

**Title:** Association between Australian adolescent alcohol use and alcohol use risk and protective factors, 2011 and 2014

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**Word count:** 3756

**Declaration of competing interests:** The authors declare no conflicts of interest, financial or otherwise.

**Sources of funding:** The trial from which the data originates was conducted with funding support from the National Health and Medical Research Council, nib Foundation, Hunter New England Population Health and infrastructure support from the Hunter Medical Research Institute.

**Trial registration:** Australia and New Zealand Clinical Trials Register (Ref no. ACTRN12611000606987) <http://www.anzctr.org.au/>

**Running head:** Factors associated with alcohol use

## **ABSTRACT**

**Introduction and aims:** Changes in the known risk and protective factors of adolescent alcohol use may be contributing to the recent decline in Australian adolescents alcohol use. The study aimed to determine the: 1) prevalence of alcohol use, risk and protective factors in 2011 and 2014; and 2) association between alcohol use and risk and protective factors in 2011 and 2014.

**Design and methods:** A repeat cross sectional study was conducted. Grade 9-10 (aged 15-17 years) students from 32 Australian secondary schools were sampled in 2011 and 2014. A self-report survey collected data regarding alcohol use (ever, recent, 'binge drinking'), risk factors (e.g. alcohol use/permissive attitude to alcohol by friends/sibling/parents), and protective factors (e.g. self-efficacy; school/home/community support; peer caring relationships). Descriptive statistics were used to determine differences in alcohol use, risk and protective factors between 2011 and 2014. Adjusted multivariable logistic regression analyses examined associations between alcohol use, risk and protective factors separately in 2011 and 2014 (6 models).

**Results:** Fewer adolescents reported alcohol use in 2014 compared with 2011 (ever: 56.6% v 67.9%, recent: 17.3% v 21.2%, 'binge drinking': 20.0% v 23.5%; 2011: N=4366; 2014: N=5199). Significant differences between 2014 and 2011 were found for some risk (5 lower; 1 higher) and protective factors (4 lower). Risk factors that were significantly lower in 2014 compared to 2011 were amongst variables with the strongest associations with alcohol use.

**Discussion and conclusions:** The strength of associations with alcohol use, and decrease in the prevalence of certain risk factors in 2014 compared to 2011, suggests such factors may be contributing to the decline in adolescent alcohol use.

**Keywords:** alcohol, protective factors, risk factors, resilience, adolescents

## BACKGROUND

Alcohol misuse contributes significantly to global rates of morbidity and mortality.<sup>1</sup> Initiation to alcohol consumption typically occurs during adolescence with earlier age of initiation associated with greater likelihood of ongoing use, dependence and harm in later life.<sup>2-4</sup> The prevalence of alcohol consumption in young people has declined in recent decades in many countries worldwide including those in North America and Europe.<sup>5</sup> In Australia both the prevalence and volume of alcohol consumption by drinkers has declined between 1995 and 2013.<sup>6</sup>

A large body of research has sought to identify the temporal precursors, that is those preceding factors that either increase or decrease the likelihood of alcohol use in young people in an effort to identify credible intervention targets for reducing such use.<sup>7-18</sup> Such factors are typically categorised as either risk or protective factors. Risk factors are those found to be associated with an increased risk of alcohol use and in adolescents have been reported to include use of alcohol by parents, siblings or peers,<sup>10;14;19;20</sup> permissive attitudes or perceptions of permissive attitudes to alcohol by parents, siblings and peers,<sup>10;20;21</sup> access or availability,<sup>10;19;21</sup> and poor school achievement or low degree of commitment to school.<sup>10;19;22</sup> Protective factors are those that have been found to be associated with a decreased risk of adolescent alcohol use and are often categorised into ‘individual’ protective factors such as self-esteem,<sup>17;19</sup> social competence skills,<sup>10;19;21</sup> and problem solving ability,<sup>21</sup> and ‘environmental’ protective factors such as connection to school<sup>14;16;17;19;21</sup> or family,<sup>10;17;19;21</sup> parental monitoring with clear rules,<sup>19;20</sup> and pro-social peers.<sup>19;23</sup> Whilst numerous studies describe risk or protective factors associated with adolescent alcohol use,<sup>9;10;13;16-18</sup> fewer studies have sought to determine the relative association of specific risk or protective factors with adolescent alcohol use.<sup>7;8;11;15</sup> Of the studies that have investigated both risk and protective factors, risk factors have generally been found to have a stronger association with alcohol use than protective factors.<sup>7;8;11;15</sup> For example, a cross sectional study of 91778 students in the United States that examined associations between risk factors and protective factors, found risk factors to be the strongest predictors of lifetime and recent use of alcohol.<sup>8</sup>

The continued decline in alcohol use by adolescents in Australia in the last decade may be a result of changes in the association between adolescent alcohol use and the identified risk and protective factors over time. However, no studies have sought to investigate the association between adolescent alcohol use and alcohol use risk and protective factors at different time points.

A study was conducted to determine the: 1) prevalence of alcohol use, risk factors and protective factors in 2011 and in 2014; and 2) association between risk and protective factors and alcohol use in 2011 and in 2014.

## **METHODS**

### **STUDY DESIGN AND SETTING**

A repeat cross sectional study was conducted in one Health District of New South Wales, Australia. The District encompasses metropolitan, regional, rural and remote areas with a population of approximately 114,000 people aged 10 to 19 years.<sup>24</sup> The data used within the current study were collected as part of a cluster-randomised controlled trial (the parent trial) that examined the effectiveness of a pragmatic school-based universal resilience intervention in reducing the prevalence of tobacco, alcohol and illicit substance use, and increasing the resilience protective factors of a cohort of adolescent followed from Grade 7 to 10 (Hunter New England Health Ref:09/11/18/4.01; University of Newcastle Ref:H-2010-0029). The methods of the randomised controlled trial are described in detail elsewhere.<sup>25</sup> The resilience intervention implemented within the parent trial was not effective in reducing the prevalence of tobacco, alcohol or illicit substance use, nor increasing the individual or environmental resilience protective factors of adolescents.<sup>25</sup>

### **PARTICIPANTS AND RECRUITMENT**

#### **Secondary schools**

Eligible schools eligible for participation in the parent trial were either Government or Catholic secondary schools located in a disadvantaged Local Government Area, with enrolments in Grades 7 to 10 (typically aged 12 to 16 years) on one campus, and with more than 400 total student enrolments.

Independent, special needs, selective, central (schools catering for children aged 4 to 18 years), boarding schools or schools that were not co-educational were ineligible. Eligible schools were approached for participation in the trial according to a randomly ordered list of schools. If a school declined, the next school was invited to participate until a quota of 32 schools was recruited.

## Students

In the parent trial, all Grade 7 students in the 32 participating schools in 2011 were eligible to participate. In the current study, all students enrolled in Grade 9 (aged 14 to 15 years) and Grade 10 (aged 15 to 16 years) in the 32 participating schools in both 2011 and 2014 were eligible to participate (2011 n=9106; 2014 n=9292). Data collected from students at both intervention and control schools were eligible for the current study on the basis that the resilience intervention was not effective in reducing the prevalence of alcohol use nor increasing the resilience protective factors of adolescents.<sup>25</sup>

## DATA COLLECTION PROCEDURES

Parents of students were mailed a study information sheet, a consent form and a reply paid envelope. Two weeks following, non-responding parents were telephoned by school-affiliated staff to prompt return of the consent form. At both time points (August-November 2011 and July-November 2014) students with parental consent were invited to complete the same self-report anonymous web-based survey in class time.

## MEASURES

### Student and school characteristics

Student age, school grade, gender, Aboriginal and Torres Strait Islander status and residential postcode were collected via the student survey.

### Alcohol use

Students' reported alcohol use was assessed using three measures from a national triennial survey of school students' health behaviours<sup>4</sup>: ever use, recent use and 'binge drinking' (see Table 1).

\*\*\*Insert Table 1 here\*\*\*

### Risk factors

The survey included items developed by the authors to assess a range of variables previously identified to be risk factors for adolescent alcohol use or other drug use and included: student's personal income (from pocket money or paid employment);<sup>26</sup> whether their friends, siblings or parents drank alcohol;<sup>10;14;19;20</sup> whether their friends, siblings, parents had or the student had permissive attitudes to them drinking alcohol;<sup>10;20;21</sup> and belief that drinking alcohol would not damage their health<sup>26</sup> (Table 1). The reliability of these items has not been examined.

### Protective factors

The Resilience and Youth Development module of the California Healthy Kids Survey,<sup>27</sup> an internally consistent and valid measure of 14 adolescent individual and environmental protective factors (termed internal and environmental assets), was used to measure protective factors that have been found to be associated with alcohol use.<sup>12</sup> The survey incorporates 51 items (4 point Likert scale – '1: Never true' to '4: True all of the time') that address six individual protective factor subscales and eight environmental factor subscales (Table 1).<sup>27</sup> The survey tool, as previously reported, has been found to be an internally consistent and valid measure (Cronbach alpha coefficients for individual factor subscales: 0.55-0.81; environmental factor subscales: 0.71-0.91),<sup>12</sup> and a confirmatory factor analysis demonstrated the individual and environmental subscale factor structure to be a good model fit (Comparative fit index 0.92, Standardized Root Mean Square Residual 0.04, Root Mean Square Error of Approximation 0.04, Adjusted Goodness of Fit 0.90).<sup>27</sup>

## STATISTICAL ANALYSIS

### Student characteristics

For both surveys, participants who did not answer any alcohol use items (that is, they started the online survey but dropped out before the alcohol use items) were excluded from analyses. Socio-economic status and remoteness of residential location were calculated from student-reported residential postcode using the Australia Bureau of Statistics Socio-Economic Indexes for Areas and the Accessibility/Remoteness Index of Australia respectively. Consent and participation rates were examined using descriptive statistics.

#### Alcohol use

The response options for 'binge drinking' were dichotomised ('none' versus 'once'/'twice'/'3-6 times'/'7 or more times').

#### Risk factors

A personal income variable (yes/no) was created from the pocket money ('less than \$5' or more) and paid employment ('less than \$5' or more) variables.

#### Protective factors

Fourteen protective factor scores (six individual and eight environmental factor subscales) were created. Protective factor subscale scores were calculated by averaging the responses to all items in a subscale ranging from 1 to 4 for each student.<sup>27</sup>

#### ***Differences in alcohol use prevalence, risk factor prevalence and mean protective factor scores – 2011 and 2014***

Proportions or means and 95% confidence limits that accounted for potential clustering of student responses within schools were calculated at each time point for all alcohol use, risk factor and protective factor outcomes. Such descriptive statistics were examined to determine any differences in outcomes between 2011 and 2014. Outcomes were considered significantly different if the confidence limits in 2011 did not overlap those in 2014.

### ***Association between alcohol use and risk/protective factors – 2011 and 2014***

To examine the multivariable associations between student alcohol use and risk and protective factors at each time point separately, logistic regression analyses were conducted using generalized linear mixed models to explore the associations the alcohol use measure (ever use, recent use and ‘binge drinking’) and risk and protective factors (9 risk factors and 14 protective factors) separately at each time point (3 models each in 2011 and 2014). All models included a random effect for each school to account for clustering of responses within schools and potential demographic confounders of alcohol use: school size (400-800 medium/>800 large), school type (government/Catholic school) and student characteristics (gender, grade, remoteness of residential location, socio-economic and Aboriginal/Torres Strait Islander status). Odds ratios and 95% confidence levels were calculated for each model.

A sensitivity analysis was conducted for all 6 models using only the control group participants (that is excluding intervention students who were exposed to a resilience intervention as part of the C-RCT) and compared to the main results using all participants to explore the impact of including both intervention and control participants in the analyses.

## **RESULTS**

### **SAMPLE**

Forty-four of 47 eligible schools were approached prior to achieving the quota of 32 schools (73% consent rate). Characteristics of the participating schools were similar to all eligible schools within the geographic area.

For the 2011 survey, parental consent was granted for 6480 out of 9106 students (71.2%) of which 4538 students started the student survey (participation rate: 49.8% of total enrolled students; 70.0% of students with parental consent). For the 2014 survey, parental consent was granted for 6447 out of 9292 students (69.4%) of which 5270 students started the student survey (participation rate: 56.7% of total enrolled students; 81.7% of students with parental consent). Those students who completed at



least one alcohol use item (2011 N=4366; and 2014 N=5199) are reported in the results, the demographic characteristics of whom are shown in Table 2.

\*\*\*Insert Table 2 here\*\*\*

***Differences in alcohol use prevalence, risk factor prevalence and mean protective factor scores – 2011 and 2014***

**Alcohol use**

Significantly fewer students in 2014 compared to 2011 reported ever (56.6% v 67.9%), recent (17.3% v 21.2%) use of alcohol and ‘binge drinking’ (20.0% v 23.5%).

\*\*\*Insert Table 3 here\*\*\*

**Risk factors**

Apart from 5 risk factors, the proportion of participants reporting each risk factor did not differ between 2014 and 2011. The proportion of students reporting having the following risk factors was significantly lower in 2014 compared to 2011: friend or sibling who drank alcohol; a friend or sibling with a permissive attitude to alcohol use; or permissive attitude to own alcohol use (Table 3).

**Protective factors**

Apart from four protective factors, the mean protective factor scores did not differ between 2014 and 2011. The mean scores for protective factors ‘cooperation and communication’, ‘self-awareness’, ‘community support’ and ‘peer caring relationships’ were significantly lower (i.e. worse) in 2014 compared to 2011 (Table 3):

**ASSOCIATIONS BETWEEN ALCOHOL USE AND RISK/PROTECTIVE FACTORS – 2011 AND 2014**

The risk and protective factors that were associated with each alcohol use outcome in 2011 and 2014 are shown in table 4. The variables with the five highest odds ratios varied across both alcohol use measures and time points, with between three and four risk factors and one and two protective factors having the highest odds ratios. All such risk and protective factors were positively associated with alcohol use. Across both time points and all three alcohol use outcome measures the variables with the highest odds ratios were consistently the risk factors ‘friend alcohol use’ (odds ratio range: 3.50 – 5.32) and ‘permissive attitude to own alcohol use’ (odds ratio range: 2.11-3.18) (Table 4). Other variables consistently ranked within the 5 highest odds ratios included risk factors ‘sibling alcohol use’ and ‘sibling permissive attitude to alcohol use’ for ever use of alcohol, and risk factor ‘personal income’ and protective factor ‘pro-social peers’ for both recent use of alcohol and binge drinking.

\*\*\*Insert Table 4 here\*\*\*

Of the five risk factors that had a significantly lower prevalence in 2014 compared to 2011 (‘friend alcohol use’, ‘sibling alcohol use’, ‘friend permissive attitude to alcohol use’, ‘sibling permissive attitude to alcohol use’, ‘permissive attitude to own alcohol use’), most (4 of 5) were positively associated with each alcohol use measure at each time point. Of these risk factors, four of the five were consistently ranked in the top five highest odds ratios for ever alcohol use (‘friend alcohol use’, ‘permissive attitude to own alcohol use’, ‘sibling permissive attitude to alcohol use’ and ‘sibling alcohol use’), and two of the five (‘friend alcohol use’ and ‘permissive attitude to own alcohol use’) for both recent alcohol use and binge drinking.

Of the four protective factors that had a significantly lower score in 2014 compared to 2011, ‘cooperation and communication’ was not associated with any alcohol use measure at any time point, whereas ‘self-awareness’ was inversely associated (odds ratio range: 0.77-0.86), and both ‘community support’ (odds ratio range: 1.22-1.42) and ‘peer caring relationships’ (odds ratio range: 1.17-1.35) were positively associated, with some alcohol use measures at some time points. These latter three protective factors were ranked as a minimum of 8<sup>th</sup> highest odds ratio.

In sensitivity analyses conducted with data from the control students only, the risk and protective factors that were associated with each alcohol use measure were similar (Table 5). The risk and protective factors ranked as having the highest odds ratios were also largely consistent in sensitivity analyses for each alcohol use measure at each time point.

## **DISCUSSION**

This study explored the association between three measures of adolescent alcohol use and known risk and protective factors of alcohol use in two separate cross sectional samples of Australian adolescents three years apart. Consistent with international and Australian trends,<sup>5,6,28</sup> the proportion of students reporting alcohol use was lower in 2014 than in 2011. Across all three alcohol use outcomes, and at both time points, risk factors were consistently the stronger predictors of alcohol use and generally ranked higher with respect to odds ratios compared to protective factors. Of the 9 assessed risk factors, a lower prevalence was found for five in 2014 compared to 2011. Whereas of the 14 assessed protective factors, a lower score (i.e. worsening) was found in 2014 compared to 2011 on four protective factors. The five risk factors with a lower prevalence and one risk factor with a higher prevalence in 2014 compared to 2011, were positively associated with the majority of alcohol use outcomes, and had a stronger association with alcohol use than the four protective factors with lower scores in 2014 compared to 2011.

The findings of this study should be viewed in light of a number of the study characteristics. First, the study included a number of design strengths, including: two large cross sectional samples of adolescents; comprehensive measurement of known risk and protective factors of alcohol use; use of multiple accepted measures of alcohol use; and analyses that accounted for possible confounders and potential clustering effects within schools. The study was limited by the reliance adolescent self-report of alcohol use, however strategies to increase the validity of self-report were adopted to reduce this risk.<sup>12</sup> Finally whilst the study did assess a comprehensive range of known risk and protective factors, it did not assess access to alcohol which may be important in future research to understand

whether legislation to restrict availability of alcohol to adolescents or parent provision of alcohol is implicated in the decline in alcohol use.

Although non-response bias may exist, the demographic characteristics and prevalence of adolescent substance use found in this study are consistent with those reported in Australian triennial nation-wide surveys,<sup>4;28</sup> suggesting that the likelihood of this bias may be limited. The conduct of the study in one local health district of New South Wales Australia limits the generalisability of the results to other adolescent populations. Additionally, the data were collected as part of a cluster-randomised controlled trial that aimed to increase protective factors and reduce adolescent alcohol use and both intervention and control students were included in the sample. Whilst a decline in alcohol use between the 2011 and 2014 surveys was evident, the impact of the intervention was not a factor as a null result was recorded for the trial for both alcohol use and protective factors in the trial cohort study.<sup>25</sup> Finally, the study is limited by its repeat cross-sectional design which does not allow for investigation of the causal pathways of associations between risk and resilience factors and adolescent alcohol use. Similarly, the cross-sectional design does not allow for examination of which risk and protective factors predict the decline in alcohol use.

The finding that the prevalence of adolescent alcohol use was lower in 2014 compared to 2011 is consistent with previously reported Australian data. For example data from an Australian triennial survey of students aged 12 to 17 years reported the proportion of students who consumed alcohol in the past week, month and in their lifetime to be significantly lower in 2014 compared to 2011.<sup>28</sup>

The finding that risk factors were the strongest predictors of adolescent alcohol use is consistent with previous studies that have examined the associations of both risk and protective factors with adolescent alcohol use.<sup>7;8;11;15</sup> For example an Australian longitudinal study that examined whether risk and protective factors predicted alcohol use one year later similarly reported risk factors such as parent and peer favourable attitude to alcohol use to be more strongly associated with alcohol use than protective factors in 1957 Grade 7 and 9 students.<sup>11</sup> Such findings are also consistent with various models of adolescent substance use prevention that describe the roles of both risk and protective

factors, including the Social Development Model, transactional models and models of resilience.<sup>10;17;29-32</sup> Such models typically propose that protective factors operate by mediating or buffering the effects of risks factors, or that risk factors dampen the effect of protective factors where they occur together.<sup>10;17;29-32</sup>

Whilst the study design does not allow for an attribution of causality, the reduced prevalence of five risk factors over the same time period that declines in alcohol use were found, may be indicative of such risk factors contributing to the decline in adolescent alcohol use. The finding that a number of these risk factors were amongst the variables with the strongest associations with alcohol use strengthens the suggestion that the decline in risk factors may be contributing to the decline in adolescent alcohol use. Such a reduction in these risk factors may reflect changed attitudes or social norms towards drinking in the adolescent population as a whole. This is further reinforced through the increased predictive power of some risk factors in the 2014 sample; for example while fewer participants report having friends who drink alcohol, this risk factor had a stronger association with alcohol use in 2014 compared to 2011. Similarly, the findings are consistent with previous studies regarding the influence of perceived social norms on adolescent behaviour; as adolescent drinking declines, the socially normative nature of this behaviour also declines.<sup>33-35</sup>

The decline or worsening of four protective factors over the same time period where a reduction in alcohol was found however may suggest that such factors contributed little, if any, protective benefit to adolescent alcohol use. The findings that two of the four protective factors ( ‘community support’, ‘peer caring relationships’) had a positive association with alcohol use in multivariable analyses support this, and suggests such factors previously reported to have an inverse association with alcohol use may instead be acting as risk factors for alcohol use. This is consistent with some previous research relating to an increased exposure to alcohol among children in more ‘socially connected’ families<sup>36</sup> or those in a sociocultural environment that is supportive of alcohol use.<sup>37</sup> In the Australian social context, alcohol use is common, and while excessive consumption by parents has been associated with an increased risk for adolescents,<sup>38;39</sup> moderate consumption in social settings is

common among well-functioning families and communities. However the size of the associations between these factors and alcohol use suggest their influence was of lesser relative importance than risk factors. Additionally, whilst no change in other protective factors was found over the time period, inverse associations were found between a number of other protective factors and alcohol use suggesting their protective nature. Of those, 'goals and aspirations', 'home support', 'school support' and 'pro-social peers' were consistently found to be protective of alcohol use despite ranking behind some risk factors in strength of association.

The finding that protective factors worsened or did not change when alcohol use and a number of alcohol risk factors improved, combined with risk factors having stronger associations than protective factors, reinforces the relative importance of risk factors over protective factors in the prevention of adolescent alcohol use. In particular the results suggest the continued importance of alcohol use by siblings and peers, and permissive attitudes to alcohol use as important risk factors for alcohol use. These risk factors represent potentially very effective targets for intervention though both universal (prevention at population level) and selective approaches that identify adolescent groups with multiple risk factors, including those delivered within schools.

This study highlights the ongoing importance of addressing risk factors for adolescent alcohol consumption, and their possible contribution in the decline in adolescent alcohol consumption taking place in Australia. Such findings suggest that prevention efforts should focus on addressing risk factors and provides current evidence to policy makers regarding potential targets for alcohol use prevention. Further research is required to examine the impact of any cumulative effects of risk and protective factors on alcohol use, and to examine the causal pathways of the associations between the risk factors and alcohol use, including any mediating or moderating role protective factors may have on risk factors and causal pathways.

## **ACKNOWLEDGEMENTS**

With thanks to the staff and students from participating schools, and the Healthy Schools Healthy

Futures (HSHF) project team. Authors would like to acknowledge the in kind support of Principals Australia for the use of MindMatters curriculum resources and training. Funding support from NHMRC, nib Foundation, and Hunter New England Population Health, and infrastructure support from the Hunter Medical Research Institute. For the duration of the research project a HSHF Aboriginal Cultural Steering Group made up of Aboriginal staff from local Aboriginal community organizations and Government Departments was established to provide Aboriginal cultural advice and direction regarding the design, implementation, evaluation and dissemination of all research trial elements. Similarly, a HSHF Cultural Advice Group was established consisting of Aboriginal staff from the HSHF project team to provide advice regarding the research trial. We would like to thank the members of both the HSHF Aboriginal Cultural Steering Group and the HSHF Cultural Advice Group for their on-going advice. Additionally, ethical approval was received from the Aboriginal Health and Medical Research Council (AH&MRC).

## **AUTHORS' CONTRIBUTIONS**

Contributors: RKH contributed to the design of the data collection tools, monitored the data collection, led conception of the paper, cleaned and analysed the data, drafted and revised the paper. JW, EC, CG and HL contributed to the conception of the paper, provided critical revision and approved the final version of the paper. CL provided statistical advice and contributed to the critical revision of the manuscript and approved the final manuscript.

## TABLES

Table 1. Student alcohol use, and risk and protective factor of alcohol use survey items

Outcomes	Indicator	Survey item	Response options
<b>Alcohol use</b>			
Alcohol	Ever use	Have you ever had a drink of alcohol? E.g. beer, wine or alcopops/pre-mix drinks (do not count sips or tastes)	Yes/No
	Recent use	Have you had any alcoholic drinks, such as beer, wine or alcopops/pre-mix drinks in the last week? (do not count sips or tastes)	Yes/No
	‘Binge drinking’	In the last 4 weeks, how many times have you had 5 or more alcoholic drinks in a row? <sup>4</sup>	None/Once/Twice/3-6 times/7 or more times
<b>Alcohol use risk factors</b>			
Personal income	Pocket money	How much pocket money did you receive last week from unpaid employment? (I.e. chores around the house)	\$0, I didn’t receive any pocket money in the last week/Less than \$5/\$5 to \$15/\$16 to \$30/More than \$30
	Paid employment	How much money did you earn last week from paid employment? (i.e. paper route or working at McDonalds)	\$0, I didn’t receive any money in the last week from paid work/Less than \$30/\$30 to \$50/\$51 to \$80/More than \$80
Alcohol use	Friend	Do your friends drink alcohol?	Yes/No
	Sibling	Does your brother or sister drink alcohol?	Yes/No
	Parent	Does your mother, father or carer drink alcohol?	Yes/No
Permissive attitude	Friend	Do your friends think it is ok for you to drink alcohol?	Yes/No
	Sibling	Does your brother or sister think it is ok for you to drink alcohol?	Yes/No
	Parent	Does your mother, father or carer think it is ok for you to drink alcohol?	Yes/No
	Self	Do you think it is ok for you to drink alcohol?	Yes/No
Belief health not damaged from alcohol use		Do you think that your health will be damaged if you drink alcohol?	Yes/No
<b>Alcohol use protective factors</b>			
<b>Individual</b>	Cooperation and communication	2 items; e.g. “I enjoy working together with other students my age”	1: Never true, 2: True some of the time; 3: True most of the time; 4: True all of the time
	Self-efficacy	4 items; e.g. “I can do most things if I try”	As above
	Empathy	3 items; e.g. “I try to understand what other people feel and think”	As above
	Problem solving	3 items; e.g. “When I need help I find someone to talk with”	As above
	Self-awareness	3 items; e.g. “I understand why I do what I do”	As above
	Goals and aspirations	3 items; e.g. “I have goals and plans for the future”	As above



<b>Environmental</b>	School support	6 items; e.g. "At my school there is an adult who really cares about me"	As above
	School meaningful participation	3 items; e.g. "At my school, I help decide things like class activities or rules"	As above
	Community support	6 items; e.g. "Outside of school and home, there is an adult whom I trust"	As above
	Community meaningful participation	3 items; e.g. "I am part of clubs, sports teams, church/temple, or other groups"	As above
	Home support	6 items; e.g. "At home, there is an adult who listens to me when I have something to say"	As above
	Home meaningful participation	3 items; e.g. "I do fun things or go fun places with my parents or other adult from my home"	As above
	Peer caring relationships	3 items; e.g. "I have a friend who helps me when I'm having a hard time"	As above
	Pro-social peers	3 items; e.g. "My friends try to do what is right"	As above

Table 2. Demographic characteristics of participating students in 2011 (N=4366) and 2014 (N=5199)

Student demographics	2011 Student sample N (%)	2014 Student sample N (%)
Gender		
Male	2220 (50.9)	2606 (50.1)
Grade		
Year 9	2476 (56.7)	2471 (47.5)
Year 10	1890 (43.3)	2728 (52.5)
Age <sup>a</sup>		
14 or younger	1163 (26.6)	1281 (25.0)
15	2181 (50.0)	2516 (49.1)
16	996 (22.8)	1290 (25.2)
Older than 16	26 (0.6)	40 (0.8)
Aboriginality <sup>b</sup>		
Aboriginal and/or Torres Strait Islander	459 (10.5)	615 (11.8)
Socioeconomic status <sup>c</sup>		
Lower half (most disadvantaged)	2497 (57.2)	3068 (59.1)
Upper half	1866 (42.8)	2124 (40.9)
Remoteness (ARIA) <sup>d</sup>		
Major Cities	1845 (42.3)	2548 (49.0)
Inner Regional	1184 (27.1)	2115 (40.7)
Outer Regional/Remote	1334 (30.6)	533 (10.3)

\*Postcode missing for 15 students therefore SES and remoteness could not be calculated

a 2014: 72 missing; b 2014: 7 missing; c 2011: 3 missing, 2014: 7 missing; d 2011: 3 missing, 2014: 3 missing

Table 3. Student alcohol use, risk factors and protective factors in 2011 (n=4366) and 2014 (n=5199)

Substance use	2011 % (95%CI)	2014 % (95%CI)
<i>Alcohol use</i>		
Ever	67.9 (65.7 – 70.1)	56.6 (53.9 - 59.3)
Recent <sup>a</sup>	21.2 (19.6 – 22.9)	17.3 (15.3 – 19.3)
'Binge drinking' <sup>b</sup>	23.5 (22.0 – 25.1)	20.0 (18.0 – 21.9)
<i>Risk factors</i>		
Personal income	74.8 (73.1 – 76.5)	71.9 (70.2 – 73.7)
Friend alcohol use	79.8 (77.7 – 82.0)	60.4 (57.2 - 63.5)
Sibling alcohol use	51.5 (49.4 – 53.7)	46.0 (44.0 – 48.0)
Parent alcohol use	83.9 (82.5 – 85.3)	81.3 (79.7 – 82.9)
Friend permissive attitude to alcohol use	72.8 (70.7 – 74.9)	59.4 (57.2 – 61.5)
Sibling permissive attitude to alcohol use	37.8 (36.0 – 39.6)	30.9 (29.0 – 32.8)
Parent permissive attitude to alcohol use	29.9 (27.8 – 32.0)	30.5 (28.9 – 32.2)
Permissive attitude to own alcohol use	48.2 (46.0 – 50.5)	42.5 (40.8 – 44.2)
Belief health not damaged by alcohol use	18.7 (17.0 – 20.5)	21.5 (20.2 – 22.8)
<i>Protective factors<sup>c</sup></i>		
<i>Individual protective factors:</i>		
Cooperation and communication (Mean (SD))	3.03 (3.00 – 3.05)	2.93 (2.89 – 2.97)
Empathy (Mean (SD))	3.03 (3.00 – 3.06)	3.05 (3.01 – 3.09)
Goals and aspirations (Mean (SD))	3.17 (3.13 – 3.21)	3.21 (3.16 – 3.26)
Problem solving (Mean (SD))	2.75 (2.72 – 2.77)	2.71 (2.68 – 2.74)
Self-awareness (Mean (SD))	3.05 (3.02 – 3.07)	2.97 (2.93 – 3.01)
Self-efficacy (Mean (SD))	3.05 (3.03 – 3.07)	3.02 (2.99 – 3.04)
<i>Environmental protective factors:</i>		
School support (Mean (SD))	2.82 (2.78 – 2.86)	2.76 (2.71 – 2.80)
School meaningful participation (Mean (SD))	2.27 (2.23 – 2.31)	2.24 (2.20 – 2.28)
Community support (Mean (SD))	3.16 (3.12 – 3.20)	3.03 (2.99 – 3.07)
Community meaningful participation (Mean (SD))	2.99 (2.92 – 3.05)	2.93 (2.87 – 3.00)
Home support (Mean (SD))	3.33 (2.30 – 3.36)	3.27 (3.23 – 3.31)
Home meaningful participation (Mean (SD))	2.84 (2.81 – 2.87)	2.79 (2.75 – 2.83)
Pro-social peers (Mean (SD))	2.88 (2.85 – 2.91)	2.94 (2.90 – 2.97)
Peer caring relationships (Mean (SD))	3.44 (3.40 – 3.47)	3.25 (3.21 – 3.30)

<sup>a</sup> 2011: 26 missing, 2014: 13 missing; <sup>b</sup> 2011: 28 missing, 2014: 18 missing;

<sup>c</sup> 2014: 0 to 5 missing.

Table 4. Associations between student alcohol use and risk/protective factors – 2011 and 2014<sup>a,c</sup>

	Ever used alcohol <sup>b</sup>				Recent alcohol use <sup>b</sup>				'Binge drinking' <sup>b</sup>			
	2011		2014		2011		2014		2011		2014	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Risk factors</b>												
Personal income	1.23	(1.02-1.47)	1.36	(1.16-1.60)	1.52	(1.23-1.88)	1.50	(1.22-1.86)	1.52	(1.23-1.88)	1.73	(1.40-2.13)
Friend alcohol use	3.50	(2.76-4.42)	4.42	(3.65-5.38)	4.00	(2.52-6.37)	4.27	(3.04-6.02)	3.45	(2.16-5.49)	5.32	(3.80-7.41)
Sibling alcohol use	1.62	(1.36-1.94)	1.90	(1.62-2.23)	1.24	(1.01-1.52)			1.37	(1.12-1.67)	1.30	(1.06-1.58)
Friend permissive attitude to alcohol use							1.39	(1.01-1.92)	1.62	(1.15-2.29)		
Sibling permissive attitude to alcohol use	1.64	(1.32-2.04)	1.62	(1.31-1.98)	1.31	(1.06-1.63)	1.32	(1.05-1.65)			1.37	(1.10-1.70)
Parent permissive attitude to alcohol use			1.31	(1.09-1.58)	1.51	(1.25-1.83)	1.34	(1.10-1.63)	1.23	(1.02-1.5)	1.25	(1.03-1.52)
Permissive attitude to own alcohol use	2.46	(2.03-2.98)	2.11	(1.78-2.49)	2.22	(1.81-2.74)	2.68	(2.17-3.31)	3.18	(2.58-3.92)	2.82	(2.31-3.46)
Belief health not damaged from alcohol use			1.30	(1.08-1.56)							1.27	(1.05-1.54)
<b>Individual protective factor subscales:</b>												
Goals and aspirations <sup>d</sup>	0.74	(0.65-0.88)			0.85	(0.75-0.96)	0.83	(0.73-0.94)	0.69	(0.61-0.79)	0.87	(0.77-0.99)
Problem solving <sup>d</sup>			0.84	(0.74-0.95)								
Self-awareness <sup>d</sup>			0.77	(0.67-0.87)	0.79	(0.68-0.91)			0.86	(0.74-0.99)	0.81	(0.70-0.93)
<b>Environmental protective factor subscales:</b>												
School support <sup>d</sup>	0.84	(0.73-0.97)					0.83	(0.72-0.96)	0.78	(0.68-0.90)	0.86	(0.74-0.99)
School meaningful participation <sup>d</sup>			0.87	(0.77-0.99)								
Community support <sup>d</sup>	1.24	(1.09-1.41)			1.22	(1.07-1.40)			1.42	(1.24-1.63)		
Home support <sup>d</sup>	0.66	(0.55-0.80)	0.71	(0.60-0.83)	0.69	(0.58-0.83)	0.64	(0.53-0.77)	0.69	(0.57-0.82)	0.64	(0.54-0.77)
Home meaningful participation <sup>d</sup>			1.25	(1.08-1.44)	1.18	(1.00-1.39)					1.27	(1.08-1.50)
Peer caring relationships <sup>d</sup>	1.35	(1.19-1.53)	1.25	(1.13-1.39)	1.17	(1.03-1.33)			1.23	(1.08-1.40)	1.25	(1.11-1.40)
Pro-social peers <sup>d</sup>	0.65	(0.56-0.76)	0.72	(0.63-0.83)	0.54	(0.47-0.63)	0.61	(0.52-0.71)	0.46	(0.40-0.54)	0.60	(0.52-0.69)

<sup>a</sup> Models adjusted for school clustering, gender, grade, Aboriginal/Torres Strait Islander, socio-economic status, remoteness, school size, and school type;

<sup>b</sup> Recent: 2011: 26 missing, 2014: 13 missing; 'Binge drinking' 2011: 28 missing, 2014: 18 missing;

<sup>c</sup> Only variables that significantly contributed to the prediction of the alcohol use variable were are reported<sup>d</sup> Reported data refer to association between alcohol use and a one unit decrease in each mean protective factor score.

Table 5. Sensitivity analysis of associations between student alcohol use and risk/protective factors – 2011 and 2014<sup>a,c</sup>

	Ever used alcohol <sup>b</sup>				Recent alcohol use <sup>b</sup>				'Binge drinking' <sup>b</sup>			
	2011		2014		2011		2014		2011		2014	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
<b>Risk factors</b>												
Personal income	1.30	(1.16-1.46)			1.51	(1.28-1.78)	1.52	(1.04-2.21)	1.54	(1.31-1.81)	1.62	(1.12-2.33)
Friend alcohol use	3.82	(3.33-4.39)	4.83	(3.47-6.71)	4.39	(3.30-5.85)	5.32	(2.87-9.9)	4.10	(3.04-5.52)	6.85	(3.72-12.5)
Sibling alcohol use	1.62	(1.45-1.82)	2.04	(1.55-2.69)	1.29	(1.10-1.51)			1.47	(1.26-1.73)	1.47	(1.03-2.10)
Parent alcohol use			0.97	(0.69-1.35)					0.80	(0.66-0.97)	0.75	(0.49-1.13)
Friend permissive attitude to alcohol use	1.22	(1.06-1.41)			1.37	(1.09-1.73)			1.75	(1.37-2.21)		
Sibling permissive attitude to alcohol use	1.48	(1.27-1.72)			1.36	(1.15-1.61)	1.54	(1.02-2.32)	1.23	(1.04-1.46)		
Parent permissive attitude to alcohol use	1.16	(1.00-1.33)	1.76	(1.28-2.42)	1.52	(1.30-1.77)	1.78	(1.25-2.53)	1.28	(1.10-1.50)		
Permissive attitude to own alcohol use	2.18	(1.91-2.48)	2.02	(1.51-2.69)	2.11	(1.80-2.49)	2.38	(1.63-3.47)	2.84	(2.42-3.34)	2.58	(1.80-3.68)
Belief health not damaged from alcohol use			1.41	(1.02-1.96)	1.22	(1.04-1.43)					1.52	(1.08-2.13)
<b>Individual protective factor subscales:</b>												
Cooperation and communication									1.14	(1.01-1.29)		
Empathy											0.74	(0.59-0.92)
Goals and aspirations <sup>d</sup>	0.82	(0.76-0.90)			0.83	(0.75-0.92)			0.70	(0.63-0.78)		
Self-awareness <sup>-d</sup>	0.91	(0.82-1.00)	0.68	(0.55-0.85)	0.89	(0.79-0.99)	0.75	(0.59-0.96)	0.88	(0.79-0.99)	0.74	(0.58-0.93)
Self-efficacy			1.37	(1.04-1.80)								
<b>Environmental protective factor subscales:</b>												
School support <sup>d</sup>	0.77	(0.70-0.85)							0.82	(0.74-0.92)		
School meaningful participation <sup>d</sup>			0.80	(0.65-0.98)								
Community support <sup>d</sup>	1.23	(1.13-1.35)			1.15	(1.03-1.28)			1.32	(1.19-1.47)		
Community meaningful participation									0.91	(0.83-1.00)		
Home support <sup>d</sup>	0.66	(0.59-0.75)	0.77	(0.59-0.99)	0.68	(0.59-0.78)	0.62	(0.46-0.83)	0.70	(0.61-0.81)	0.63	(0.47-0.84)
Home meaningful participation <sup>d</sup>					1.18	(1.04-1.34)					1.42	(1.07-1.87)
Peer caring relationships <sup>d</sup>	1.28	(1.18-1.38)	1.22	(1.03-1.44)	1.18	(1.07-1.30)			1.23	(1.11-1.36)		
Pro-social peers <sup>d</sup>	0.66	(0.60-0.73)			0.56	(0.50-0.63)	0.58	(0.45-0.74)	0.52	(0.46-0.58)	0.60	(0.47-0.76)

<sup>a</sup> Models adjusted for school clustering, gender, grade, Aboriginal/Torres Strait Islander, socio-economic status, remoteness, school size, and school type;

<sup>b</sup> Recent: 2011: 2 missing, 2014: 9 missing; 'Binge drinking' 2011: 5 missing, 2014: 11 missing;

<sup>c</sup> Only variables that significantly contributed to the prediction of the alcohol use variable were are reported

<sup>d</sup> Reported data refer to association between alcohol use and a one unit decrease in each mean protective factor score.

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