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Risk and protective factors for adolescent substance use in Washington State, United States and Victoria, Australia: A longitudinal study

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Abstract

Purpose—Compare the levels of risk and protective factors and the predictive influence of these factors on alcohol, tobacco and cannabis use over a 12-month follow-up period in Washington State in the United States and Victoria, Australia.

Method—Longitudinal school-based survey of students drawn as a 2-stage cluster sample recruited through schools, and administered in 2002 and 2003 in both states. The study uses state-wide representative samples of students in Grades 7 and 9 ($N = 3876$) in Washington State and Victoria.

Results—Washington State students relative to Victorian students had higher rates of cannabis use but lower rates of alcohol and tobacco use at time 1. Levels of risk and protective factors showed few but important differences that contribute to the explanation of differences in substance

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use; Washington State students relative to Victorian students reported higher religiosity (Odds ratio [OR] 0.96 vs. 0.79) and availability of handguns (OR 1.23 vs. 1.18), but less favorable peer, community and parent attitudes to substance use. The associations with substance use at follow-up are generally comparable, but in many instances were weaker in Washington State.

Conclusions—Levels of risk and protective factors and their associations with substance use at follow-up were mostly similar in the two states. Further high quality longitudinal studies to establish invariance in the relations between risk and protective factors and substance use in adolescence across diverse countries are warranted.

Keywords

adolescence; substance use; cross-national comparison; longitudinal study; risk factors; protective factors

Introduction

Adolescence is a peak period for the initiation and use of alcohol and other drugs. Rates of adolescent substance use are high in many Western countries including Australia and the United States (US) [1-2]. Recent Australian data shows 26% of adolescents aged 14-19 are at risk for short-term harms arising from high alcohol use (including hospitalisation, physical injury), 10% of adolescents currently smoke, and 16% of adolescents used an illicit drug in the previous 12 months [3]. In the US, approximately 16% of 8th Grade students consumed alcohol, 5% had been drunk, 7% smoked tobacco, and 6% used cannabis [4]. Developmental research shows that adolescent substance misuse can result in immediate and long-term health and behavioral problems [5-6], in particular substance dependence [7-8], mental and physical health problems, and disruption to family and social relationships [9].

Risk factors are prospective predictors that increase the likelihood that an individual or group will engage in adverse outcomes [10-11]. *Protective factors* are both hypothesized to directly decrease the likelihood of adverse outcomes [12] and to mediate or moderate the influence of risk factors [13]. Risk and protective factors related to substance use are organized according to their influence in different contexts including communities (e.g., legal and normative expectations for behavior, indicators of neighbourhood disorganization) [10, 14], families (e.g., family history of antisocial behavior, unclear family rules, low monitoring of adolescent's behavior) [15-16], schools (e.g., low interest in subjects, academic failure) [17-18], peer groups (e.g., association with antisocial peers) [19-20], and within individuals (e.g., lack of impulse control) [10, 21]. Protective factors at the family, school and community levels include opportunities to engage in prosocial activities (e.g., sport, community groups, input into school activities and rules) and recognition for prosocial involvement as well as attachment, and healthy beliefs and clear standards [15, 22]. Studies have investigated risk and protective factors for specific substances and across substances [e.g. 23]. A few studies have examined associations between these factors and adolescent substance use across countries [24-27].

Cross-national studies can make an important contribution to knowledge of adolescent substance use; such studies identify differences in substance use trends, and risk and protective factors underpinning these differences, as well as investigate differences within the countries' policy approaches [28]. A major limitation of current cross-national comparisons of adolescent substance use is the opportunistic use of existing data in each country rather than planning for a study design using common methodology. Without this type of planning, methodological inconsistencies across countries may be the source of similarities and differences in prevalence and prediction rather than underlying patterns in the countries [28].

The current paper builds on existing research to examine associations between risk and protective factors and substance use measured 12 months later in Washington State, US and Victoria, Australia from students participating in the International Youth Development Study (IYDS). These two states were chosen for their similarities on population socio-demographic characteristics [27] yet different substance use policies that may be related to differences in substance use. US policies can be characterised as zero tolerance and abstinence-focused [29] whereas Australian policies focus on harm reduction or harm minimisation (including abstinence) to reduce the health, social, and economic consequences of substance use for the individual and the community [30-31]. The IYDS is unique in using exactly the same study methodology across the two states. This paper addresses two research questions:

1. Are there state differences in levels of risk and protective factors?
2. Are there state differences in the association between risk and protective factors and alcohol, tobacco and cannabis use measures 12-months later? Consistent with previous findings, we expect exposure to risk and protective factors in Victoria and Washington State to be similar with differences related to more favorable attitudes to substance use given the policy differences [24]. For associations between time 1 risk and protective factors and substance use at 12-month follow-up, we anticipate few differences between the two states [24].

Method

Participants

The IYDS employed a two-stage cluster sampling approach in 2002. To obtain statewide representative samples in Victoria and Washington State, in the first stage of sampling, public and private schools containing students in Grades 5, 7 and 9, within each state and grade level, were randomly selected using a probability proportionate to grade-level size sampling procedure [32]. The second sampling stage employed random selection of one class within each school [27]. Further details on school recruitment have been described previously [27].

Written parental consent was obtained, and students provided assent to participate in the study on the day of the survey. Across the three grade levels (5, 7 and 9), classes in Washington State yielded a total of 3856 eligible students, of whom 2885 (74.8%) consented to and participated in the survey. In Victoria, 3926 students were eligible to participate, of whom 2884 (73.5%) consented and participated. Ninety-nine percent of students in both states participated in the follow-up survey. The current paper reports on 3876 students in Grades 7 and 9 in both states across a 12-month period (time 1 and 2). Table 1 summarises the sample characteristics.

Procedures

Ethics approval was obtained from the University of Washington Human Subjects Review Committee, and the Royal Children's Hospital Ethics in Human Research Committee in Victoria, Australia. Permission to conduct research in schools in Washington State was obtained from the school districts containing sampled schools and then from principals. In Victoria permission to conduct research in schools was granted by the Department of Education and Training for government (public) schools, and the Catholic Education Office for some private schools, and then by school principals.

The surveys were administered in 2002 and again in 2003. To ensure seasonal equivalence, surveys were conducted from February to June in Washington State and from May to

November in Victoria. Study staff in both states were trained using a single survey administration protocol. Surveys were group-administered within students' classrooms, during an average 50-60 minute period. When students were absent on the day of survey administration, these surveys were conducted later by trained school personnel. In a small percentage of cases (< 4% at each time-point) study staff conducted the survey by telephone. Upon survey completion in 2002 and 2003 students in Washington State received \$10. Students in Victoria received a small thank-you gift (a pocket calculator in 2002 and a stress ball in 2003).

Instruments

Self-report measures of substance use and risk and protective factors were drawn from a modified version of the *Communities That Care* (CTC) survey [33]. The survey displays good reliability and cross-sectional validity with large US samples of students in Grades 6-12 [33]. The same survey has been piloted and administered in Victoria [34]. The items in the survey assessing current alcohol, tobacco, and cannabis use were adapted from the *Monitoring the Future* survey [35].

Substance use—*Current alcohol use* was measured at both time-points by asking students how many times in the past 30 days they had consumed more than a sip or two of an alcohol beverage. Response options were on an 8-point scale ranging from 'Never', to '40 or more times'. *Current tobacco use and cannabis use* was assessed at both surveys by asking students how frequently they had smoked cigarettes/used cannabis in the past 30 days. Response options for both tobacco use and cannabis use were rated on a 6-point scale ('Not at all', 'Less than 1 per day' through to '40 or more per day'. The distribution of scores on substance use measures was skewed. Hence, scores on these items were recoded to form single dichotomous measures of no recent use (0) and any use in the past 30 days (1).

Risk and protective factors—The summary statistics for the 31 risk and protective factor scales measured at time 1 are presented in Table 2. Across all measures, higher scores reflect higher levels of risk or protection. Response options on most risk and protective factors range from 1 to 4.

Student honesty

Items were included to assess whether or not students answered the survey questions honestly. Students were categorised as dishonest if they reported any of the following: a) that they were *not honest at all* when filling out the survey); b) using a fake drug in their lifetime or in the past 30 days; or c) using illicit drugs on more than 120 occasions in the past 30 days. A single, dichotomous measure of honesty was calculated using these items. The few students (17 at time 1, 35 at time 2, and 6 at both time-points) who met the criteria for dishonesty were excluded from analysis.

Statistical Analyses

Data for a total of 3876 students in Grades 7 and 9 in both states were analysed using STATA IC software for Windows, version 10 [36]. There were three steps in the analyses. First, cross-state prevalence estimates were calculated for current alcohol, tobacco, and cannabis use at each time-point. Separate logistic regression analyses for each grade level were conducted for males and females to test for state differences in prevalence estimates by regressing state and age on each substance use outcome. Prevalence estimates and 95% confidence intervals (CI) were derived from logistic regression models' predicted values, after fixing the continuous measure of age at the average age for each grade level (i.e., at time 1, 13 and 15 years for seventh, and ninth grades, respectively). Analyses accounted for

clustering of students within schools and the sampling design. Sample weights were calculated separately for each class as the inverse probability of selection in a particular grade at a school.

Second, independent *t*-tests were conducted to compare mean scores on the time 1 risk and protective factors across states for males and females in each cohort (grade 7 or 9). For factors on which there were statistically significant differences, effect sizes were calculated using pooled standard deviations [37].

In the third step of the analyses, two sets of logistic regression analyses were conducted. In the first set, each risk and protective factor, age, and gender at time 1 was regressed onto each outcome at time 2 separately in the Washington State and Victorian samples to generate an adjusted odds ratio (OR). In the second set of logistic regression analyses, the state samples were combined and time 1 age, gender, state, each risk and protective factor, and the interaction between state and each risk/protective factor were regressed onto each substance use outcome at time 2. A statistically significant interaction term indicated that the relation between a particular risk or protective factor and use of a specific substance differed significantly across countries. Statistical significance levels were corrected for the number of family-wise comparisons made in each step of the analyses (i.e., Bonferroni correction). Each set of logistic regression analyses controlled for the clustering of students within schools. For this third step of the analyses, results showing odds ratios (ORs) of close to 2.00 or higher for risk factors and 0.50 or lower for protective factors (equivalent to a 2-fold difference) are discussed in the text.

Results

Prevalence of alcohol, tobacco, and cannabis use in each state

Prevalence estimates for current alcohol, tobacco and cannabis use in each state at each time-point within gender and cohort are shown in Table 3. Across both time-points in Grades 7 and 9, more Victorian than Washington State students engaged in current alcohol and tobacco use, whereas Washington State females displayed higher rates of cannabis use than their Victorian counterparts. Almost three-quarters of Grade 9 males and females in Victoria reported current alcohol use at time 2. Across the sample, rates of use of all substances increased from time 1 to 2.

State comparisons of risk and protective factor means

Figure 1 shows the effect sizes for state differences in the mean level of risk and protective factors across each domain at time 1. The reported effect sizes have been calculated only for those risk and protective factors where a significant state difference was observed in independent *t*-test analyses ($p < 0.002$, Bonferroni adjustment). The observed effect sizes are small.

Of the thirty-one risk and protective factors examined, sixteen factors (52%) showed state differences. The largest differences (effect size approaching 0.30) displayed higher levels of protection for religiosity, and higher levels of risk for perceived availability of handguns, and transitions and mobility for Washington State students relative to Victorian students. Higher levels of risk for Victorian students compared with Washington State students were found for peer recognition for substance use involvement and parental attitudes favorable towards drug use.

Associations between time 1 risk and protective factors and time 2 substance use

Table 4 presents the ORs for the associations between time 1 risk and protective factors and substance use at 12-month follow-up. Most of the risk and protective factors were significantly related to at least one of the substances in one of the states. This section summarises results with ORs of close to 2.00 or higher for risk factors and 0.50 or lower for protective factors. Next, the risk and protective factors that differed significantly between states are summarised.

The following risk factors were most strongly associated with increased risk for alcohol, tobacco and cannabis use in both states: perceived availability of drugs, poor family management, family history of substance use, parental attitudes favorable towards drug use and antisocial behavior, low commitment to school, academic failure, rebelliousness, individual favorable attitudes to drug use and antisocial behavior, interaction with antisocial peers, friends' use of drugs, and antisocial behavior. Only one protective factor, belief in the moral order, had an OR less than 0.50.

Results in Table 4 show only a few state differences in the strength of associations between the risk and protective factors and particular substances; in all cases with weaker associations in Washington State. These include community laws and norms favorable to drug use and current alcohol use, antisocial behavior and current tobacco and cannabis use, interaction with antisocial peers and current tobacco use, friends' use of drugs and current cannabis use, academic failure and current cannabis use, and school rewards for prosocial involvement (protective factor, marginally significant $p = .002$) and current cannabis use.

Discussion

This multi-site study is unique in the literature as it used the same methodology to recruit and survey students in Washington State, US and Victoria, Australia to compare the levels of risk and protective factors for substance use and the associations between time 1 risk and protective factors and substance use 12 months later. The findings of this study mostly show cross-state similarities in levels and predictive associations. Differences were noted, however, in the rates of substance use in Washington State and Victoria, with female students in Washington State reporting higher rates of cannabis use and Victorian students reporting higher rates of alcohol and tobacco use. These results are consistent with previous findings on this data [27, 38]. In general, about half the differences in the levels of risk and protective factors across the two states (16 of 31) show differences, though most were small, and there was a great deal of comparability in the associations across time between risk and protective factors and substance use (6 state differences in 93 comparisons). Despite these similarities, there were some notable state differences identified in this study.

Levels of risk and protective factors

Examination of the risk and protective factors differences showed small effect sizes (at or below 0.30). Where there are state differences, Victorian students report more favorable attitudes and norms for drug use (self, peers, parents and community) and peer attitudes towards antisocial behavior, and Washington State students show higher levels of religiosity, perceived availability of handguns and drugs, and transitions and mobility. These results are similar to those of Beyers et al. [24], the most comparable study to the current research. The higher levels of favorable attitudes and norms for drug use in Victoria are in line with harm minimization prevention strategies that suggest that drug use is a normative part of development and is probably one influence leading to higher prevalence rates for drug use in Victoria. Higher levels of religiosity in Washington State are also in line with state differences in substance use given its protective effect.

Relations between time 1 risk and protective factors and substance use 12 months later

Almost all risk and protective factors were significantly related to at least one of the substances in one of the states. The strongest longitudinal associations between risk and protective factors and substance use were found for peer/individual, family, and school factors. Only one community factor, perceived availability of drugs showed strong associations with substance use. Poor family management, parental attitudes favorable towards drug use and antisocial behavior had notably high odds ratios for all three substances in both states. Interaction with antisocial peers and student attitudes favorable to drugs were also strongly related to substance use in both states. The findings of this study were similar to those of Beyers et al. [24], but importantly in this case they are extended to longitudinal data, for the first time studying the validity of the survey measures as risk factors. Further, the longitudinal associations evident for family and community risk and protective factors in this study are greater in magnitude than those cross-sectional associations demonstrated by Beyers et al. [24]. The magnitude of associations for peer and school factors are generally comparable across the two studies.

Since the levels of half of the risk and protective factor are the same, if these factors predict substance use, the same types of prevention activities are indicated across states for these factors. For the 16 factors that have different levels, if their relationship with substance use is substantial, this may provide clues for differential emphasis for prevention activities between the two states.

Of the few state differences in the longitudinal associations between risk and protective factors and substance use, there were no clear defining patterns and they were specific to particular substances; only one, antisocial behavior, was common across tobacco and cannabis use. In all cases of state differences the relationship was stronger in Victoria compared to Washington State, although most differences are a matter of degree not of direction, or significance compared to non-significance. Associations are 2-3 times larger between antisocial behavior and tobacco and cannabis use, and there are strong associations between school opportunities for prosocial involvement and cannabis use. With these exceptions, the implications are that similar risk and protective factors might be addressed to reduce substance use in both states.

Implications

Given there are few state differences in the relations between risk and protective factors at time 1 and substance use at 12-month follow-up, rates of substance use differ primarily from differences in levels of risk and protective factors between the two states. Combining these level differences with the association between these factors and substance use provides clues to why rates of substance use are different between the two states and why perhaps some differences in foci of preventive intervention may be indicated. The individual, parent, peer, and community favorable attitudes towards substance use are higher in Victoria in line with harm minimization strategies and are strongly associated with alcohol and tobacco use, and may drive the higher rates of substance use in the Victorian students. The factors that are higher in Washington State are religiosity (protective factor), perceived availability of handguns, and transitions and mobility (risk factors) and these are weakly related to substance use. Availability of drugs is slightly more prevalent in Washington State, the only strongly correlated variable with substance use, pushing students in the opposite direction, but because the level difference is small it may be having little effect compared to the strong differences in highly correlated factors in Victoria.

The higher rates of cannabis use for Washington State females may be due to the slightly higher levels of family history of substance use, availability of drugs and low

neighbourhood attachment in Washington State compared to Victorian females. The findings of this study suggest that Victorian students might benefit from preventive interventions focused on individual, family, peer, and community attitudes favorable towards drug use. This could include approaches to change public attitudes through education, limiting advertising or social marketing. For cannabis use, Washington State females might benefit compared to their Victorian counterparts from preventive interventions focused on family history of substance use, low neighbourhood attachment and perceived availability of drugs. Community prevention literature research shows that increased community enhancement approaches may reduce overall risk and enhance protective factors for adolescent substance use, violence, and academic outcomes [39-40].

Conclusions

The IYDS shows that it is possible to collect highly comparable longitudinal data using the same methodology in two sites in different parts of the world. Findings of this paper contrast with previous cross-sectional and less rigorous comparisons [24] in revealing that there are minor differences in the levels of risk and protective factors and few differences in the relations between risk and protective factors and substance use at follow-up in Victoria and Washington State. Comparisons between countries that are more broadly different (e.g., non-Western, Lower and Middle Income) may reveal other differences in levels and associations between risk and protective factors and substance use. Further research in multiple countries from around the world using standardised methods is warranted. Results of such research can inform global approaches to policy and practice [28].

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References

1. Corroa, MA.; Guindon, GE.; Sharma, N., et al. Tobacco control country profiles. Atlanta, GA: American Cancer Society; 2000.
2. World Health Organisation. Global status report on alcohol. Geneva: World Health Organisation; 1999.
3. Australian Institute of Health and Welfare. Making progress the health, development and wellbeing of Australia's children and young people. Cat no PHE 104. Canberra: Australian Institute of Health and Welfare; 2008.
4. Johnston, LD.; O'Malley, PM.; Bachman, JG., et al. Monitoring the Future: National survey results on drug use, 1975-2008 Volume 1, Secondary School Students. Bethesda, Maryland: National Institute on Drug Abuse U.S Department of Health and Human Services. National Institutes of Health; 2008.
5. Bond L, Toumbourou JW, Thomas L, et al. Individual, family, school, and community risk and protective factors for depressive symptoms in adolescents: A comparison of risk profiles for substance use and depressive symptoms. *Prev Sci.* 2005; 6(2):73–88. [PubMed: 15889623]
6. Smart, D.; Richardson, N.; Sanson, A., et al. Patterns and precursors of adolescent antisocial behaviour: Outcomes and connections, The Third Report. Melbourne, Victoria: Australian Institute of Family Studies, Crime Prevention Victoria, Department of Justice; 2005. Report No.: 3

7. Hawkins JD, Graham JW, Maguin E, et al. Exploring the effects of age of alcohol use initiation and psychosocial risk factors on subsequent alcohol misuse. *J Stud Alcohol*. 1997; 58(3):280–290. [PubMed: 9130220]
8. Rachal JV, Guess LL, Hubbard RL, et al. Facts for planning no. 4: Alcohol misuse by adolescents. *Alcohol Health and Res World*. 1982; 6:61–68.
9. Australian Institute of Health and Welfare. Young Australians: their health and wellbeing 2007. Cat no PHE 87. Canberra: Australian Institute of Health and Welfare; 2007.
10. Hawkins JD, Catalano RF, Miller JY. Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychol Bull*. 1992; 112(1):64–105. [PubMed: 1529040]
11. National Crime Prevention. Pathways to prevention Developmental and early intervention approaches to crime in Australia. Canberra: Commonwealth of Australia Ministerial Council on Drug Strategy; 1999.
12. Jessor R, Turbin MS, Costa FM. Protective factors in adolescent health behavior. *J Pers Soc Psychol*. 1998; 75:788–800. [PubMed: 9781412]
13. Garmezy, N. Stress-resistant children: The search for protective factors. In: Stevenson, JE., editor. Recent research in developmental psychopathology *Journal of Child Psychology and Psychiatry Book Supplement No 4*. Oxford, HK: Pergamon Press; 1985. p. 213-233.
14. Beyers JM, Bates JE, Pettit GS, et al. Neighborhood structure, parenting processes, and the development of youths' externalizing behaviors: a multilevel analysis. *Am J Community Psychol*. 2003; 31(1-2):35–53. [PubMed: 12741688]
15. Guo J, Hawkins JD, Hill KG, et al. Childhood and adolescent predictors of alcohol abuse and dependence in young adulthood. *J Stud Alcohol*. 2001; 62(6):754–762. [PubMed: 11838912]
16. Peterson PL, Hawkins JD, Abbott RD, et al. Disentangling the effects of parental drinking, family management, and parental alcohol norms on current drinking by Black and White adolescents. *J Res Adolescence*. 1994; 4(2):203–227.
17. Ellickson PL, Hays RD. On becoming involved with drugs: Modeling adolescent drug use over time. *Health Psychol*. 1992; 11:377–385. [PubMed: 1286657]
18. Ennett ST, Flewelling RL, Lindrooth RC, et al. School and neighborhood characteristics associated with school rates of alcohol, cigarette, and marijuana use. *J Health Soc Behav*. 1997; 38(1):55–71. [PubMed: 9097508]
19. Battin SR, Hill KG, Abbott RD, et al. The contribution of gnag membership to delinquency beyond delinquent friends. *Criminology*. 1998; 36(1):93–115.
20. Mason WA, Windle M. Family, religious, school and peer influences on adolescent alcohol use: A longitudinal study. *J Stud Alcohol*. 2001; 62:44–53. [PubMed: 11271963]
21. Skara S, Sussman SD, C W. Predicting regular cigarette use among continuation high school students. *Am J Health Behav*. 2001; 25:147–156. [PubMed: 11297044]
22. Catalano, RF.; Hawkins, JD. The Social Development Model: A theory of antisocial behavior. In: Hawkins, JD., editor. *Delinquency and Crime: Current Theories*. New York: cambridge; 1996. p. 149-197.
23. Cleveland MJ, Feinberg ME, Bontempo DE, et al. The role of risk and protective factors in substance use across adolescence. *J Adolesc Health*. 2008; 43:157–164. [PubMed: 18639789]
24. Beyers JM, Toumbourou JW, Catalano RF, et al. A cross-national comparison of risk and protective factors for adolescent substance use: The United States and Australia. *J Adolesc Health*. 2004; 35(1):3–16. [PubMed: 15193569]
25. Kokkevi A, Richardson C, Florescu S, et al. Psychosocial correlates of substance use in adolescence: A cross-national study in six European countries. *Drug Alcohol Depend*. 2007; 86:67–74. [PubMed: 16837140]
26. Makkai, T. Patterns of drug use: Australian and the United States. Canberra: Australian Government Publishing Service; 1994.
27. McMorris BJ, Hemphill SA, Toumbourou JW, et al. Prevalence of substance use and delinquent behaviour in adolescents from Victoria, Australia and Washington State, United States. *Health Educ Behav*. 2007; 34(4):634–650. [PubMed: 16740513]

28. Pirkis JE, Irwin CE, Brindis C, et al. Adolescent substance use: beware of international comparisons. *J Adolesc Health*. 2003; 33:279–286. [PubMed: 14519570]
29. The White House. National Drug Control Strategy. Washington DC: The White House; 2002.
30. Caulkins JP, Reuter P. Setting goals for drug policy: Harm reduction or use reduction? *Addiction*. 1997; 92(9):1143–1150. [PubMed: 9374012]
31. Ministerial Council on Drug Strategy. National Drug Strategic Framework 1998-99 to 2002-03: Building partnerships. Canberra: Commonwealth of Australia Ministerial Council on Drug Strategy; 1998.
32. Kish, L. Survey Sampling. New York, NY: John Wiley & Sons; 1965.
33. Glaser RR, Lee Van, Horn M, Arthur MW, et al. Measurement properties of the communities that care youth survey across demographic groups. *J Quant Criminol*. 2005 Mar; 21(1):73–102.
34. Bond, L.; Thomas, L.; Toumbourou, JW., et al. Improving the lives of young Victorians in our community: A survey of risk and protective factors. Melbourne: The Centre for Adolescent Health; 2000.
35. Bachman, JG.; Johnston, ID.; O'Malley, PM. Monitoring the future: Questionnaire responses from the nation's high school seniors, 1988. Ann Arbor, MI: University of Michigan, Institute of Social Research; 2001.
36. Statacorp. Stata: Statistics/Data Analysis. 10.1 IC. Texas: Statcorp; 2009.
37. Cohen, J. Statistical power analysis for the behavioral sciences. New York: Academic Press; 1977. Revised
38. Toumbourou JW, Hemphill SA, McMorris BJ, et al. Alcohol use and related harms in school students in the USA and Australia. *Health Promot Int*. 2009; 24(4):373–382. [PubMed: 19884245]
39. Lenton S, Allsop S. A tale of CIN - The cannabis infringement notice scheme in Western Australia. *Addiction*. 2010; 105(5):808–816. [PubMed: 20331566]
40. Hawkins DJ, Oesterle s, Brown EC, et al. Results of a type 2 translational research trial to prevent adolescent drug use and delinquency: A test of Communities That Care. *Arch Pediatr Adolesc Med*. 2009; 163(9):789–798. [PubMed: 19736331]

Figure 1.

Effects sizes for state differences in time 1 risk and protective factors for males and females in the Grade 7 and 9 cohorts in Victoria and Washington State.

Note. Following Bonferroni adjustments conducted separately for males and females, all risk and protective factors with significance level $p < .002$ on independent samples t -tests are reported. Some gender-specific state differences were found but effect sizes were very small (further details available from the lead author).

Table 1
Age, gender, and ethnicity of participants in Victoria and Washington State at time 1

	VICTORIAN SAMPLE		WASHINGTON STATE SAMPLE	
Sample Size				
Grade 7 Cohort	984		961	
Grade 9 Cohort	973		981	
Age				
Grade 7 Cohort	Mean 12.93	SD 0.41	Mean 13.09	SD 0.44
Grade 9 Cohort	Mean 14.89	SD 0.39	Mean 15.10	SD 0.45
Gender				
Female	50.8%		59.2%	
Ethnicity		GRADE 7 COHORT (%)		GRADE 9 COHORT (%)
Washington State				
<i>White</i>	65.0		68.0	
<i>Hispanic/Latino</i>	16.0		11.0	
<i>African American</i>	4.0		4.0	
<i>Native American</i>	6.0		5.0	
<i>Asian/Pacific Islander</i>	6.0		10.0	
<i>Other</i>	3.0		2.0	
Victoria				
<i>Australian</i>	91.0		90.0	
<i>African</i>	0.7		0.7	
<i>Aboriginal and Torres Strait Islander</i>	1.0		0.7	
<i>Spanish/Hispanic/Latino</i>	0.4		1.0	
<i>Asian</i>	5.2		5.8	
<i>Pacific Islander</i>	0.9		0.3	
<i>Other</i>	1.0		2.0	

Table 2

Summary statistics for risk and protective factors measured at time 1 for study participants in Victoria and Washington State.

RISK AND PROTECTIVE FACTORS	VICTORIAN SAMPLE			WASHINGTON STATE SAMPLE				
	N	Mean	SD	Alpha	N	Mean	SD	Alpha
Community risk factors								
Low neighbourhood attachment (3-items; e.g. I'd like to get out of my neighbourhood.)	1899	1.88	0.78	0.81	1830	2.03	0.84	0.82
Community disorganisation (5-items; e.g. How much do each of the following statements describe your neighbourhood: lots of graffiti?)	1895	1.48	0.53	0.77	1879	1.49	0.57	0.82
Transitions and mobility (4-items; e.g. Have you changed homes in the past year?)	1947	1.97	0.63	0.60	1939	2.18	0.69	0.61
Laws and norms favorable to drug use (3-items; e.g. How wrong would most adults (over 21) in your neighbourhood think it is for kids your age: to smoke cigarettes?)	1894	1.73	0.70	0.82	1832	1.56	0.71	0.90
Perceived availability of drugs (4-items; e.g. If you wanted to get some cigarettes, how easy would it be for you to get some?)	1889	2.04	0.85	0.84	1870	2.18	0.97	0.88
Perceived availability of handguns (1-item; e.g. If you wanted to get a handgun, how easy would it be for you to get one?)	1886	1.26	0.67	n/a	1867	1.65	0.98	n/a
Community protective factors								
Rewards for prosocial involvement (3-items; e.g. There are people in my neighbourhood who are proud of me when I do something well.)	1900	2.35	0.87	0.87	1878	2.39	0.92	0.90
Opportunities for prosocial involvement (5-items; e.g. Which of the following activities for people your age are available in your community: sports teams?)	1896	2.61	0.66	0.65	1870	2.67	0.70	0.68
Family risk factors								
Poor family management (8-items; e.g. The rules in my family are clear.)	1929	1.79	0.52	0.78	1911	1.70	0.54	0.79
Family conflict (3-items; e.g. We argue about the same things in my family over and over.)	1912	2.26	0.78	0.80	1884	2.28	0.78	0.79
Family history of substance use (7-items; e.g. Has anyone in your family ever had a severe (serious) alcohol or drug problem?)	1925	2.07	0.91	0.73	1899	2.13	1.08	0.81
Parental attitudes favorable toward drug use (4-items; e.g. How wrong do your parents feel it would be for you to: smoke cigarettes?)	1913	1.55	0.59	0.64	1891	1.26	0.48	0.77
Parental attitudes favorable to antisocial behavior (3-items; e.g. How wrong do your parents feel it would be for you to: steal something worth more than \$5/10?)	1913	1.38	0.49	0.73	1891	1.30	0.46	0.73
Family protective factors								
Mother Attachment (3-items; e.g. Do you feel very close to your mother?)	1913	3.25	0.68	0.84	1812	3.20	0.75	0.84

	VICTORIAN SAMPLE				WASHINGTON STATE SAMPLE			
	N	Mean	SD	Alpha	N	Mean	SD	Alpha
Father Attachment (3-items; e.g. Do you share your thoughts and feelings with your father?)	1900	2.97	0.81	0.86	1792	2.94	0.88	0.88
Opportunities for prosocial involvement (3-items; e.g. If I had a personal problem, I could ask my mum or dad for help.)	1919	3.08	0.70	0.82	1874	3.07	0.74	0.85
Rewards for prosocial involvement (2-items; e.g. My parents notice when I am doing a good job and let me know about it.)	1909	3.02	0.78	0.73	1821	3.06	0.84	0.75
School risk factors								
Academic failure (2-items; e.g. Putting them all together, what were your grades/marks like last year?)	1913	2.00	0.64	0.68	1921	2.06	0.71	0.72
Low commitment to school (6-items; e.g. How often do you feel that the schoolwork you are assigned is meaningful and important?)	1955	2.24	0.62	0.74	1942	2.23	0.59	0.70
School protective factors								
Opportunities for prosocial involvement (5-items; e.g. I have lots of chances to be part of class discussions of activities)	1951	2.98	0.45	0.59	1938	3.04	0.41	0.52
Rewards for prosocial involvement (4-items; e.g. The school lets my parents know when I have done something well.)	1949	2.87	0.58	0.71	1936	2.82	0.56	0.68
Peer/individual risk factors								
Rebelliousness (3-items; e.g. I do the opposite of what people tell me, just to get them mad.)	1941	1.95	0.65	0.79	1934	1.87	0.63	0.76
Favorable attitudes toward antisocial behavior (5-items; e.g. How wrong do you think it is for someone your age to steal something worth more than \$5/10?)	1939	1.58	0.57	0.84	1931	1.45	0.49	0.82
Favorable attitudes toward drug use (5-items; e.g. How wrong do you think it is for someone your age to smoke cigarettes?)	1942	1.69	0.69	0.88	1926	1.47	0.64	0.92
Interaction with antisocial peers (8-items; e.g. In the past year, how many of your best friends have been suspended from school?)	1946	0.29	0.49	0.84	1936	0.32	0.54	0.85
Friends' use of drugs (4-items; e.g. In the past year, how many of your best friends have smoked cigarettes?)	1944	0.92	0.97	0.78	1933	0.86	1.05	0.85
Sensation seeking (3-items; e.g. How many times have you done crazy things even if they are a little dangerous)	1942	2.37	1.25	0.78	1934	2.35	1.27	0.76
Peer recognition for substance use involvement (3-items; e.g. What are the chances you would be seen as cool if you smoked cigarettes?)	1940	2.71	1.28	0.90	1928	1.90	1.03	0.90
Antisocial behavior (5-items; e.g. How many times in the past year have you been suspended from school?)	1949	1.10	0.26	0.71	1940	1.14	0.37	0.82
Peer/individual protective factors								
Religiosity (1-item; How often do you attend religious services or activities?)	1943	2.04	1.00	n/a	1899	2.69	1.12	n/a
Belief in the moral order (4-items; e.g. It is important to be honest with your parents, even if they become upset or you get punished)	1944	3.13	0.64	0.72	1926	3.19	0.61	0.69

Alpha = Cronbach's alpha

Note. n/a refers to scales with one item and therefore a Cronbach's alpha could not be calculated.

Response options ranged from 0 through 4 for interaction with antisocial peers and friends' use of drugs, and 1 through 5 for transitions and mobility, family history of substance use, low commitment to school, and peer recognition for substance use involvement. Response options on sensation seeking ranged from 0-5 and on antisocial behavior from 1-8.

Table 3
Prevalence of current substance use for students in Victoria and Washington State at time 1 and 2

	Grade 7 Male Cohort					Grade 7 Female Cohort				
	Washington State		Victoria			Washington State		Victoria		
	%	95% CI	Low	High	%	%	95% CI	Low	High	%
Time 1 Alcohol	12.1	9.4	14.5	35.9***	31.4	13.2	10.0	17.2	31.4***	27.4
Time 2 Alcohol	24.0	2.9	27.3	56.5***	52.3	29.8	25.7	34.2	58.5	54.2
Time 1 Tobacco	4.0	2.3	6.9	7.5*	5.4	4.3	2.7	6.7	9.7***	7.2
Time 2 Tobacco	8.9	6.8	11.7	17.3***	14.8	20.1	9.4	16.1	22.4***	19.1
Time 1 Cannabis	3.4	2.1	5.4	2.3	1.5	3.6	5.3***	3.7	7.7	2.0
Time 2 Cannabis	11.9	9.8	14.3	9.0	7.0	11.5	13.2*	10.3	16.8	7.7

	Grade 9 Male Cohort					Grade 9 Female Cohort				
	Washington State		Victoria			Washington State		Victoria		
	%	95% CI	Low	High	%	%	95% CI	Low	High	%
Time 1 Alcohol	22.1	18.6	26.1	53.6***	48.5	27.2	23.1	31.8	53.1***	47.1
Time 2 Alcohol	40.0	34.3	46.0	73.3***	66.3	47.1	39.9	54.5	74.8***	68.2
Time 1 Tobacco	10.00	6.5	15.1	17.5*	14.2	21.5	16.5	19.8	25.4***	31.3
Time 2 Tobacco	18.4	13.5	24.6	32.5***	26.6	19.8	14.9	25.8	33.5***	25.8
Time 1 Cannabis	13.4	10.6	16.8	9.5	6.5	13.8	10.2	17.0	5.3	3.7
Time 2 Cannabis	24.2	19.9	29.2	19.0	13.7	25.8	18.5**	13.6	24.8	11.1

Note. Figures in bold display statistically significant state differences in rates of substance use and non-overlapping 95% CIs within cohort and gender.

Male sample comprises 1891 participants, and female sample 1969 participants for alcohol use, 1882 and 1960 for tobacco use, and 1890 and 1970 for cannabis use.

CI = confidence interval

The presented estimates and confidence intervals were derived using the “svyset” analysis technique in STATA. These estimates take into account the sample design weight, school nesting (strata), and age. Estimates have been adjusted for exact age at each survey.

* $p < .05$.

.100 > *p*

'10' < *p*

Table 4
Cross-state comparisons of longitudinal relations between time 1 risk and protective factors and time 2 current substance use for Grade 7 and 9 students in Victoria and Washington State

RISK AND PROTECTIVE FACTORS (Time 1)	CURRENT ALCOHOL USE (Time 2)		CURRENT TOBACCO USE (Time 2)		CURRENT CANNABIS USE (Time 2)	
	WASH Adjusted OR	VIC Adjusted OR	WASH*P/ Adjusted OR	VIC Adjusted OR	WASH Adjusted OR	WASH*P/ Adjusted OR
COMMUNITY RISK FACTORS						
Low neighbourhood attachment	1.16	1.26***	0.90	1.66***	1.33***	1.55***
Community disorganisation	1.43***	1.38***	1.04	1.64***	1.69***	1.92***
Transitions and mobility	1.19	0.99	1.23	1.39***	1.28	1.60***
Laws and norms favorable to drug use	1.45***	2.01***	0.68***	1.93***	1.54***	2.29***
Perceived availability of drugs	1.79***	1.96***	0.84	2.46***	2.19***	3.20***
Perceived availability of handguns	1.23***	1.18	1.01	1.30***	1.14	1.24
COMMUNITY PROTECTIVE FACTORS						
Rewards for prosocial involvement	0.91	1.00	0.93	0.88	0.80	0.71***
Opportunities for prosocial involvement	0.82	0.95	0.90	0.73***	0.68***	0.57***
FAMILY RISK FACTORS						
Poor family management	2.62***	2.61***	0.91	3.40***	3.16***	5.68***
Family conflict	1.64***	1.42***	1.14	1.68***	1.56***	1.82***
Family history of substance use	1.88***	2.05***	0.89	2.33***	2.22***	2.64***
Parental attitudes favorable toward drug use	2.81***	3.89***	0.66	2.37***	2.21***	3.39***
Parental attitudes favorable to antisocial behavior	2.32***	2.01***	1.05	2.11***	2.11***	2.77***
FAMILY PROTECTIVE FACTORS						
Mother attachment	0.79***	0.76***	1.07	0.60***	0.72***	0.51***
Father attachment	0.78***	0.84***	0.92	0.63***	0.72***	0.62***
Opportunities for prosocial involvement	0.74***	0.74***	1.03	0.55***	0.67***	0.45***
Rewards for prosocial involvement	0.81***	0.80***	1.02	0.63***	0.82	0.60***
SCHOOL RISK FACTORS						
Academic failure	1.40***	1.83***	0.75	2.98***	1.99***	3.67***
						0.52***

RISK AND PROTECTIVE FACTORS (Time 1)	CURRENT ALCOHOL USE (Time 2)			CURRENT TOBACCO USE (Time 2)			CURRENT CANNABIS USE (Time 2)		
	WASH Adjusted OR	VIC Adjusted OR	WASH*P/ Adjusted OR	WASH Adjusted OR	VIC Adjusted OR	WASH*P/ Adjusted OR	WASH Adjusted OR	VIC Adjusted OR	WASH*P/ Adjusted OR
Low commitment to school	2.04 ***	1.99 ***	0.95	3.39 ***	3.24 ***	1.03	2.51 ***	4.02 ***	0.63
SCHOOL PROTECTIVE FACTORS									
Opportunities for prosocial involvement	0.69 **	0.82	0.89	0.64	0.52 ***	1.20	0.73	0.33 ***	2.11
Rewards for prosocial involvement	0.68 ***	0.68 ***	1.04	0.70	0.55 ***	1.30	0.74	0.44 ***	1.65
PEER/INDIVIDUAL RISK FACTORS									
Rebelliousness	2.02 ***	2.10 ***	0.90	2.50 ***	2.84 ***	0.86	2.01 ***	2.51 ***	0.78
Favorable attitudes toward antisocial behavior	2.71 ***	2.05	1.13	2.78 ***	2.83 ***	0.92	2.76 ***	3.56 ***	0.74
Favorable attitude towards drug use	2.88 ***	3.54 ***	0.73	3.35 ***	3.99 ***	0.78	3.29 ***	4.73 ***	0.74
Interaction with antisocial peers	2.52 ***	3.74 ***	0.60	2.84 ***	5.29 ***	0.53 ***	2.57 ***	3.95 ***	0.64
Friends' use of drugs	2.01 ***	2.39 ***	0.80	2.44 ***	3.10 ***	0.76	2.39 ***	3.64 ***	0.70 ***
Sensation seeking	1.57 ***	1.69 ***	0.89	1.69 ***	1.80 ***	0.94	1.56 ***	1.89 ***	0.82
Peer recognition for substance use involvement	1.38 ***	1.18 ***	1.12	1.65 ***	1.23 ***	1.28	1.56 ***	1.23	1.24
Antisocial behavior	4.43 ***	7.57 ***	0.37	4.22 ***	14.92 ***	0.20 ***	6.73 ***	15.71 ***	0.29 ***
PEER/INDIVIDUAL PROTECTIVE FACTORS									
Religiosity	0.96	0.79 ***	1.22	0.74 ***	0.73 ***	1.02	0.85	0.67 ***	1.28
Belief in the moral order	0.37 ***	0.39 ***	1.05	0.34 ***	0.29 ***	1.16	0.35 ***	0.24 ***	1.45

Note. WASH = Washington State; VIC = Victoria

Following Bonferroni corrections conducted by gender, all risk and protective factors displaying an effect size with significance level $p < .002$ are reported.

The range of the Washington State and Victorian samples are 1850-1900 for alcohol use, 1850-1890 for tobacco use, and 1850-1890 for cannabis use. For analyses including the interaction between state and each factor, the sample ranges from 3550-3890 for alcohol use, 3550-3790 for tobacco use, and 3550-3860 for cannabis use.

** $p < .002$;

*** $p < .001$

Odds ratios adjusted for gender and exact age at time 1.

WASH*P = Odds ratios correspond to the interaction between the dichotomous country variable (coded "0" for Victorian adolescents and "1" for Washington State adolescents) and the risk or protective factor of interest. For risk factors, odds ratios greater than one indicate a stronger association in Washington State compared to Victoria, and odds ratios less than one indicate a stronger association in Victoria compared to Washington State. For protective factors, odds ratios greater than one indicate a stronger association in Victoria compared to Washington State, and odds ratios less than one indicate a stronger association in Washington State compared to Victoria.