40 or more times (8). Items for subtypes of antisocial behaviour including sexual assault, fraud and deception, using prohibited or regulated weapons, property damage, cautioned by police, charged by the police, and appeared in court were rated on a 4-point scale, ranging from No (1) to Yes, more than once in the past 12-months (4). For subtypes of antisocial behaviour comprising multiple items, scores for each subtype were obtained through averaging the responses to each item. Due to the skewed distribution of data on the item(s) comprising each antisocial behaviour subtype, scores were recoded to form a dichotomous measure, never engaged in the subtype of antisocial behaviour (0) and engaged in the subtype of antisocial behaviour once or more (1).

Predictors

Socioeconomic inequality (low SES) was based on levels of family income and education. *Family socio-economic status* (SES) was measured using a composite scale combining information pertaining to parent education and family income reported by parents in phone interviews in the first year of the IYDS (2002, 95% coverage of participants). The measure of socioeconomic status used here has also been used in previous IYDS work (e.g. Evans-Whipp et al. 2010) and comprises the mean parental education level and weighted family income level, with three levels, low socioeconomic status, middle socioeconomic status and high

socioeconomic status. (Toumbourou et al. 2015) noted SES may increase child-onset pathways to violence and antisocial behaviour where children experience severe poverty, hence family SES was dichotomised to identify the 10% of children in the highest decile for disadvantage.

Family problems (conflict and parenting were estimated by (Aos et al. 2011) for Child abuse and neglect/ and Out of Home Care placement. To assess child reports of similar risk factors the IYDS scales of (1) family conflict, (2) poor family management and (3) family history of antisocial behaviour were combined. *Poor family management* included nine items (e.g., "The rules in my family are clear"; Cronbach's alpha = .83) and *family conflict* had three items (e.g., "People in my family have serious arguments"; Cronbach's alpha = .84). *Family history of antisocial behaviour* such as sibling and other significant adult alcohol and drug use, was measured using ten items. "Have any of your brothers or sisters ever smoked cigarettes?" and "How many adults have you known personally who in the past year have sold or dealt drugs?" are example items. Items comprising the *family conflict, poor family management* and *family history of antisocial behaviour scales* were rated on a 4-point scale ranging from No, definitely not true for you (1) to Yes, definitely true for you (4). The average response was calculated for the above three scales. Toumbourou et al. (2015) noted family risk factors were relatively common in Australia, hence students in the top 24% were coded as high family risk (1) and the remaining group coded to the comparison or reference sample (0).

Child behaviour problems for the analyses conducted here focussed on the domains estimated by Aos and colleagues (2011) relevant to Conduct Problems and Crime. These risk factors were assessed in the IYDS through five questions assessing *Antisocial behaviour* asking students how often they had engaged in behaviours over the past year. These items included how often they had carried a weapon, stolen something worth more than $10 [in 2002 in Australia], been arrested, attacked someone with the idea of seriously hurting them, and beaten up someone so badly that they probably needed to see a doctor or nurse (Cronbach's alpha = .49). Items were rated on an 8-point scale ranging from never (1) to 40 or more times (8). The average response was calculated for this scale. Students above one standard deviation from the mean (top 17%) were coded as high conduct problems and crime (1) and the remaining students as comparisons (0).

Substance use risk factors in (Aos et al. 2011) were estimated based on Age of first substance use and rates of substance use. To equate these in the IYDS, scales examining past month frequency of alcohol and illicit drug consumption at age 15 were utilised. *Past month alcohol use* was measured using the item, "In the past year (12 months), on how many occasions (if any) have you had alcoholic beverages (like beer, wine or liquor/spirits) to drink – more than just a few sips?". Responses were rated on an 8-point scale ranging from 'Not at all' (1) to '40 or more times' (8). *Illicit drug consumption* was measured using a similar item to alcohol use, assessing the use of a range of illicit substances including cannabis, LSD and psychedelics, cocaine or crack, inhalants, stimulants, ecstasy, heroin, and other illegal drugs. "In the past year (12 months), on how many occasions (if any) have you sniffed glue, breathed the contents of an aerosol spray can, or inhaled other gases or sprays in order to get high?" is an example item. Due to the skewed distribution of data on the substance use item(s), scores were recoded to form a dichotomous measure, no substance use (0) and substance use once or more (1). Student's one standard deviation above the mean were selected on this risk factor, hence students at the top 18% on this scale (used substances) were coded as high substance use risk (1) and the remaining coded as comparisons (0).

School problems assessed by (Aos et al. 2011) included *school attendance* indicated in the IYDS by (1) truancy, (2) expulsion, and (3) suspension and *test scores/school completion* indicated in the IYDS by low

school commitment. Two items assessed *truancy*; "During the last four weeks how many whole days have you missed because you skipped or "cut/wagged"? is an example item. *School expulsion* was measured using the item "How many times in the past year (12 months) have you been expelled from school". *School suspension* was measured using the item: ''How many times in the past year (12 months) have you been suspended from school?''. *Low school commitment* was measured through six items such as "How often do you feel that the school-work you are assigned is meaningful and important?" (reverse coded). Items for each school risk factor measure were rated on an 8-point scale of never (1) to 40 or more times (8). For the school attendance measure students with any truancy or suspension (27% on this scale) were coded as high risk of non-attendance and non-completion (1) and the remaining students as comparisons (0).

Age 21 alcohol problems were assessed in the 2010-11 follow-up using the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al. 2013). The AUDIT as a screening instrument for hazardous and harmful alcohol consumption. "How often do you have 6 or more drinks on one occasion?" and "How often during the last year have you had a feeling of guilt or remorse after a drink?" are example items. AUDIT items were rated on a 5-point scale of never (0) to daily or almost daily (4). Based on international conventions a cut-off of eight or more symptoms was used to define alcohol problems and 41% of young adults were assessed to be at risk (1) with the remainder coded as comparisons (0).

Honesty of student responses. Students were categorised as ''dishonest'' if they reported any of the following: (1) they were not honest at all when completing the survey, (2) they had used a fake drug in their lifetime or in the past 30 days, or (3) they had used illicit drugs on more than 120 occasions in the past 30 days. The number of ''dishonest'' students was low, with a total of 23 in the Year 5 cohort, 66 in the Year 7 cohort, 111 in the Year 9 in 2002. Sensitivity analyses were run including and excluding dishonest cases from the analyses and few differences were noted.

Ethics approval

Approval to conduct the study was granted by the University of Washington Human Subjects Review Committee in Washington State. Approval to approach schools was provided by school districts. In Victoria, the Royal Children's Hospital Ethics in Human Research Committee, and the Human Research Ethics Committee at the University of Melbourne provided permission to conduct the study. The Department of Education and Training (now the Department of Education and Early Childhood Development) for government-operated (public) schools, and the Catholic Education Office for some privately-operated schools, provided permission to conduct the study in schools. Permission was also obtained from the relevant school district authorities.

Specific Research Methodology

Aim 1: Population rates of antisocial outcomes

Estimated population rates in the Victorian context of different forms of antisocial outcomes at different points in the life-course.

The analyses conducted in this section examined population rates of different forms of antisocial (and related) behaviours at different points in the life-course (e.g., prevalence rates for any violence, arrests, convictions, or incarceration from late childhood to young adulthood). Prevalence estimates obtained through the sensitivity analysis (refer page 12) were weighted to the Victorian Census data with the criteria for weighting that our findings reflect official state rates for outcomes such as incarceration. The results addressing this aim inform the subsequent aims of this project.

Statistical analyses

Prevalence estimates at age 15 years for (1) family risk (child abuse and neglect/out-of-home care placement), individual child behaviour (conduct problems and crime), substance use, and school risk (non-attendance, low test scores/school completion), (2) alcohol problems at age 21, (3) incarceration and intimate partner violence at age 25 years, and (4) subtypes of antisocial behaviour from ages 10-25 years, were derived using Stata, version 13 (StataCorp 2013). Unweighted prevalence estimates were projected for gender groups with age considered as a covariate fixed at the mean age for each age group (15 years for risk factors and 25 years for subtypes of antisocial behaviour). For the sensitivity analyses, prevalence estimates and 95% confidence intervals for each subtype of antisocial behaviour, weighted to the Victorian Census data, were derived using design-based estimation of proportions. IYDS incarceration rates at age 25 were compared to officially recorded rates for Victoria (Department of Justice and Regulation 2014), recording longer periods of incarceration. The IYDS rates of long incarceration (one months or more) were similar to official rates for females and higher for males. The high rate of incarceration within the IYDS sample reflects the additional follow-up efforts made in the IYDS to include prisoners. Given the IYDS sample appeared to adequately estimate incarceration in Victoria, no sample adjustments were deemed necessary.

Results

Risk factors, Intimate Partner Violence and Incarceration. Rates of risk factors for the full sample and separately for males and females are presented in Table 2. Specifically, males reported significantly higher rates of risk factors across the domains of child behaviour problems, substance use and age 21 alcohol problems, compared to females. Rates of child behaviour problems were almost 10% higher for males compared to females, while rates of Age 21 alcohol problems were 14% higher for males.

Also shown in Table 2 are the rates intimate partner violence and incarceration, for the full sample and separately for males and females. Across the full sample rates of psychological aggression were greater than rates for physical assault or acts causing physical injury in the intimate partner violence domain, with 17% of participants reporting perpetration of psychologically aggressive behaviour towards their partner. Rates of physical assault approached 9% across the sample, with rates acts causing physical injury were less than 5%. Results showing gender differences in intimate partner violence perpetration should be interpreted with caution. Intimate partner violence perpetration and victimization are highly intertwined, and items used to measure these behaviours and experiences do not account for the context in which this behaviour has occurred (refer Discussion section for a detailed explanation).

For the full sample, rates of incarceration were 3.5%, with rates for males (6%), significantly greater than that for females (1%). More specifically, rates of incarceration for males were six times that of females.

TABLE 2. PERCENTAGES FOR RISK FACTORS AT AGE 15 YEARS AND INTIMATE PARTNER VIOLENCE AND INCARCERATION AT AGE 25 YEARS.

Risk factors at Age 15 (Percentage)			
Sample size	*Full sample (n=2,884)*	*Males (n=1,394)*	*Females (n=1,490)*
Socioeconomic inequality (low SES)	10.26	9.90	10.60
Family problems: Conflict and parenting	23.98	22.53	25.32
Child behaviour problems	17.24	**21.29*** **	13.45
Substance use	18.20	**20.51** **	16.03
Age 21 alcohol problems	40.81	**48.91*** **	34.02
School problems	26.96	28.15	25.85

Intimate partner violence and incarceration at Age 25 (Percentage)			
Sample size	*Full sample (n=2,884)*	*Males (n=1,394)*	*Females (n=1,490)*
Intimate partner violence			
Psychological aggression	16.99	13.15	**20.15*** **
Physical assault	8.52	6.25	**10.38*** **
Acts causing physical injury	2.99	2.98	3.00
Incarceration	3.50	**6.10*** **	1.07

Note. See measures section for definitions. SES = Socioeconomic Status. Statistically significant *p*-values shown in bold. ** $p < .01$, *** $p < .001$.

Sensitivity analyses: Antisocial behaviour (Ages 10-25). Prevalence estimates for the IYDS sample of different forms of antisocial behaviour at different points in the life-course (e.g., prevalence rates for any violence, arrests, late childhood to young adulthood) were weighted to the Victorian Census data (see Appendix 1). Rates for subtypes of antisocial behaviours varied considerably across age groups (refer Table 9, Appendix 1). Rates were low (less than 5%) among 10-12-year olds. Rates of acts intended to cause injury, theft, carrying prohibited or regulated weapons and public order offences were the behaviours with the highest prevalence (range 10-18%) among 13-17-year olds. The prevalence rate for theft increased steadily from age 13, peaking at age 15 (approximately 17%). Rates for all subtypes of antisocial behaviour were greater for males compared to females, with rates for males at least doubling that for females across most of behaviours. For males 14-17 years of age, the prevalence rate for acts intended to cause physical injury, carrying prohibited or regulated weapons, and public order offences exceeded 20%, compared to less than 10% for females. Notably, illicit drug use began to emerge for males from the age of 15 years, with rates approaching 5%.

Rates of most subtypes of antisocial behaviour appeared to peak between the ages of 18-21 before decreasing over the years between ages 23-25 (refer Table 10, Appendix 1). Across antisocial behaviour subtypes, rates of public order offences and intimate partner violence, in particular psychological aggression and physical assault, were highest among this age group (18-21 years). Rates of public order offences ranged from approximately 20-30% from ages 18-24, before decreasing to 12% at age 25 years. Rates of intimate partner violence were substantially higher with rates of psychological aggression over 50% at ages 18-19 years and greater than 60% across the remaining age groups. Rates of physical assault against a partner were at least 10% across most of age groups. For other antisocial behaviour subtypes rates of theft, fraud and deception remained steady at about 10% from ages 18-25, while rates of being cautioned by police and appearing in court were above 10% and 5% respectively, across the same age period. Again, rates across all antisocial behaviour subtypes were greater for males compared to females.

Aim 2: Modifiable risk factors for antisocial behaviour

Estimated effect sizes for modifiable risk factors.

In this project, estimated prevalence and longitudinal predictive effect sizes (in the form of odds ratios) for the modifiable risk factors described in Aim 1 were calculated using logistic regression analyses. The selected risk factors were explicitly selected because they are targeted by the evidence-based prevention approaches described in the project background/literature review section and examined in the return-on-investment analyses conducted in Aim 3.

Statistical analyses

Measures of association between family, individual, substance use and school-level risk factors at age 15 years and intimate partner violence and incarceration at age 25 were examined using hierarchical logistic regression analyses. A series of multivariate (hierarchical by each risk factor domain) logistic regression analyses (controlling for clustering of participants at recruitment) with robust standard errors were performed, controlling for participant age and gender. The analyses were structured to conduct the most conservative test possible of the impact of risk factors on intimate partner violence and incarceration outcomes (Tables 3 to 6). Logistic regression analyses were also conducted as part of the sensitivity analyses (see Appendix 2) to examine associations of family, individual, substance use and school-level risk factors at ages 11, 12 and 15 years and subtypes of antisocial behaviour at ages 18-25 (inclusive).

Results

Intimate partner violence. The findings of hierarchical logistic regression analyses investigating longitudinal risk factors at ages 15 and 21 for intimate partner violence at age 25 (psychological aggression, physical assault, and acts causing physical injury) are presented in Tables 3-5.

Intimate partner violence: Psychological aggression. Several modifiable risk factors showed statistically significant risk effects for later perpetration of psychologically aggressive behaviour towards ones' partner in young adulthood. The series of regression models show a pattern common in the developmental literature whereby early age risk factors are overshadowed in regression models that adjust for risk factors operating later in life. As shown in Table 3, Age 21 alcohol problems and school problems (that is, non-attendance at school through truant behaviour, or having been suspended or expelled from the school environment) in mid-adolescence predicted a significantly increased likelihood of young adult psychologically aggressive behaviour (by a factor of 1.5). Family risk factors that operate early in life, display of child behaviour problems (emerging in childhood) and adolescent substance use (including alcohol use) problems showed some statistically significant risk effects, however, following the inclusion of Age 21 alcohol problems and school problems (non-attendance and completion) (Model 6) these associations did not remain statistically significant.

TABLE 3. HIERARCHICAL LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS AT AGE 15 FOR INTIMATE PARTNER VIOLENCE (PSYCHOLOGICAL AGGRESSION) AT AGE 25 (N=2,884)

Risk factors	**Psychological aggression (OR, 95% CI)**					
Model	*1*	*2*	*3*	*4*	*5*	*6*
Cohort recruited in Year 7	1.25 [.97, 1.60]	1.28 [.98, 1.68]	1.27 [.96, 1.66]	1.28 [.98, 1.69]	**1.39* [1.05, 1.86]**	**1.37* [1.03, 1.84]**
Cohort recruited in Year 9	**1.44** [1.11, 1.88]**	**1.51** [1.15, 1.98]**	**1.48** [1.13, 1.94]**	**1.52** [1.15, 2.01]**	**1.48* [1.09, 2.00]**	**1.45* [1.07, 1.95]**
Urbanicity Middle cohort	.84 [.63, 1.11]	.87 [.65, 1.16]	.88 [.66, 1.17]	.87 [.66, 1.16]	.88 [.64, 1.20]	.88 [.64, 1.20]
Urbanicity Oldest cohort	1.02 [.80, 1.31]	.98 [.76, 1.26]	.99 [.77, 1.28]	.99 [.76, 1.28]	.95 [.72, 1.26]	.96 [.73, 1.26]
Socioeconomic inequality (low SES)	1.21 [.86, 1.70]	1.14 [.80, 1.63]	1.13 [.80, 1.61]	1.13 [.79, 1.61]	1.04 [.70, 1.54]	1.00 [.67, 1.49]
Family problems: Conflict and parenting		**1.91*** [1.52, 2.39]**	**1.69*** [1.34, 2.15]**	**1.59*** [1.24, 2.05]**	**1.46** [1.11, 1.93]**	1.33 [.99, 1.79]
Child behaviour problems			**1.54** [1.17, 2.01]**	**1.40* [1.06, 1.87]**	**1.42* [1.05, 1.92]**	1.22 [.88, 1.71]
Substance (including alcohol) use				1.31 [.99, 1.73]	**1.35* [1.01, 1.80]**	1.22 [.90, 1.66]
Age 21 alcohol problems					**1.34* [1.05, 1.69]**	**1.34* [1.06, 1.71]**
School problems						**1.61** [1.17, 2.22]**

Note. Analyses compared high risk versus low risk for socioeconomic inequality, family problems, child behaviour problems, substance (including alcohol) use, age 21 alcohol problems and school problems. The fully adjusted Model 6 controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female) – significantly increased risk for females not shown in Table. SES = socioeconomic status, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. *$p < .05$, **$p < .01$, ***$p < .001$.

Intimate partner violence: Physical assault. Table 4 presents the findings of hierarchical logistic regression analyses investigating longitudinal risk factors at age 15 for intimate partner violence at age 25 involving physical assault. In the fully adjusted model, two modifiable risk factor emerged as statistically significant predictors for physically assaulting ones' partner: family and school problems (Model 6). School problems (not attending school as a result of truancy, suspension or expulsion) increased the odds of this behaviour twofold. Similarly, to the findings for psychological aggression, family problems showed some statistically significant risk effects in partially adjusted models, however, following the inclusion of child behaviour problems, substance (including alcohol) use and Age 21 alcohol problems this association did not remain statistically significant in the final fully adjusted Model 6.

Intimate partner violence: Acts causing physical injury. The findings of hierarchical logistic regression analyses investigating longitudinal risk factors at age 15 for intimate partner violence at age 25 causing physical injury are presented in Table 5. Findings showed living in an urban environment (as opposed to a large/small town or rural environment) reduced the odds of causing injury to ones' partner by half, while school problems (not attending school as a result of truancy, suspension or expulsion) increased the odds of this behaviour twofold. As evident in other models of intimate partner violence, family problems displayed significant risk effects in partially adjusted models, however, did not remain so following the inclusion of child behaviour problems, substance (including alcohol) use and Age 21 alcohol problems.

TABLE 4. HIERARCHICAL LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS AT AGE 15 FOR INTIMATE PARTNER VIOLENCE (PHYSICAL ASSAULT) AT AGE 25 (N=2,884)

Risk factors	**Physical assault (OR, 95% CI)**					
Model	*1*	*2*	*3*	*4*	*5*	*6*
Cohort recruited in Year 7	1.18 [.83, 1.68]	1.24 [.87, 1.76]	1.23 [.86, 1.75]	1.21 [.85, 1.73]	1.26 [.87, 1.83]	1.27 [.87, 1.84]
Cohort recruited in Year 9	1.05 [.71, 1.54]	1.11 [.76, 1.64]	1.10 [.75, 1.61]	1.10 [.75, 1.61]	1.04 [.69, 1.58]	1.00 [.66, 1.52]
Urbanicity Middle cohort	.82 [.54, 1.24]	.81 [.54, 1.23]	.82 [.54, 1.24]	.83 [.55, 1.26]	.88 [.58, 1.34]	.88 [.58, 1.34]
Urbanicity Oldest cohort	.93 [.68, 1.28]	.86 [.63, 1.18]	.87 [.64, 1.19]	.88 [.64, 1.20]	.90 [.64, 1.26]	.93 [.66, 1.29]
Socioeconomic inequality (low SES)	1.31 [.84, 2.06]	1.22 [.76, 1.98]	1.21 [.75, 1.96]	1.21 [.75, 1.97]	1.11 [.64, 1.92]	1.02 [.58, 1.80]
Family problems: Conflict and parenting		**2.08*** [1.49, 2.91]**	**1.89*** [1.33, 2.68]**	**1.89** [1.31, 2.74]**	**1.88** [1.28, 2.74]**	**1.60* [1.06, 2.41]**
Child behaviour problems			1.41 [.95, 2.08]	1.41 [.92, 2.15]	1.40 [.90, 2.17]	1.09 [.68, 1.75]
Substance (including alcohol) use				1.01 [.655, 1.57]	.87 [.54, 1.38]	.73 [.45, 1.19]
Age 21 alcohol problems					1.32 [.96, 1.80]	1.34 [.97, 1.83]
School problems						**2.42*** [1.67, 3.52]**

Note. Analyses compared high risk versus low risk for socioeconomic inequality, family problems, child behaviour problems, substance (including alcohol) use, age 21 alcohol problems and school problems. The fully adjusted Model 6 controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female) – significantly increased risk for females not shown in Table. SES = socioeconomic status, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. *$p < .05$, **$p < .01$, ***$p < .001$.

TABLE 5. HIERARCHICAL LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS AT AGE 15 FOR INTIMATE PARTNER VIOLENCE (ACTS CAUSING PHYSICAL INJURY) AT AGE 25 (N=2,884)

Risk factors	**Acts causing physical injury (OR, 95% CI)**					
Model	*1*	*2*	*3*	*4*	*5*	*6*
Cohort recruited in Year 7	1.12 [.61, 2.05]	1.18 [.64, 2.18]	1.17 [.64, 2.16]	1.19 [.65, 2.19]	1.19 [.64, 2.20]	1.09 [.57, 2.09]
Cohort recruited in Year 9	1.12 [.62, 2.02]	1.19 [.65, 2.17]	1.18 [.65, 2.15]	1.20 [.66, 2.19]	1.03 [.55, 1.92]	.99 [.53, 1.83]
Urbanicity Middle cohort	.81 [.42, 1.55]	.78 [.41, 1.48]	.79 [.42, 1.49]	.78 [.41, 1.47]	.85 [.45, 1.61]	.90 [.48, 1.70]
Urbanicity Oldest cohort	**.50* [.26, .96]**	**.49* [.25, .94]**	**.49* [.26, .94]**	**.49* [.26, .94]**	**.45* [.23, .90]**	**.49* [.24, .98]**
Socioeconomic inequality (low SES)	1.29 [.60, 2.74]	1.30 [.60, 2.81]	1.30 [.60, 2.81]	1.29 [.60, 2.79]	.92 [.35, 2.44]	.73 [.25, 2.12]
Family problems: Conflict and parenting		**2.03** [1.29, 3.20]**	**1.84* [1.15, 2.94]**	**1.74* [1.04, 2.92]**	1.68 [.98, 2.90]	1.44 [.80, 2.59]
Child behaviour problems			1.39 [.77, 2.54]	1.29 [.71, 2.34]	1.30 [.69, 2.45]	1.01 [.52, 1.96]
Substance (including alcohol) use				1.25 [.68, 2.29]	1.16 [.61, 2.22]	.89 [.46, 1.72]
Age 21 alcohol problems					1.33 [.78, 2.26]	1.35 [.79, 2.29]
School problems						**2.36** [1.29, 4.32]**

Note. Analyses compared high risk versus low risk for socioeconomic inequality, family problems, child behaviour problems, substance (including alcohol) use, age 21 alcohol problems and school problems. The fully adjusted Model 6 controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female). SES = socioeconomic status, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. *$p < .05$, **$p < .01$, ***$p < .001$.

Incarceration. The findings of the hierarchical logistic regression analyses investigating longitudinal risk factors at age 15 for incarceration at age 25 are presented in Table 6. In partially adjusted analyses controlling for gender, age, cohort and urbanicity, risk for incarceration was increased by exposure to family problems, child behaviour problems and substance (including alcohol) use risk factors. Following the inclusion of Age 21 alcohol problems and school problems these early risk-based associations did not remain statistically significant. In the final fully adjusted Model (6) significant modifiable risk factors of, Age 21 alcohol problems and school problems (non-attendance) each increased risk for incarceration in young adulthood. Specifically, the risk for incarceration was tripled where young people reported having alcohol problems at age 21 and not attending school at age 15 years.

TABLE 6. HIERARCHICAL LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS AT AGE 15 FOR INCARCERATION AT AGE 25 (N=2,884).

Risk factors	**Incarceration (OR, 95% CI)**					
Model	*1*	*2*	*3*	*4*	*5*	*6*
Cohort recruited in Year 7	1.20 [.78, 1.84]	1.50 [.92, 2.45]	1.39 [.85, 2.27]	1.49 [.92, 2.43]	1.45 [.86, 2.45]	1.48 [.85, 2.58]
Cohort recruited in Year 9	.89 [.52, 1.52]	1.08 [.60, 1.94]	1.00 [.56, 1.80]	1.12 [.62, 2.03]	1.09 [.55, 2.17]	1.12 [.56, 2.24]
Urbanicity Middle cohort	.99 [.54, 1.84]	1.03 [.56, 1.91]	1.07 [.57, 2.03]	.97 [.52, 1.81]	.68 [.33, 1.37]	.63 [.31, 1.31]
Urbanicity Oldest cohort	1.30 [.87, 1.94]	1.35 [.88, 2.08]	1.43 [.92, 2.20]	1.38 [.89, 2.14]	1.10 [.68, 1.79]	1.06 [.63, 1.80]
Socioeconomic inequality (low SES)	1.34 [.71, 2.51]	1.26 [.60, 2.66]	1.19 [.56, 2.54]	1.20 [.57, 2.54]	1.88 [.85, 4.17]	1.85 [.80, 4.29]
Family problems: Conflict and parenting		**3.33*** [2.09, 5.30]**	**2.27** [1.33, 3.88]**	**1.90* [1.10, 3.27]**	1.57 [.84, 2.97]	1.15 [.60, 2.19]
Child behaviour problems			**3.08*** [1.95, 4.84]**	**2.29** [1.37, 3.85]**	**2.35** [1.32, 4.17]**	1.65 [.88, 3.08]
Substance (including alcohol) use				**2.20** [1.27, 3.81]**	**1.86* [1.03, 3.37]**	1.70 [.92, 3.16]
Age 21 alcohol problems					**3.17*** [1.84, 5.45]**	**3.29*** [1.92, 5.65]**
School problems						**3.19*** [1.76, 5.78]**

Note. Analyses compared high risk versus low risk for socioeconomic inequality, family problems, child behaviour problems, substance (including alcohol) use, age 21 alcohol problems and school problems. The fully adjusted Model 6 controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female) – significantly lower risk for females not shown in Table. SES = socioeconomic status, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. *$p < .05$, **$p < .01$, ***$p < .001$.

Sensitivity analyses: The effect of early and mid-adolescent risk factors on antisocial behaviour.

The sections that follow summarise sensitivity analyses reported in the Tables in Appendix 2. In overview these analyses confirmed that the effects in the main analyses reported above (Tables 3 to 6) were generally in a similar range (overlapping confidence intervals) to those at different ages.

The effects described below should be interpreted cautiously as they utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups. The variables reported in the Tables in Appendix 2 in some cases use different cut-points to the final regression analyses reported in Tables 3 to 6.

Multivariate logistic regression models investigating the influence of age 11, 12 and 15 risk factors on engagement in various subtypes of antisocial behaviour (intimate partner violence and incarceration) at age 23 were investigated (refer Appendix 2, Tables 11-14).

In the first set of analyses examining perpetration of psychologically aggressive behaviour, several age 11 risk factors displayed statistically significant effects for later perpetration of this behaviour (refer Table 11, Appendix 2). Specifically, family problems at age 11 were associated with a two-fold increase in the odds of psychological aggression at age 18. Display of child behaviour problems at age 11 was also a statistically significant risk factor for perpetration of psychologically aggressive behaviour, showing a two-fold increase in the risk of this behaviour, at age 21 years. No statistically significant associations were evident in the fully adjusted models predicting psychological aggression at ages 18-23 from age 12 or 15 risk factors; however, the included factors generally showed tendencies for increased engagement in this behaviour.

The findings for multivariate logistic regression models investigating age 11, 12 and 15 risk factors for the intimate partner violence subtype, physical assault, from ages 18 to 23 are presented in Table 12 (refer Appendix 2). Few risk factors assessed at age 11 showed statistically significant risk effects for engagement in this behaviour, except for child behaviour problems. Specifically, risk associated with this problem behaviour at age 11 increased the odds of physically assaulting ones' partner by over three times. No risk factors remained statistically significant in models of age 12 predictors.

Several risk factors at age 15 were associated with intimate partner violence (physical assault) at ages 18-19 and 21-22 in fully adjusted models. Family problems displayed the strongest and most consistent associations. Specifically, family problems at age 15 were associated with at least double the odds of physical assaulting ones' partner in the fully adjusted models for ages 19, 21 and 22. Child behaviour problems showed a risk effect for physical assault when included as a predictor at age 15, displaying a three-fold increase in this behaviour at age 18. Likewise, substance (including alcohol) use at age 15 doubled the likelihood of physically assaulting one's partner at age 21 years.

Few examined risk factors were statistically significant predictors in fully adjusted models examining intimate partner violence (acts causing physical injury; refer Table 13, Appendix 2). Family problems at age 12 were associated with a four-fold increase in risk for acts causing physical injury at age 23, and a six-fold increase in acts causing physical injury at age 19 when present at age 15 years. In other findings, child behaviour problems at age 11 increased risk for acts causing physical injury at age 20 six-fold, while school problems (non-

attendance) at age 15 increased risk for the same behaviour at age 21 by more than four times. No other age 11, 12 or 15 predictors remained statistically significant in models of age 18-23 acts causing physical injury.

Two associations were significant in predictive models for incarceration (refer Table 14, Appendix 2). Specifically, school problems (non-attendance) at age 11 years was associated with five times the risk of incarceration at age 18; while child behaviour problems at age 15 predicted almost an eight-fold increase in incarceration at age 21 years. There were no statistically significant age 12 risk factors predictive of later incarceration.

Aim 3: Return-on-investment

Estimated return-on-investment in Victoria a $150 million investment would have in a mix of 6 evidence-based strategies.

The risk factor estimates obtained from the analyses conducted in Aim 2 were used to estimate the reduction in incarceration and intimate partner violence achievable in the state of Victoria if $150 million was invested in a mix of the six previously described evidence-based prevention strategies (Nurse Family Partnership; Triple P Universal; Triple P level 4 groups, Tutoring by peers; Secondary School Age Alcohol Supply Reduction; and Brief Alcohol Screening and Intervention of College Students [BASICS]).

Analysis Steps

The analyses of the return-on investment included the following steps:

1. A review of the relevant program and policy literature and manuals was completed to identify the costs of implementing the 6 selected prevention programs that were selected due to their high-quality evidence for reducing pathways to crime in Australia as summarised in the introduction. Where possible we used Australian estimates and where these were not available we used the cost estimates reported by the Washington State Institute for public policy (Aos et al. 2012). For cost or benefit estimates in USD, costs/benefits were first converted to AUD in the reference year where costs/benefits were estimated using Purchasing Power Parity (PPP) (https://data.oecd.org). These values were then inflated to AUD in 2015 using the Australian health price deflator (Australian Institute of Health and Welfare 2015);
2. Based on a range of analyses completed in the IYDS, risk factors and prevention policies have been found to have equivalent longitudinal impacts for children in Victoria and Washington State. Hence, Aos et al. (2011) estimates of the effect of interventions in reducing risk factor effects were applied for Victoria. As described in the method section, we aligned the risk factor constructs Aos et al. (2011) evaluated to be reduced by each prevention strategy to match those measured in the IYDS allowing us to use the Aos et al estimates of the risk reduction achievable for each strategy. We used the regression odds ratio results from Table 4 (Model 6, Intimate Partner Violence with Physical Assault) and Table 6 (Model 6, incarceration) to establish the number of cases of Intimate Partner Violence and Incarceration caused by each risk factor in Victoria. We then used the Aos et al estimates to establish how much risk reduction was achievable for each prevention strategy;
3. Economic gains from each strategy were calculated based on the net benefit (benefit – cost) estimated for the 6 prevention strategies. We began by calculating the proportion of the at-risk Victorian population which could be covered with each prevention strategy. This allowed us to calculate the size of the population and hence the cost of exposing them to each prevention strategy. Costs were calculated by multiplying the total population to be covered by the cost per participant of each strategy and then adjusting coverage until we achieved an overall cost of around $150 million. The number of individuals with each risk factor was multiplied by the number covered by the risk reduction effect the relevant prevention strategy (adapted from Aos et al. 2011) to estimate the number of cases prevented. Additional economic gains from each strategy were estimated based on the per participant benefits gained by each strategy reported in (Aos et al. 2011) multiplied by the covered population; and

4. An assessment of the riskiness of the estimates were conducted by completing sensitivity analyses for risk estimates across different age groups and cohorts within the IYDS and by using the intervention risk estimates presented by (Aos et al. 2011).

The conduct of the return-on investment analysis is detailed below:

1. The IYDS risk factor prevalence estimates arising from Aim 1 (Table 7, Column A) were aligned to the specific prevention strategies listed in Column B (see Table 7). Apart from the Secondary School Age Alcohol Supply Reduction (SSAASR), the prevention strategies are as described by Aos et al. (2011; see Column B). SSAASR combines compliance checks for alcohol sales to underage youth (as described in Lee 2016) with brief behavioural communication to parents to discourage alcohol supply to adolescents (as described in Rowland et al. 2013).

2. The measures used to assess risk factors in longitudinal studies such as the IYDS are often the same measures used to evaluate the outcomes of prevention strategies (see Toumbourou et al. 2015). For the present analysis, risk factor constructs assessed in the IYDS were linked to the most closely aligned outcomes reported in the evaluations of the six prevention strategies (Lee, 2016). The rationale for these decisions is described below.

3. Column C in Table 7 presents the estimated risk factor reduction achievable for each prevention strategy, expressed as a Cox effect size (ES). The ES value of –0.04 for Nurse Family Partnerships was calculated by averaging the secondary participant (parent) reported outcomes for employment (ES 0.036), high school graduation (0.035), and reduced food assistance (–0.054; see www.wsipp.wa.gov/BenefitCost/Program/35). These outcomes were selected as they most closely aligned with the risk factor construct of parental socio-economic status assessed from parent-reported family income and education in the IYDS.

4. The ES value of –0.08 for Triple P Universal was calculated by averaging the effects for 'child abuse and neglect' (–0.050) and 'out-of-home placements' (–0.108; see www.wsipp.wa.gov/BenefitCost/Program/79). The risk construct assessed in the IYDS was age 15 adolescent self-reports of family conflict, poor child management, and history of antisocial behaviour.

5. The ES value of –0.13 for Triple P Level 4 averaged outcomes for 'disruptive behaviour disorder symptoms' assessed at first (–0.17) and second follow-up (–0.081; see www.wsipp.wa.gov/BenefitCost/Program). The risk construct assessed in the IYDS was age 15 self-reported antisocial behaviour (delinquency).

6. The ES value of –0.05 for SSAASR was informed by the Lee (2016) outcome estimates for compliance checks for alcohol sales to underage youth. The ES for 'Alcohol use in high school' was estimated as –0.243 (Lee 2016). This rate was discounted on the assumption that effects will be lower in Australia, where laws and norms prohibiting underage alcohol use tend to be weaker (Hemphill et al. 2011). The risk construct assessed in the IYDS was age 15 self-reported alcohol and drug use.

7. The ES value of –0.09 for Brief Alcohol Screening and Intervention of College Students (BASICS) averaged outcomes for 'Problem alcohol use' assessed at first (–0.166) and second follow-up (–0.023; see www.wsipp.wa.gov/BenefitCost/Program). The risk construct assessed in the IYDS was age 21 self-reported alcohol problems.

8. The ES value of –0.13 for Tutoring by Peers averaged outcomes for 'Test scores' assessed at first (–0.159) and second follow-up (–0.095; see www.wsipp.wa.gov/BenefitCost/Program). The risk construct assessed in the IYDS was age 15 self-reported school problems and low school commitment.

9. Column D (refer Table 7) presents the program costs per individual as reported in US dollars by Lee (2016) for all cases except for SSAASR. Lee (2016) reported the costs per participant as follows:

    - Nurse Family Partnerships—US$10,049;
    - Triple P Universal—US$150;
    - Triple P Level 4 groups—US$553;
    - Tutoring by Peers—US$114; and
    - Brief Alcohol Screening and Intervention of College Students (BASICS)—US$72.

    Australian cost estimates were sought for each of the prevention strategies, but they were not available in most cases and appeared conservative (lower estimates) in the cases where they were available. The US dollar costs were first converted to Australian dollars in the same year that the costs were reported and then inflated to 2016 Australian dollars using the Australian health price deflator.

10. The estimates for SSAASR were based on Australian pilot study costings of A$10,400 for 200 students. These costs are likely to be substantially lower per participant for scaled-up interventions.

11. Column E (refer Table 7) shows the proportion of the at-risk Victorian population that could be covered with each prevention strategy, given the overall budget. Adjusting the size of the population covered in Column E changed the overall cost of exposing the participants to each prevention strategy, presented in Column F (refer Table 7). A range of alternatives were examined prior to finalising.

12. The percentage reduction in the incarceration rate in the at-risk group after treatment (Column G; refer Table 7) was calculated as (E×R×PC)×100, where E is defined as in Table 7 above and R and PC are as defined below. R is the incarceration rate in the at-risk group = (K/((OR× A)+(1–A)))×OR), where K = the estimated proportion of the population incarcerated (0.035), OR = the Odds Ratio estimated for the relevant risk factor, and A is the proportion of the population exposed to the risk factor (from Column A).

13. PC is calculated by transforming the Cox effect size to a percentage change (as reported in Aos et al. 2011) using the formula ((EXP(C×1.65)×A) / (1 –A+A×EXP(C×1.65)) / (A–1), where A and C are as defined in Table 7. For example, the percentage reduction in the incarceration rate in the at-risk group after treatment was calculated for those exposed to low SES= –0.01%=(E×R×PC)×100 =(0.02×0.0597× –

0.096)×100, where E=0.02 (from Table 3); R=0.0597=0.035/((1.85× 0.1)+(1 – 0.1))× 1.85; and PC= –0.096=(EXP(–0.0417×1.65)×0.10)/(1–0.10+0.10×EXP(–0.0417×1.65))/(0.10–1)

14. The number of incarcerations prevented in 2015 is presented in Column H (refer Table 7). This was calculated using the formula H=A×G×P, where A and G are estimated as in Table 7 and P is the population of Victoria aged 20 to 29 in 2014 (n=870,686). For example, the percentage reduction in the number incarcerated (H) was calculated for those exposed to low SES=8=0.10×870,686× –0.01.

15. The percentage reduction in IPV with physical assault in the at-risk group (Column I; Table 7) was calculated in the same way as for incarceration (Column G) but substituting for K the estimated proportion of the population perpetrating IPV with physical force (0.85) and the OR for IPV. The number of IPV with physical assault incidents prevented in 2015 (Column J; Table 7) was calculated in the same way as for incarceration (Column H), but substituting I for G.

Results

Table 7 below presents the main parameters and results of the prevention strategies analysis. Analyses revealed the 10-year lag effect of having invested $150 million would have been an annual reduction of 1,624 cases of incarceration (5% reduction in the total Victorian youth population experiencing any incarceration) and 3,034 cases of intimate partner violence (4% annual reduction across the total Victorian youth population).

TABLE 7. REDUCED ANNUAL INCARCERATION AND INTIMATE PARTNER VIOLENCE (PHYSICAL ASSAULT) ACHIEVABLE THROUGH A $150 MILLION PREVENTION STRATEGY INVESTMENT

Risk Factor	A	B	C	D	E	F	G	H	I	J
Socioeconomic inequality (low SES)	0.10	Nurse Family Partnership	-0.04	$15,493	0.03	$34,599,870	-0.01%	8	-0.01%	12
Family problems	0.24	Triple P Universal	-0.08	$231	0.17	$34,229,805	-0.06%	132	-0.19%	404
Child behaviour problems	0.17	Triple P Level 4 groups	-0.13	$853	0.40	$51,190,177	-0.33%	499	-0.58%	876
Substance use	0.18	Secondary School Age Alcohol Supply Reduction (SSAASR)	-0.05	$53	0.30	$13,900,488	-0.10%	165	-0.13%	204
Age 21 alcohol problems	0.41	Brief Alcohol Screening and Intervention of College Students (BASICS)	-0.09	$111	0.24	$9,466,176	-0.13%	461	-0.22%	775
School problems	0.27	Tutoring by peers	-0.13	$176	0.15	$6,188,427	-0.15%	360	-0.33%	764
TOTAL INVESTMENT						$149,574,944		1,624		3,034

Note.

A = Estimated risk factor prevalence (based on IYDS analyses)
B = Prevention strategy
C = Estimated risk factor reduction due to prevention strategy (as a Cox effect size)
D = Program cost per individual
E = Proportion of young people at-risk and involved in the prevention strategy (with increased cover at given prevention investment in F)
F = Cost of delivering the prevention strategy to proportion E of the at-risk group
G = Reduction in incarceration in at-risk group
H = Number of incarcerations prevented in 2015
I = Reduction in rate of intimate partner violence with physical assault in at-risk group
J = Number of intimate partner violence with physical assault incidents prevented in 2015

Table 8 below presents an analysis of the estimated return on investment achievable through the prevention strategy investment listed in Table 7. The prevention strategies included: Nurse Family Partnerships, Triple P Positive Parenting Program, Tutoring by Peers, and the strategies to reduce alcohol availability, early age and heavy young adult use. The analysis in Table 8 is based on figures for economic returns on prevention strategy investments presented by Aos et al (2012) and does not include the returns achievable through the alcohol prevention strategies listed in Table 7. Economic gains or losses from each prevention strategy were calculated based on the net benefit (total benefit minus total cost) estimated for each of the six chosen prevention strategies. Overall costs and benefits for each chosen prevention strategy were estimated for the at-risk population covered (Table 4). Overall costs and benefits were calculated as the program cost/benefit per individual multiplied by the number in the population covered. Costs and benefits presented in Table 4 are lifetime costs and benefits per participant, valued in 2016 Australian dollars. Benefits accrued by others (non-taxpayers, victims or the community) were not included. In overview, we conservatively estimate that based on the implementation of the prevention strategies listed in Table 7, the net return on a $150 million prevention strategy investment would be $191 million. The implementation of these prevention strategies is also likely to reduce the non-monetised human suffering (e.g. the emergence and/or exacerbation of mental health problems) related to the lower number of incarcerations and reduced perpetration of intimate partner violence.

TABLE 8. RETURN ON INVESTMENT FOR THE PREVENTION STRATEGY INVESTMENTS LISTED IN TABLE 7

Prevention Strategy	Cost of the proportion coverage in Column E	Benefits achieved per participant	Total benefits/gains	ROI = (Total benefits - Total costs)/Total costs
Nurse Family Partnership	$34,599,870	$10,048.87	$22,442,228	-$0.35
Triple P Universal	$34,229,805	$596.64	$21,177,433	-$0.38
Triple P Level 4 groups	$51,190,177	$615.14	$36,934,685	-$0.28
Secondary School Age Alcohol Supply Reduction	$13,900,488	n/a	n/a	n/a
Tutoring by Peers	$9,466,176	$632.10	$53,904,614	$4.69
Brief Alcohol Screening and Intervention for College Students	$6,188,427	$5,868	$206,606,596	$32.39
TOTALS	**$149,574,944**		**$341,065,556**	
Net Benefit			**$191,490,612.61**	

Note: Adapted from Lee (2016). n/a: These problems are judged independent of the above causes, so no discount was added. Column E=Proportion of those at risk with increased cover at given cost in F. ROI=return on investment

Assessment of riskiness of the estimates

In overview, the return on investment estimates presented in the current report appear to have a low risk that they are inflated. Sensitivity analyses were completed for the rate estimates (as reported in earlier sections of this report) by comparing rates across different age periods. In summary, the young adult outcome age selected was a period of reducing violence. Official statistics suggest the twenties represent an age when incarcerations increase and hence represent a valuable period to focus prevention. Longitudinal risk estimates were also compared across different age groups and showed variation. The risk estimates selected at age 15 did not appear inflated. Aos et al. 2011 report the prevention strategies selected in the present report to have a high probability that they will at least break-even with the specific estimates: 89% for Nurse Family Partnership; 100% for Triple P Universal; 89% for Triple P Level 4 groups; 74% for Tutoring by peers; and 97% for Brief Alcohol Screening and Intervention for College Students (BASICS: Aos et al. 2012). We compared our estimated rates of incarceration to official data and note our rate for 1-day or more (1%) is in the upper range reported in Victoria (o.6%). Our rates capture periods in police lock up that are not included in official figures but are none-the-less costly and indicative of antisocial behaviour.

Discussion

Internationally antisocial behaviours, including violent offences such as causing injury to others and Intimate Partner Violence associated with physical assault examined here, are major health and social issues among adolescents and young adults. As one telling example of public concern the State of Victoria announced on the 18th April 2016 a package of $572 million over 2-years in response to recommendations made in the report by the state's Royal Commission into Family Violence. Finding effective ways to reduce the developmental pathways that lead to youth antisocial behaviour and Intimate Partner Violence is therefore essential. There is a detailed literature on the factors that predict engagement in antisocial behaviour (i.e., risk factors) and those that reduce the likelihood of engagement in antisocial behaviour (i.e., protective factors). Risk and protective factors can be arranged by the social context of the young person including peer group, family, school, community, and characteristics of the young person (Catalano et al. 1996). Multifaceted approaches that target these different contexts, for example 'Communities That Care' (Hawkins et al. 2002), are essential and have been shown to decrease adolescents' engagement in antisocial behaviour. Strategies addressing risk and protective factors that influence the development of antisocial behaviours may not only reduce the incidence of these behaviours but also have broader health, social and economic benefits.

This project is one of the first studies to use prospective cohort data and estimates of rates and predictors of antisocial behaviour from adolescence to young adulthood to forecast the potential outcomes of prevention strategy investment in Australia. Previous research has shown that specific risk factors from within the individual, family and school contexts, as well as early age alcohol and drug use, are associated with young adult violent behaviour and incarceration (e.g. Farrington et al. 2001; Holt et al. 2008; Jaffe et al. 2003; Jung et al. 2017; Toumbourou et al. 2013). The findings of this study are consistent with those of the prior research.

Prevalence of antisocial behaviours

This project is one of the first studies to use prospective cohort data estimates of rates and predictors of antisocial behaviour from adolescence to young adulthood as inputs into models forecasting the potential outcomes of prevention strategy investment in Australia. Findings from the sensitivity analyses examining rates of antisocial behaviours showed engagement in different forms of antisocial behaviour varied across developmental periods from early adolescence. Higher rates of all antisocial behaviours emerged at around 13 years of age, with approximately 1 in 10 adolescents reporting engaging in behaviours intended to cause physical injury and carrying prohibited/regulated weapons at this age. Public order offences and perpetration of Intimate Partner Violence (namely psychological aggression and physical assault) appeared to peak between the ages of 18-21 years. At our target age in the mid-twenties (age 25, range 21 to 29) we estimated 8.5% of youth in Victoria were perpetrators of Intimate Partner Violence associated with physical assault) and 3.5% had been incarcerated in the prior year.

Modifiable risk factors for antisocial behaviours

Our regression findings are consistent with previous evidence that specific risk factors at the level of the family, individual and school contexts, and early age alcohol use, are associated with young adult violent behaviour (Toumbourou et al. 2013), consistent with earlier studies (e.g. Farrington et al. 2001; Holt et al. 2008; Jaffe et al. 2003; Jung et al. 2017) and incarceration. We found evidence of a developmental staging of risk factors with exposure to socioeconomic disadvantage and related family problems/risk factors in late childhood and mid-late adolescence associated longitudinally with engagement in adolescent antisocial behaviour (child behaviour problems, substance use) culminating in school disengagement and young adult alcohol problems that were predictors of perpetration of intimate partner violence and incarceration in young adulthood.

Our regression findings supported prior evidence that higher levels of family problems (higher conflict, low parental monitoring and unclear family rules) were predictive of antisocial behaviours. These findings demonstrate the long-term impact adverse family environments can have on emotional and behavioural outcomes and underline the need for primary and secondary prevention programs that are effective in reducing one or more of these family risk factors and in reducing youth antisocial behaviour.

Not surprisingly, youths' display of child behaviour problems (conduct problems and engagement in crime) was predictive of intimate partner violence and incarceration. Other researchers (Hemphill et al. 2009; Herrenkohl et al. 2000; Jung et al. 2017) have reported similar associations. Our findings are consistent with many other existing studies suggesting that past behaviour is a reliable predictor of current behaviour, and the continuity across time of violent behaviour in particular (Farrington et al. 2000). An interesting finding in the sensitivity analysis in the present study is the fact that early age alcohol use was predictive of some antisocial behaviour, but not others. Early age alcohol use (including foetal alcohol symptoms) has been associated with impaired neurological development, increased early- and late-onset antisocial pathways and increased engagement in antisocial behaviour (Streissguth et al. 2004). Why early alcohol use was associated with some, but not other, forms of antisocial behaviour in this study remains an important area for further investigation.

Return-on-investment

Baseline data were obtained in the IYDS at average age 15 from a sample recruited to be state-representative of students in Victoria. Follow-up data were obtained at average age 25 in 2014/15. Based on the IYDS in 2014/15 for those aged 23 to 28 the average annual incarceration rate (any police or court apprehension) was estimated at 3.5% and involvement in Intimate Partner Violence causing physical injury was 3.0%.

Our investment model presented in Table 7 began in the early years with an expensive but important investment of $35 million to expand coverage of the Nurse Family Partnership model to an extra 2.0% of families in the highest decile of disadvantage. If this investment had been made in earlier years, it was estimated this would have directly contributed to preventing a modest 8 cases of incarceration but was estimated in Table 8 to have other important returns. The initial investment was followed by increased investments of $34 and $51 million in each of the two variants of Triple P and $14 million in Secondary School Age Alcohol Supply Reduction. Triple P was estimated to directly contribute to substantial reductions in incarcerations and intimate partner violence incidents.

Analyses revealed the total 10-year lag effect of having invested $150 million would have been an annual reduction of 1,624 cases of incarceration (5% reduction in the total Victorian youth population experiencing any incarceration) and 3,034 cases of intimate partner violence associated with physical assault (10% reduction across the total Victorian youth population). In addition to these estimated 1-year effects benefits would also be observed in each of the prior nine years and in subsequent years. The prevention strategy investment mix investigated in this report was: Nurse Family Partnership for low income ($35 M), Triple P Universal ($34 M), Triple P Level 4 groups ($51 M), Secondary School Age Alcohol Supply Reduction (SAASR; $14 M), Screening and brief intervention for alcohol problems in young adults ($7 M) and Tutoring by Peers ($9 M). Based on the two outcomes examined in this report, and projecting from US estimates, the net return from the $150 million investment in prevention strategies is conservatively estimated at $191 million. The net return reported in this report would be higher given that we did not include the benefits gained from the Secondary school age alcohol supply reduction strategy and the benefits accrued for non-participants in the cost-benefit analysis due to the limitations on data available within the time restrictions for preparing this report.

Comparing the returns of each of the six prevention strategies, it may be attractive to seek efficiencies by dropping strategies such as Nurse Family Partnership, which are costly and contribute to few cases being prevented. The philosophy of this study has been to retain this investment and to calculate whether it may have benefits beyond the crime prevention focus.

The current study has demonstrated that it is feasible to produce the crime prevention investment models shown here. Hence, it is recommended that the prevention strategies investment analysis demonstrated in the present project be further developed as a method for strategically planning crime prevention investment in Australia.

Study Strengths and Limitations

This study has several notable strengths. The longitudinal design and comprehensive measures enabled the study of a wide range of risk factors from early on in adolescence to be examined in their association with young adult engagement in antisocial behaviour. The recruited sample was state-representative at the commencement of the study in 2002, with strong retention over the study period. The survey administration method used from 2002-2015 was identical, enabling the comparison of rates of antisocial behaviour across a 13-year period and weighting to Victorian Census data.

Several study limitations are acknowledged. The measures of antisocial behaviour (e.g. intimate partner violence and incarceration) are based on self-report data. However, the survey measures have been found to be reliable and valid predictors for use with Victorian adolescents (Hemphill et al. 2011) and the estimated rate of long-term incarceration (1%) was within the range for official Victorian data for 2014 (0.6%). The present findings equate to consistent evidence that self-report in studies of preadolescents and adolescents is a reliable data source for behaviours (including antisocial behaviours) that may not readily observable, and the reliability of reporting is not likely to have changed over the study period (Rutter 1983). This study examined the prevalence of, and associations between early risk factors and subsequent antisocial behaviour. Research is also needed to investigate associations from early antisocial behaviour to subsequent risk factor exposure, as well as reciprocal relationships between antisocial behaviour and risk factors.

The estimates for intimate partner violence should be interpreted with caution. As noted earlier in this report, intimate partner violence perpetration and victimisation are highly intertwined, and the items comprising the Conflict Tactics Scale (CTS) do not consider the context in which intimate partner violence has occurred. The CTS is valid when compared against other observations of Intimate partner violence. However, in over 200 prior studies the CTS has consistently identified higher rates of female reporting of both IPV perpetration and victimisation (Straus et al 2012). The severity of the consequences of IPV are known to be greater for females who are commonly victims of perpetration from physically stronger males (State of Victoria 2016), and the results of our analyses are not dissimilar to previous studies (e.g. Sakar 2009). Given the recent Australian media coverage of family and domestic violence as well as the Royal Commission into Family Violence is also possible that females are more forthcoming about violence in their relationships as the consequences for revealing this to others are fewer because of the legal consequences and social stigma that exist for males.

Some limitations to the return-on-investment analysis apply. First, the cost and the benefit estimates applied here were adapted from US studies (Lee 2016). The estimates in this report were deliberately calculated to avoid overstating benefits relative to costs. Costs were calculated using the higher figures where more than one estimate was available. Benefits were calculated based on both Australian data and figures reported by Lee (2016), using the lowest estimate. The benefits of SSAASR were excluded due to limited data being available. Due to time and budget constraints associated with this project, collecting Australian resources for the return on investment estimates was beyond the scope of the present study. Future research is needed for further economic evaluation assessing the implementation of the prevention strategies listed in Table 7 within the Australian context.

A further potential limitation of this analysis is the possibility that diminishing returns may arise as the recommended prevention strategies are more widely implemented. After reflecting on this possibility, it is concluded that the benefits of the proposed level of investment would not be heavily curtailed due to diminishing returns. Firstly, the scale of investment proposed targets less than a third of the population. For example, the highest population coverage would be 30 percent for SSAASR. Secondly, each of the interventions has clearly specified guidelines for effective implementation. Hence, it should be feasible for the government to set performance contracts to guarantee that the modest risk factor reduction targets listed in Table 7 are measurably achieved to ensure the forecast population reductions in incarceration and intimate partner violence.

Due to time limitations, the current project sought only to demonstrate the feasibility of combining longitudinal cohort and prevention strategy investment data to model estimates of the potential return on specific investment in six prevention strategies. In addition, due to time restrictions, the current project modelled only a single investment strategy mix and did not attempt to compare a range of investment options to calculate an optimal investment mix. The current report is highly conservative in estimating effects for only 1-year on only two outcomes of incarceration and intimate partner violence associated with physical assault.

Recommendations

As the current project has demonstrated that it is feasible to produce the prevention investment models presented in Tables 7 and 8, it is recommended that the prevention strategies investment analysis demonstrated in the present project be further developed in consultation with the Washington State Institute for Public Policy as a method for strategically planning crime prevention investment in Victoria, Australia.

Conclusions

Adolescent antisocial behaviour is a significant social and public health issue. The findings of the present study demonstrate there are several modifiable risk factors for antisocial behaviour that could be targeted in early intervention and prevention programs to reduce the developmental pathways that lead to youth perpetration of intimate partner violence and incarceration. The results of the current study demonstrate the importance of targeting effective prevention programs at children and adolescents with family and school-based problems, as well as those who have previously engaged in substance use (including alcohol use) or other antisocial behaviour. The present analysis reveals there is sound data to perform return-on-investment analyses of crime prevention programs in Victoria. It is recommended that the prevention strategy investment analysis demonstrated in the present project be further developed for preventing intimate partner violence, while also reducing incarceration rates.

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Appendix 1

Sensitivity analyses: Weighted prevalence estimates for different forms of antisocial behaviours in the life-course

TABLE 9. WEIGHTED PREVALENCE RATES AND 95% CONFIDENCE INTERVALS (CI) FOR SUBTYPES OF ANTISOCIAL BEHAVIOUR OF PARTICIPANTS AGES 10-17 YEARS

Antisocial behaviour (%,95% CI) /Age (Years)	10	11	12	13	14	15	16	17
Full Sample								
Sample size	390	736	1,054	538	1,503	2,275	1,185	395
Acts intended to cause physical injury	8.54 (2.16, 28.27)	7.59 (4.02, 13.85)	4.69 (1.98, 10.71)	11.53 (5.38, 23.00)	12.02 (8.63, 16.50)	11.85 (9.51, 14.67)	10.74 (9.78. 14.29)	7.74 (4.66, 12.57)
Theft	.13 (.00, 5.51)	3.06 (1.36, 6.75)	4.97 (2.24, 10.67)	11.46 (5.13, 23.65)	13.37 (10.18, 17.37)	17.53 (14.26, 21.37)	16.01 (12.54,20.22)	14.57 (9.85, 21.02)
Illicit drug offences	-	-	.72 (.00, 26.17)	2.02 (.39, 9.84)	2.07 (.93, 4.54)	2.57 (1.57, 4.17)	2.37 (1.28, 4.33)	1.25 (.42, 3.61)
Prohibited/regulated weapons	5.40 (1.58, 16.87)	7.88 (4.15, 14.46)	5.96 (2.39, 14.11)	10.21 (3.82, 24.57)	12.69 (9.06, 17.49)	11.86 (9.44, 14.80)	9.44 (6.81, 12.94)	9.18 (5.77, 14.30)
Public order offences	-	-	.95 (.17, 5.16)	2.38 (.51, 10.36)	7.44 (4.96, 11.01)	6.02 (4.33, 8.31)	6.59 (4.74, 9.10)	18.39 (12.63, 26.00)
Arrest	-	.35 (.01, 17.30)	1.53 (.25, 8.84)	3.09 (.62, 13.93)	3.50 (1.81, 6.68)	2.17 (.91, 5.06)	9.54 (1.70, 39.22)	2.12 (.78, 5.59)
Appeared in court	-	-	-	-	-	.35 (.07, 1.73)	.92 (.02, 32.99)	2.02 (.74, 5.42)
Males								
Sample size	176	164	479	254	711	1,089	577	197
Acts intended to cause physical injury	26.24 (6.55, 64.36)	11.99 (647, 21.13)	8.78 (3.53, 20.22)	13.06 (4.45, 32.64)	20.38 (14.14, 28.46)	18.66 (14.58, 23.57)	19.34 (14.03, 26.06)	16.04 (9.74, 25.26)
Theft	.07 (.00, 5.88)	5.84 (1.73, 17.99)	4.68 (1.67, 12.47)	14.80 (5.25, 35.25)	10.74 (7.15, 15.82)	17.90 (13.43, 23.44)	17.44 (12.09, 24.50)	18.00 (10.87, 28.33)
Illicit drug offences	-	-	.01 (.00, .15)	1.26 (.09, 15.15)	2.31 (.88, 5.91)	4.30 (2.47, 7.40)	4.76 (2.49, 8.92)	4.67 (2.14, 9.90)
Prohibited/regulated weapons	15.85	30.41	13.02	20.94	21.56	20.68	20.43	15.21

	(4.60, 42.39)	(16.23, 49.64)	(4.71, 31.20)	(6.20, 51.48)	(14.65, 30.57)	(16.42, 25.71)	(15.19, 26.92)	(9.21, 24.09)
Public order offences	-	-	.74 (.09, 5.80)	5.67 (.99, 26.56)	9.23 (5.23, 15.78)	5.28 (3.11, 8.84)	7.73 (5.10, 11.57)	30.46 (21.61, 41.04)
Arrest	-	.01 (.00, 1.22)	.48 (.00, 17.00)	3.78 (.49, 23.74)	4.46 (1.91, 10.05)	2.04 (.64, 6.31)	7.02 (.44, 56.51)	5.83 (2.02, 15.63)
Appeared in court	-	-	-	-	-	.09 (.00, 1.68)	11.11 (.24, 86.53)	5.05 (1.53, 15.35)
Females								
Sample size	214	572	575	284	792	1,186	608	198
Acts intended to cause physical injury	1.39 (.08, 20.17)	6.61 (2.79, 14.87)	3.10 (.82, 11.05)	12.22 (3.79, 32.96)	7.12 (3.97, 12.46)	7.72 (5.13, 11.44)	5.34 (2.95, 9.45)	2.54 (.99, 6.35)
Theft	.30 (.00, 16.55)	2.73 (1.02, 7.13)	5.48 (1.95, 14.46)	8.61 (3.03, 22.14)	15.87 (10.46, 23.35)	17.20 (13.04, 22.36)	14.76 (10.55, 20.25)	11.45 (6.40, 19.66)
Illicit drug offences	-	-	5.32 (.66, 32.20)	3.28 (.35, 24.77)	2.47 (.67, 8.61)	1.73 (.72, 4.10)	1.06 (.29, 3.71)	.16 (.02, 1.36)
Prohibited/regulated weapons	1.79 (.05, 38.81)	4.02 (1.35, 11.38)	6.15 (1.78, 19.16)	5.37 (1.04, 23.53)	8.31 (4.67,14.38)	7.08 (4.71, 10.50)	3.68 (1.79, 7.40)	4.83 (1.97, 11.40)
Public order offences	-	-	1.14 (.12, 9.90)	.65 (.04, 10.31)	6.01 (3.11, 11.30)	6.82 (4.63, 9.92)	5.70 (3.56, 9.01)	10.46 (4.83, 21.18)
Arrest	-	1.98 (.15. 20.83)	3.12 (.49, 17.39)	2.63 (.20, 26.99)	3.49 (1.36, 8.63)	2.91 (.99, 8.21)	11.36 (1.20, 57.39)	.38 (.08, 1.80)
Appeared in court	-	-	-	-	-	.92 (.19, 4.37)	.16 (.00, 60.99)	.38 (.08, 1.80)

- = measure not available at the specified age group. Caution: The above estimates are sensitivity analyses that utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups.

TABLE 10. WEIGHTED PREVALENCE RATES AND 95% CONFIDENCE INTERVALS (CI) FOR SUBTYPES OF ANTISOCIAL BEHAVIOUR OF PARTICIPANTS AGES 18-25 YEARS

Antisocial behaviour (%,95% CI) /Age (Years)	18	19	20	21	22	23	24	25
Full sample								
Sample size	406	373	769	801	873	712	712	344
Acts intended to cause physical injury	11.80 (3.86, 30.88)	8.03 (4.88, 12.93)	9.96 (4.74, 16.74)	6.72 (4.32, 10.30)	8.37 (4.07, 16.44)	5.40 (3.32, 8.68)	13.05 (7.14, 22.64)	3.32 (1.44, 7.49)
Sexual assault	n/a	2.49 (.62, 9.46)	1.38 (.13, 12.81)	.18 (.00, 1.47)	.45 (.00, 18.48)	.46 (.07, 2.96)	1.29 (.12, 12.61)	1.04 (.14, 7.22)
Theft	17.56 (7.40, 36.22)	12.98 (8.66, 19.02)	7.95 (4.05, 15.02)	15.81 (11.92, 20.67)	10.98 (6.20, 18.71)	12.63 (9.05, 17.36)	12.39 (7.16, 20.59)	10.72 (5.88, 18.75)
Fraud/Deception	23.53 (11.67, 41.74)	12.71 (8.42, 18.73)	11.33 (6.28, 19.59)	9.24 (6.56, 12.87)	15.37 (9.31, 24.33)	13.07 (9.34, 17.97)	14.19 (8.31, 23.18)	11.76 (6.96, 19.16)
Illicit drug offences	9.28 (2.92, 25.81)	5.84 (3.28, 10.17)	7.39 (3.20, 16.17)	8.21 (5.54, 12.00)	6.53 (3.06, 13.40)	6.66 (4.38, 10.00)	12.19 (7.05, 20.27)	2.64 (.88, 7.64)
Prohibited/regulated weapons	5.91 (1.32, 22.78)	4.94 (2.32, 10.23)	4.96 (1.84, 12.66)	5.67 (3.46, 9.16)	6.00 (2.67, 12.93)	4.74 (2.81, 7.90)	5.79 (2.60, 12.37)	2.22 (.65, 7.23)
Property damage	13.94 (5.79, 29.92)	11.15 (7.14, 17.01)	11.65 (6.24, 20.72)	9.05 (6.32, 12.79)	13.71 (8.11, 22.25)	7.59 (5.01, 11.35)	11.92 (6.68, 20.38)	3.89 (1.56, 9.37)
Public order offences	30.31 (16.08, 49.68)	21.55 (15.75, 28.77)	16.84 (10.60, 25.70)	24.81 (19.82, 30.57)	24.86 (16.88, 35.02)	18.64 (14.33, 23.88)	29.95 (20.90, 40.89)	12.05 (7.26, 19.33)
Intimate partner violence								
Psychological aggression	52.08 (31.30, 72.16)	53.88 (42.60, 64.78)	61.96 (48.69, 73.67)	61.99 (54.59, 68.86)	74.71 (63.86, 83.17)	61.90 (54.36, 68.91)	79.63 (68.79, 87.40)	70.21 (59.75, 78.91)
Physical assault	8.39 (2.07, 28.39)	18.53 (10.76, 30.03)	14.22 (7.27, 25.96)	12.99 (8.93, 18.51)	11.02 (5.68, 20.30)	8.74 (5.66, 13.25)	18.40 (10.13, 31.08)	6.40 (2.85, 13.75)
Acts causing physical injury	3.27 (.31, 26.73)	8.48 (4.02, 16.99)	6.49 (1.96, 19.39)	3.18 (1.61, 6.16)	3.39 (.87, 12.32)	3.52 (1.68, 7.23)	3.47 (.99,11.40)	2.62 (.69, 9.45)

Incarceration	2.69 (.18, 29.37)	1.37 (.47, 3.92)	3.39 (1.30, 8.54)	2.32 (.97, 5.47)	1.40 (.17, 10.40)	2.15 (.65, 6.90)	13.16 (3.88, 36.24)	3.60 (.69, 16.80)
Cautioned by police	16.91 (5.48, 41.67)	12.67 (6.96, 21.94)	13.29 (6.79, 24.38)	19.02 (14.04, 25.24)	24.52 (15.18, 37.09)	10.34 (6.89, 15.23)	23.68 (14.30, 36.60)	10.07 (5.36, 18.13)
Charged by police	6.05 (1.54, 20.92)	3.35 (1.07, 10.06)	2.32 (.75, 6.95)	6.99 (4.23, 11.34)	12.69 (5.80, 25.55)	5.42 (2.80, 10.25)	8.45 (3.87, 17.46)	2.01 (.31, 12.04)
Appeared in court	6.05 (1.54, 20.92)	3.35 (1.07, 10.01)	1.52 (.41, 5.47)	6.10 (3.63, 10.10)	8.35 (3.28, 19.66)	5.12 (2.69, 9.52)	7.68 (3.32, 16.76)	1.75 (.35, 8.24)
Males								
Sample size	161	188	321	385	372	349	349	166
Acts intended to cause physical injury	16.33 (3.71, 49.72)	10.00 (5.23, 18.28)	28.21 (13.25, 50.27)	11.10 (6.72, 17.77)	18.90 (8.94, 35.61)	9.46 (5.49, 15.81)	23.25 (12.64, 38.80)	8.38 (3.55, 18.51)
Sexual assault	n/a	2.49 (.62, 9.46)	n/a	.27 (.00, 4.02)	.45 (.00, 18.48)	.43 (.02, 7.29)	2.15 (.11, 30.74)	n/a
Theft	12.95 (3.53, 37.66)	16.39 (9.64, 26.46)	12.95 (5.16, 28.91)	18.87 (12.86, 26.82)	9.76 (4.30, 20.68)	13.56 (8.44, 21.07)	15.68 (7.87, 28.80)	9.82 (4.10, 21.70)
Fraud/Deception	24.49 (8.00, 54.73)	17.39 (10.25, 27.95)	17.95 (8.18, 34.92)	14.44 (9.55, 21.24)	24.43 (13.55, 40.00)	13.95 (8.84, 21.33)	19.97 (10.81, 33.98)	18.35 (9.39, 32.76)
Illicit drug offences	8.07 (1.24, 38.09)	10.84 (5.74, 19.52)	18.94 (7.46, 40.37)	9.45 (5.77, 15.09)	9.03 (3.63, 20.72)	8.64 (5.05, 14.42)	19.39 (10.31, 33.48)	3.29 (.95, 10.79)
Prohibited/regulated weapons	29.21 (7.64, 67.29)	13.13 (6.94, 23.44)	12.60 (4.08, 32.86)	6.66 (3.58, 12.05)	11.48 (4.64, 25.67)	8.34 (4.52, 14.53)	9.23 (3.86, 20.50)	4.91 (1.58, 14.21)
Property damage	19.32 (6.36, 45.75)	16.32 (9.83, 25.88)	23.86 (11.69, 42.58)	15.02 (9.99, 21.95)	23.01 (12.94, 37.54)	15.11 (9.80, 22.57)	22.82 (12.92, 37.07)	8.80 (3.93, 18.55)
Public order offences	40.57 (18.26, 67.60)	32.95 (22.94, 44.78)	33.16 (19.61, 50.22)	35.06 (27.09, 43.96)	36.83 (24.39, 51.31)	30.89 (23.24, 39.74)	42.21 (29.33, 56.24)	28.44 (17.48, 42.71)
Intimate partner violence								
Psychological aggression	61.26 (24.58, 88.47)	49.51 (33.00, 66.12)	67.80 (47.39, 83.11)	53.21 (42.11, 64.01)	72.05 (54.51, 84.72)	56.81 (45.61, 67.36)	76.78 (60.26, 87.83)	63.42 (46.17,77.81)

Physical assault	8.44 (.44, 65.56)	20.13 (8.76, 39.81)	12.06 (3.75, 32.57)	7.79 (3.88, 15.04)	3.11 (.54, 15.92)	4.81 (1.95, 11.36)	15.03 (5.12, 36.73)	3.15 (.63, 14.32)
Acts causing physical injury	.18 (.02, 1.50)	10.26 (3.27, 27.87)	8.03 (1.34, 35.86)	2.32 (.83, 6.29)	4.53 (.54, 29.48)	2.76 (.82, 8.89)	3.29 (.51, 18.37)	.80 (.11, 5.67)
Incarceration	.93 (.10, 8.04)	1.66 (.45, 5.90)	19.47 (7.71, 41.14)	3.22 (1.24, 8.10)	3.57 (.30, 30.92)	2.15 (.65, 6.90)	13.16 (3.88, 36.24)	3.60 (.69, 16.80)
Cautioned by police	15.66 (2.56, 56.71)	21.02 (10.84, 36.81)	27.96 (13.06, 50.07)	22.18 (14.79, 31.87)	40.21 (23.04, 60.18)	19.75 (12.91, 29.01)	42.55 (26.09, 60.84)	29.36 (16.06, 47.46)
Charged by police	15.82 (1.79, 65.94)	7.37 (2.68, 18.70)	5.95 (1.57, 20.07)	8.67 (4.61, 15.71)	21.35 (8.02, 45.82)	7.56 (3.89, 14.17)	26.29 (12.66, 46.72)	5.16 (.99, 22.84)
Appeared in court	15.82 (1.79, 65.94)	7.37 (2.68, 18.70)	4.61 (1.06, 17.85)	8.16 (4.31, 14.91)	14.70 (4.43, 39.06)	7.45 (3.82, 14.05)	19.69 (8.65, 38.84)	4.95 (1.08, 19.85)
Females								
Sample size	245	185	448	416	501	363	363	178
Acts intended to cause physical injury	11.57 (2.27, 42.46)	6.98 (3.39, 13.82)	1.38 (.28, 6.65)	4.84 (2.24, 10.14)	4.05 (1.21, 12.65)	3.32 (1.38, 7.76)	6.28 (1.64, 21.21)	1.05 (.18, 5.89)
Sexual assault	n/a	n/a	1.38 (.13, 12.81)	.16 (.00, 1.15)	n/a	.54 (.06, 5.11)	.57 (.00, 24.04)	1.04 (.14, 7.22)
Theft	23.70 (7.74, 53.46)	9.80 (5.16, 17.81)	4.98 (1.88, 12.52)	13.56 (8.88, 20.17)	13.74 (6.33, 27.31)	11.95 (7.43, 18.68)	9.21 (3.69, 21.16)	13.68 (6.74, 25.80)
Fraud/Deception	23.02 (8.99, 47.51)	8.74 (4.54, 16.16)	7.70 (3.30, 16.98)	5.42 (2.93, 9.83)	9.55 (4.03, 20.97)	12.67 (7.66, 20.25)	8.72 (3.09, 22.27)	7.06 (2.99, 15.78)
Illicit drug offences	13.36 (3.70, 38.24)	2.37 (.70, 7.75)	1.89 (.43, 7.98)	8.61 (4.62, 15.51)	8.58 (3.05, 21.88)	5.59 (3.02, 10.11)	6.21 (2.26, 15.91)	5.05 (1.53, 15.41)
Prohibited/regulated weapons	.25 (.00, 74.48)	1.96 (.49, 7.47)	1.26 (.21, 7.20)	6.48 (3.10, 13.06)	4.67 (1.59, 12.94)	2.62 (1.01, 6.61)	4.03 (.90, 16.32)	2.42 (.58, 9.59)
Property damage	12.34 (3.19, 37.55)	7.58 (3.32, 16.39)	5.01 (1.63, 14.34)	5.76 (3.02, 10.71)	10.02 (4.07, 22.61)	3.79 (1.72, 8.16)	5.93 (1.70, 18.68)	3.52 (11.09, 10.77)
Public order offences	27.10	12.63	8.77	18.53	20.99	10.35	21.79	3.99

	(10.64, 53.70)	(7.28, 21.03)	(4.12, 17.71)	(12.67, 26.28)	(11.09, 36.15)	(6.33, 16.46)	(10.87, 38.87)	(1.40, 10.89)
Intimate partner violence								
Psychological aggression	48.34 (24.99, 72.43)	57.52 (42.37, 71.38)	56.48 (39.12, 72.39)	69.55 (59.87, 77.75)	76.37 (61.74, 86.62)	66.22 (55.98, 75.14)	81.83 (65.67, 91.28)	75.55 (62.49, 85.14)
Physical assault	10.66 (2.31, 37.59)	23.27 (13.32, 37.44)	16.05 (7.11, 32.30)	18.91 (12.44, 27.69)	18.05 (8.98, 32.95)	13.51 (8.45, 20.90)	23.34 (11.66, 41.27)	10.18 (4.13, 22.95)
Acts causing physical injury	6.13 (.50, 45.70)	7.13 (2.67, 17.69)	5.45 (1.09, 23.15)	4.32 (1.91, 9.45)	2.73 (.49, 13.85)	4.28 (1.68, 10.46)	3.71 (.68, 17.88)	5.74 (1.56, 18.96)
Incarceration	16.76 (2.93, 57.29)	1.15 (.20, 6.21)	n/a	1.62 (.31, 8.10)	1.25 (.30, 5.15)	n/a	n/a	n/a
Cautioned by police	17.67 (4.10, 51.83)	8.77 (2.99, 23.05)	6.66 (2.06, 19.47)	18.67 (11.85, 28.16)	16.16 (7.31, 32.03)	5.89 (2.88, 11.68)	11.47 (3.99, 28.77)	1.85 (.38, 8.58)
Charged by police	2.97 (.51, 15.45)	3.19 (.34, 24.19)	.95 (.13, 6.73)	7.56 (3.45, 15.78)	8.66 (2.55, 25.54)	9.28 (3.00, 25.28)	.08 (.00, 16.98)	8.96 (1.11, 46.34)
Appeared in court	2.97 (.51, 15.45)	3.19 (.34, 24.17)	.48 (.03, 6.56)	6.16 (2.75, 13.20)	5.42 (1.31, 19.83)	5.53 (1.76, 16.08)	.85 (.03, 19.78)	.95 (.13, 6.69)

n/a = insufficient sample size to calculate prevalence estimates. Caution: The above estimates are sensitivity analyses that utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups.

Appendix 2

Sensitivity analyses: Logistic regression models investigating longitudinal risk factors for intimate partner violence and incarceration in the life-course

TABLE 11. LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS FOR INTIMATE PARTNER VIOLENCE (PSYCHOLOGICAL AGGRESSION).

Age 11 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	248	123	316	317	317	317
Younger age	1.76 [.46, 6.71]	3.26 [.47, 202.70]	1.17 [.34, 4.02]	.54 [.16, 1.86]	**.24* [.07, .84]**	2.11 [.61, 7.24]
Family problems	**2.18* [1.09, 4.35]**	1.06 [.43, 2.61]	.99 [.54, 1.79]	.75 [.42, 1.32]	1.02 [.55, 1.87]	.85 [.48, 1.53]
Child behaviour problems	.92 [.38, 1.25]	1.17 [.32, 4.35]	1.67 [.70, 4.00]	**2.28* [1.01, 5.13]**	.73 [.34, 1.56]	.88 [.39, 1.99]
Younger age of first substance use	.76 [.39, 1.51]	-	1.40 [.75, 2.63]	1.28 [.71, 2.30]	1.26 [.68, 2.31]	.77 [.42, 1.40]
School problems	1.39 [.45, 4.28]	.92 [.21, 3.97]	.60 [.18, 2.01]	.41 [.12, 1.37]	1.79 [.46, 6.93]	.74 [.21, 2.61]
Low test scores/school completion	**.37** [.19, .72]**	1.73 [.67, 4.49]	.73 [.40, 1.32]	.67 [.38, 1.19]	.79 [.44, 1.43]	1.11 [.60, 2.04]
Age 12 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	248	123	316	317	317	317
Younger age	2.14 [.59, 772]	.13 [.02, 1.05]	1.62 [.47, 5.59]	1.46 [.47, 4.56]	.86 [.27, 2.76]	1.45 [.43, 5.12]
Family problems	1.43 [.74, 2.76]	1.48 [.45, 4.80]	.97 [.52, 1.83]	.83 [.45, 1.53]	.94 [.50, 1.76]	1.43 [.75, 2.73]
Child behaviour problems	1.36 [.55, 3.39]	.24 [.05, 1.13]	1.98 [.77, 5.11]	.97 [.42, 2.27]	.68 [.30, 1.55]	.83 [.36, 1.88]
Younger age of first substance use	.84 [.46, 1.53]	.53 [.22, 1.29]	1.45 [.82, 2.57]	1.24 [.71, 2.16]	1.20 [.69, 2.11]	.66 [.39, 1.12]
School problems	1.01 [.45, 2.27]	.89 [.23, 3.44]	.70 [.32, 1.52]	.73 [.34, 1.56]	1.30 [.58, 2.94]	1.12 [.49, 2.54]
Low test scores/school completion	.73 [.37, 1.44]	.73 [.23, 2.33]	.78 [.42, 1.46]	1.00 [.54, 1.84]	1.72 [.89, 3.31]	1.17 [.61, 2.24]
Age 15 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	248	123	316	317	317	317
Younger age	2.19 [.84, 5.67]	.76 [.18, 3.19]	.57 [.22, 1.47]	**.33* [.13, .83]**	1.08 [.42, 2.78]	1.76 [.67, 4.61]
Family problems	1.23 [.68, 2.25]	1.90 [.70, 5.16]	.69 [.38, 1.24]	1.06 [.58, 1.91]	1.35 [.72, 2.52]	.87 [.49, 1.54]
Child behaviour problems	1.27 [.68, 2.38]	.78 [.24, 2.47]	.87 [.47, 1.59]	1.15 [.63, 2.11]	1.20 [.65, 2.23]	1.37 [.75, 2.49]
Younger age of first substance use	.81 [.45, 1.48]	.58 [.24, 1.38]	1.52 [.86, 2.67]	1.29 [.76, 2.19]	1.19 [.68, 2.08]	.68 [.40, 1.15]
School problems	1.19 [.63, 2.25]	1.37 [.48, 3.91]	1.56 [.81, 2.97]	1.46 [.79, 2.70]	.57 [.32, 1.05]	.90 [.50, 1.62]

Low test scores/school completion	1.32 [.67, 2.62]	1.61 [.55, 4.73]	1.10 [.56, 2.16]	.84 [.45, 1.54]	1.19 [.62, 2.25]	.96 [.51, 1.80]

Note. Analyses compared high risk versus low risk for family-, individual-, substance use, and school-level risk factors. The fully adjusted model controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female); Child abuse and neglect/OHC placement (coded 0 no child abuse/neglect, 1 child abuse/neglect); Conduct problems and crime (coded 0 no problems/crime, 1 problems/crime); Younger age of first substance use (coded 0 no use, 1 use); School non-attendance (coded 0 attendance, 1 non-attendance); Low test scores/school completion (coded 0 high scores/completion, 1 low scores/completion). OHC = out-of-home care, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. $p < .05$. - = measure not available at the specified age group. Caution: The above are sensitivity analyses that utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups. The variables reported here use different cut-points and samples to the final regression analyses reported in Tables 3 to 6.

TABLE 12. LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS FOR INTIMATE PARTNER VIOLENCE (PHYSICAL ASSAULT).

Age 11 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	248	123	315	309	317	309
Younger age	3.50 [.41, 30.22]	.98 [.12, 8.20]	1.06 [.20, 5.61]	.37 [.08, 1.77]	.72 [.13, 3.84]	.34 [.06, 1.85]
Family problems	1.45 [.52. 4.06]	1.00 [.36, 2.79]	.53 [.22, 1.28]	1.22 [.54, 2.73]	.92 [.43, 1.94]	.55 [.20, 1.47]
Child behaviour problems	2.81 [.83, 9.47]	.99 [.27, 3.54]	**3.58** [1.41, 9.04]**	1.16 [.46, 2.95]	.68 [.19, 2.35]	1.79 [.65, 4.96]
Younger age of first substance use	.65 [.22, 1.95]	-	.83 [.34, 2.02]	1.87 [.89, 3.94]	1.84 [.84, 4.00]	.96 [.36, 2.40]
School problems	1.12 [.20, 6.11]	1.20 [.28, 5.24]	1.58 [.40, 6.27]	.71 [.16, 3.18]	1.74 [.40, 7.59]	.58 [.07, 4.59]
Low test scores/school completion	.42 [.11, 1.55]	.88 [.32, 2.45]	.65 [.28, 1.53]	.93 [.41, 2.09]	.82 [.34, 1.96]	.68 [.28, 1.67]
Age 12 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	248	123	315	317	317	317
Younger age	.92 [.18, 4.66]	.20 [.03, 1.43]	2.47 [.45, 13.42]	1.47 [.31, 6.84]	1.31 [.21, 8.00]	1.53 [.29, 8.02]
Family problems	.50 [.18, 1.38]	.54 [.12, 2.44]	1.29 [.56, 2.95]	1.34 [.62, 2.91]	.78 [.31, 1.97]	1.80 [.82, 3.94]
Child behaviour problems	1.12 [.26, 4.79]	1.30 [.26, 6.58]	.84 [.25, 2.77]	.44 [.11, 1.76]	.38 [.09, 1.60]	1.49 [.54, 4.07]
Younger age of first substance use	.98 [.39, 2.48]	.96 [.36, 2.56]	1.00 [.48, 2.09]	1.97 [.97, 3.98]	1.69 [.84, 3.42]	.84 [.37, 1.90]
School problems	1.83 [.57, 5.84]	1.32 [.38, 4.63]	1.86 [.71, 4.91]	2.52 [.91, 6.99]	1.22 [.44, 3.42]	2.50 [.96, 6.53]
Low test scores/school completion	.66 [.23, 1.95]	.43 [.12, 1.59]	.84 [.38, 1.86]	.83 [.37, 1.86]	1.11 [.46, 2.68]	.68 [.28, 1.62]
Age 15 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	248	123	315	317	317	317
Younger age	3.36 [.71, 15.80]	.99 [.21, 4.69]	1.07 [.29, 3.93]	.74 [.18, 3.12]	1.85 [.48, 7.19]	.54 [.14, 2.08]
Family problems	**.19* [.05, .69]**	3.53* [1.31, 9.46]	.99 [.45, 2.17]	**2.70* [1.25, 5.83]**	**2.48* [1.15, 5.35]**	1.05 [.49, 2.26]
Child behaviour problems	**3.54* [1.31, 9.60]**	.35 [.10, 1.15]	1.09 [.45, 2.66]	**.30* [.12, .79]**	1.09 [.49, 2.42]	1.26 [.55, 2.89]
Younger age of first substance use	.80 [.31, 2.06]	.80 [.31, 2.06]	1.04 [.51, 2.14]	**2.05* [1.01, 4.17]**	1.63 [.81, 3.29]	.91 [.41, 2.06]
School problems	1.28 [.47, 3.49]	1.00 [.34, 3.00]	.92 [.37, 2.25]	1.05 [.43, 2.54]	.93 [.40, 2.14]	.96 [.39, 2.37]

Low test scores/school completion	.25 [.06, 1.17]	1.13 [.35, 3.65]	.54 [.22, 1.33]	.80 [.30, 2.08]	.72 [.29, 1.99]	.50 [.18, 1.43]

Note. Analyses compared high risk versus low risk for family-, individual-, substance use, and school-level risk factors. The fully adjusted model controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female); Child abuse and neglect/OHC placement (coded 0 no child abuse/neglect, 1 child abuse/neglect); Conduct problems and crime (coded 0 no problems/crime, 1 problems/crime); Younger age of first substance use (coded 0 no use, 1 use); School non-attendance (coded 0 attendance, 1 non-attendance); Low test scores/school completion (coded 0 high scores/completion, 1 low scores/completion). OHC = out-of-home care, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. $p < .05$; $^{**}p < .01$. - = measure not available at the specified age group, Caution: The above are sensitivity analyses that utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups. The variables reported here use different cut-points and samples to the final regression analyses reported in Tables 3 to 6.

TABLE 13. LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS FOR INTIMATE PARTNER VIOLENCE (ACTS CAUSING PHYSICAL INJURY).

Age 11 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	183	101	302	230	230	303
Younger age	.16 [.004, 6.08]	8.96 [.14, 585.06]	1.07 [.03, 35.38]	1.05 [.08, 14.22]	1.23 [.02, 63.58]	.86 [.10, 7.46]
Family problems	1.27 [.22, 7.30]	.84 [.14, 5.02]	.86 [.17, 4.37]	.39 [.05, 3.40]	.68 [.09, 5.09]	.94 [.24, 3.74]
Child behaviour problems	1.80 [.21, 15.24]	-	**5.22* [1.04, 26.08]**	1.26 [.13, 11.92]	2.18 [.21, 22.83]	.69 [.08, 5.95]
Younger age of first substance use	-	-	.18 [.02, 1.91]	-	-	.47 [.09, 2.45]
School problems	-	-	-	-	-	-
Low test scores/school completion	1.10 [.24, 5.06]	1.68 [.35, 8.08]	1.34 [.34, 5.26]	1.47 [.34, 6.28]	1.46 [.27, 7.92]	1.01 [.27, 3.70]
Age 12 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	161	115	300	202	202	317
Younger age	.64 [.05, 7.81]	**.02* [.001, .87]**	.40 [.03, 4.71]	.69 [.06, 8.41]	28.42 [.28, 2855.51	9.91 [.72, 135.77]
Family problems	.45 [.06, 3.54]	1.72 [.30, 9.79]	1.67 [.34, 8.11]	-	.64 [.10, 4.03]	**4.09* [1.33, 12.58]**
Child behaviour problems	3.26 [.48, 22.22]	2.19 [.06, 80.38]	.68 [.05, 8.63]	-	-	1.45 [.53, 4.01]
Younger age of first substance use	-	1.24 [.31, 5.00]	.26 [.03, 2.17]	-	-	.33 [.07, 1.65]
School problems	-	.59 [.02, 20.96]	.61 [.07, 5.13]	**4.56* [1.17, 17.80]**	2.52 [.54, 11.76]	.71 [.20, 2.52]
Low test scores/school completion	1.20 [.16, 9.11]	.24 [.01, 8.11]	1.47 [.43, 4.94]	.25 [.04, 1.71]	2.30 [.57, 9.33]	.78 [.26, 2.31]
Age 15 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	187	107	316	234	199	317
Younger age	8.74 [.54, 140.70]	.62 [.05, 7.83]	1.13 [.10, 13.07]	3.84 [.32, 46.32]	2.85 [.16, 50.94]	2.10 [.29, 15.03]
Family problems	.86 [.17, 4.47]	**6.35* [1.60, 25.20]**	-	2.84 [.72, 11.21]	3.48 [.81, 15.06]	.68 [.12, 3.87]
Child behaviour problems	.81 [.09, 7.26]	**.19* [.04, 1.00]**	1.74 [.45, 6.71]	.53 [.06, 4.61]	.34 [.08, 1.49]	.25 [.03, 2.00]
Younger age of first substance use	-	1.69 [.34, 8.40]	.28 [.04, 1.94]	-	-	.41 [.09, 1.92]
School problems	1.74 [.28, 10.89]	.30 [.01, 6.21]	1.36 [.35, 5.26]	.97 [.15, 6.10]	.36 [.10, 1.31]	.69 [.13, 3.53]

Low test scores/school completion	-	1.11 [.13, 9.78]	.42 [.06, 2.95]	.29 [.04, 2.31]	.52 [.11, 2.52]	.33 [.03, 3.57]

Note. Analyses compared high risk versus low risk for family-, individual-, substance use, and school-level risk factors. The fully adjusted model controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female); Child abuse and neglect/OHC placement (coded 0 no child abuse/neglect, 1 child abuse/neglect); Conduct problems and crime (coded 0 no problems/crime, 1 problems/crime); Younger age of first substance use (coded 0 no use, 1 use); School non-attendance (coded 0 attendance, 1 non-attendance); Low test scores/school completion (coded 0 high scores/completion, 1 low scores/completion). OHC = out-of-home care, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. $p < .05$. - = measure not available at the specified age group. Caution: The above are sensitivity analyses that utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups. The variables reported here use different cut-points and samples to the final regression analyses reported in Tables 3 to 6.

TABLE 14. LOGISTIC REGRESSION MODELS INVESTIGATING LONGITUDINAL RISK FACTORS FOR INCARCERATION.

Age 11 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	240	82	269	310	54	303
Younger age	.60 [.03, 13.67]	28.90 [.12, 674.47]	**.01* [.00, .40]**	**.02* [.00, .73]**	-	10.90 [.13, 933.48]
Family problems	.53 [.17, 1.70]	4.56 [.57, 36.49]	3.09 [.65, 14.75]	1.29 [.34, 4.88]	2.18 [.20, 24.07]	1.96 [.49, 7.94]
Child behaviour problems	2.12 [.95, 4.74]	-	-	.55 [.13, 2.29]	-	1.00 [.15, 6.53]
Younger age of first substance use	**.37** [.18, .73]**	-	2.48 [.30, 20.48]	.98 [.20, 4.86]	-	1.70 [.40, 7.25]
School problems	5.68* [1.24, 26.01]	-	-	4.01 [.87, 18.39]	-	-
Low test scores/school completion	.68 [.18, 2.61]	.72 [.09, 5.47]	-	1.73 [.28, 10.64]	-	.45 [.07, 2.82]
Age 12 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	199	78	48	258	70	258
Younger age	4.70 [.05, 482.20]	2.19 [.22, 21.46]	-	9.23 [.13, 635.44]	1.00 [.15, 6.49]	.88 [05, 15.54]
Family problems	4.28 [.94, 19.59]	-	-	1.04 [.13, 8.60]	2.46 [.21, 29.47]	.74 [.07, 7.46]
Child behaviour problems	-	-	-	-	-	-
Younger age of first substance use	-	-	3.06 [.16, 57.27]	1.37 [.25, 7.34]	-	1.69 [.36, 7.99]
School problems	.49 [.05, 4.80]	1.77 [.17, 18.65]	-	-	-	-
Low test scores/school completion	2.04 [.44, 9.37]	5.64 [.57, 55.50]	-	-	5.39 [.30, 97.13]	-
Age 15 Risk factors /Age (Years)	18	19	20	21	22	23
	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)	(OR, 95% CI)
Sample size	212	70	316	317	48	317
Younger age	1.08 [.03, 34.49]	.09 [.00, 3.02]	1.40 [.16, 12.40]	.22 [.01, 7.14]	-	8.99 [.72, 111.86]
Family problems	.44 [.06, 3.34]	-	-	.88 [.19, 4.01]	-	2.30 [.72, 7.31]
Child behaviour problems	5.06 [.87, 29.65]	-	2.49 [.35, 17.87]	**7.63* [1.37, 42.46]**	-	2.45 [.65, 9.27]
Younger age of first substance use	.53 [.04, 6.58]	-	3.16 [.27, 37.57]	1.49 [.26, 8.49]	-	1.48 [.32, 6.89]
School problems	.31 [.03, 3.32]	3.36 [.26, 43.33]	4.20 [.64, 27.50]	.73 [.14, 3.96]	-	.22 [.04, 1.17]

Low test scores/school completion	.79 [.12, 5.32]	-	-	.52 [.07, 4.01]	-	.43 [.08, 2.31]

Note. Analyses compared high risk versus low risk for family-, individual-, substance use, and school-level risk factors. The fully adjusted model controlled for the following variables measured at age 15: age and gender. Gender (coded 0 male, 1 female); Child abuse and neglect/OHC placement (coded 0 no child abuse/neglect, 1 child abuse/neglect); Conduct problems and crime (coded 0 no problems/crime, 1 problems/crime); Younger age of first substance use (coded 0 no use, 1 use); School non-attendance (coded 0 attendance, 1 non-attendance); Low test scores/school completion (coded 0 high scores/completion, 1 low scores/completion). OHC = out-of-home care, OR = odds ratio, CI = confidence interval. Statistically significant *p*-values shown in bold. $p < .05$; $^{**}p < .01$. - = measure not available at the specified age group. Caution: The above are sensitivity analyses that utilise small and opportunistic samples available in age groups at the time of resurvey and hence may not be representative of Victorian state rates in these age groups. The variables reported here use different cut-points and samples to the final regression analyses reported in Tables 3 to 6.