



## 24-month outcomes of an eHealth universal program for students and parents to prevent adolescent alcohol use: A cluster randomized controlled trial in schools

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### ABSTRACT

**Background:** Parents play a critical role in delaying adolescent initiation of alcohol and other drug use. However, the majority of prevention programs focus on adolescents only. This study tested the acceptability and effectiveness of an eHealth universal program for students and parents to prevent adolescent alcohol use.

**Methods:** A cluster randomized controlled trial (RCT) was conducted between 2018 and 2020 with students from one grade level (aged 12–14 years) from 12 Australian secondary schools randomly allocated to the intervention or control conditions. Students accessed a web-based program in class and parents accessed the program online at their convenience. Data were collected via online questionnaires from students ( $N = 572$ ) and parents ( $N = 78$ ) at baseline, and 12- and 24- months post baseline. Multilevel, mixed effects regression models were used to analyse student data.

**Findings:** More students in the control group reported having at least one standard alcoholic drink and engaging in heavy episodic drinking in the previous 12 months at both 12- and 24-month follow up compared to students in the intervention, however, these differences were not statistically significant. Students in the intervention group reported greater increases in alcohol-related knowledge, compared to the control students. Qualitative data from parents indicated that they found the program useful, however, the number of parents who enrolled in the research study (13.9 %) was low. Parent engagement increased following implementation of an interactive parent/adolescent homework task.

**Conclusions:** Small sample size, low prevalence of alcohol use and parental engagement, and relatively short follow-up period may have contributed to lack of observed intervention effect, other than on alcohol-related knowledge. Parents who engaged with the program found it useful, however, implementation strategies that encourage parent-child interaction and communication may increase parent engagement for future programs.

### 1. Introduction

Despite an overall trend of reduced alcohol use and increased rates of abstinence among young people in Australia and globally, alcohol use remains one of the leading causes of burden of disease globally among people aged 10–24 years (AIHW, 2020; McCabe et al., 2021). Research indicates early initiation to alcohol use predicts future harmful drinking behaviours as well as alcohol use problems (Clare et al., 2020; Kim et al., 2017) and among Australian adolescents who identify as current alcohol

drinkers, 43 % report obtaining alcohol from their parents (Guerin and White, 2020). Research further suggests that parental supply of alcohol is associated with more risky drinking and alcohol-related harm in adolescents (Clare et al., 2020). Intervention during adolescence to prevent alcohol use from becoming problematic remains critical (Botvin and Griffin, 2007; Briere et al., 2011; McBride, 2003).

Numerous alcohol use prevention programs for adolescents have been developed, yet few have shown replicable effects and are scalable (Champion et al., 2013; Malmberg et al., 2014; Newton et al., 2017).

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One program that has shown promise is the web-based *Climate Schools: Alcohol and Cannabis* course; a school-based prevention program mapped to the health education curriculum and based on the social influence approach to prevention (Faggiano et al., 2014; Sussman et al., 2004). The *Climate Schools* course has been evaluated in six previous studies and found to be effective in reducing alcohol use and related harms up to 7 years following the interventions (Newton et al., 2010a; Newton et al., 2022b; Newton et al., 2022a; Slade et al., 2021; Teesson et al., 2020).

Acknowledging that universal approaches to prevention have significant potential, there is a renewed effort to identify ways of boosting their effects (Tanner-Smith et al., 2018). Recent research demonstrates that actively involving parents in prevention programs is effective in reducing adolescent substance use behaviour (Newton et al., 2017; Smit et al., 2008; Vermeulen-Smit et al., 2015). One example of an effective parent and adolescent alcohol use prevention program is the PAS (Prevention of Alcohol use in Students) program (Koning et al., 2009; Koning et al., 2011; Koning et al., 2013), an in-school web-based intervention for students combined with in-person meetings for parents. One of the primary components of the PAS program is endorsement of a shared set of rules by parents around adolescent alcohol use. Evaluations of the PAS program found that students who participated in the combined parent-student intervention reported delayed onset of alcohol use and less alcohol consumption and heavy weekend alcohol consumption up to 50-months post baseline (Koning et al., 2009; Koning et al., 2011; Koning et al., 2013; Koning et al., 2015).

Despite the potential of combined parent/adolescent prevention programs and the advantages of online delivery methods, such as increased accessibility, flexibility and intervention fidelity, there are currently no combined web-based parent/adolescent programs that aim to prevent adolescent alcohol use and harms (Newton et al., 2017). In scoping research by our team among 242 Australian parents of teenagers, parents indicated they wanted a program which was interactive (62.4 %), brief (88.5 %) and evidence-based (97.9 %) (Thornton et al., 2018a). The *Climate Schools Plus* (CSP) combined student and parent program was developed to fill this gap (Thornton et al., 2018a). The current study presents the outcomes of a cluster randomized controlled trial (RCT) of the CSP program in Australian secondary schools (Newton et al., 2018).

In line with our published protocol (Newton et al., 2018), the primary hypothesis is that the CSP program will be more effective than health education as usual in reducing the rate of increase in alcohol use, heavy episodic drinking and alcohol-related harms among adolescents up to 24 months post-baseline.

## 2. Material and methods

### 2.1. Study design and randomisation

A cluster RCT was conducted in 12 Australian secondary (Years 7 to 12) schools from 2018 to 2020. Each school was randomly allocated to either the intervention (CSP) or control group by an external researcher using stratified random allocation (via the *statarand* procedure in *StataSE*, version 14). As is the case for school-based interventions of this kind, students, teachers and research assistants were not blind to intervention allocation. Strata were defined according to school type (co-educational or single sex). Allocation was random within strata to achieve balance across groups in the number of male and female participants. The protocol was approved by Human Research Ethics Committees at the Universities of Sydney (HREC 2018/864), New South Wales and (HREC 2018/864), Catholic Education Office Paramatta, and Sydney Catholic Schools (Newton et al., 2018).

### 2.2. Participants

Students from twelve Australian secondary schools from New South Wales ( $n = 11$ ) and Queensland ( $n = 1$ ) (6 Catholic, 6 Independent)

participated in the study. Due to time constraints, two schools (assigned to the *Climate Schools Plus* condition) withdrew after randomisation and completing baseline, but prior to completing follow-up questionnaires. Data from students in these schools were included in statistical analysis according to the intention to treat principle. To account for cluster randomisation, sample size calculations were based on formula in Heo and Leon (2009) to detect intervention by time interactions in longitudinal cluster randomized clinical trials. This trial was powered at 80 % to detect a standardized between-group mean difference of 0.2 ( $\alpha = 0.05$ ), consistent with previous trials of this nature (Teesson et al., 2020).

Eligible participants were students in Year 8 (approximately 13–14 years of age) at participating schools and their parents/guardians. Parents were provided with hard copy and electronic consent forms for their child and were also required to consent to their own participation in the study. Students provided informed consent online prior to engaging in the study. Students who did not consent to take part or whose parents did not actively consent for them to take part were allowed to access the program content (if in the intervention group), however, no data was collected from these students. Similarly, parents who did not consent to the study were allowed to access the program, however, no data was collected from these parents. All student and parent participants were asked to complete confidential self-report assessments at baseline and 12- and 24-months post-baseline.

### 2.3. Interventions

The course is an internet-based universal prevention program delivered to all students regardless of their level of risk and is based on a social influence approach to prevention (Newton et al., 2010a). This approach involves delivering accurate information about substance use, placing substance use within a normative context (ie, most students their age are not using alcohol or cannabis), and developing students' resistance skills (Newton et al., 2011). The parent component is designed to reinforce accurate messaging around normative use among adolescents, and targets modifiable parental risk and protective factors known to be associated with adolescent substance use such as parent child communication, parental monitoring and rule-setting, attitudes to and supply of alcohol and parental modelling of alcohol use (Newton et al., 2017; Yap et al., 2017; Larm et al., 2018; Clare et al., 2020; LoBraico et al., 2019). The logic model behind this intervention is found in supplementary materials.

#### 2.3.1. *Climate Schools Plus* (CSP)

Schools allocated to the CSP condition implemented the *Climate Schools: Alcohol and Cannabis* course during Year 8 and Year 9 Personal Development, Health and Physical Education (PDHPE) lessons in 2018 and 2019 (Champion et al., 2016; Newton et al., 2009; Newton et al., 2010b; Newton et al., 2018; Teesson et al., 2017; Thornton et al., 2018b). This consists of 12, 40-min lessons aimed at reducing alcohol and cannabis use and related harms. The first 6 lessons focus specifically on alcohol and are delivered in year 8, the remaining 6 lessons focus on alcohol and cannabis and are delivered 12 months later when the students are in year 9, prior to the development of harmful patterns of alcohol and cannabis use. The first part of each lesson is an internet-based cartoon storyline completed individually by students, which imparts information about alcohol (in years 8 and 9) and cannabis (in year 9). The second part of each lesson consists of optional class activities delivered by the teacher, such as role-plays and group discussions, which reinforce the information in the cartoons and allow communication among students. Teachers are provided access to an internet-based teacher's manual, which contains lesson activities, implementation guidelines, links to the syllabus, and teacher summaries for each lesson.

Over the same period, parents were invited to register online to take part in the parent program. They were then asked to consent to the

study, complete the questionnaire and engage with the program. Parents were able to register separately to their child, which meant some parents registered for the study even though their child did not register and vice versa. The CSP Parenting component was based on a successful Dutch program developed by Koning and colleagues (Koning et al., 2009; Koning et al., 2011; Koning et al., 2013), and informed by literature reviews, a large scoping survey, and consultation with Australian teachers, parents and adolescents (Thornton et al., 2018a). The parenting component included 1) two brief 5–7 min webinars (one in Year 8 and one in Year 9) 2) an online alcohol rule-ranking exercise and 3) a series of 6 brief online modules (under 10 mins each, 4 in Year 8 and 2 in Year 9) covering a range of topics about alcohol and cannabis use.

The webinars were delivered by an expert in adolescent substance use and prevention (CC) who is also a member of the research team and provide brief overviews of alcohol and cannabis use in adolescents and related harms and highlight the role parents can play in preventing substance use in their child. During the webinar, parents are introduced to the online program and encouraged to engage with the modules and the rule-ranking exercise, which allows parents to rank a series of rules related to alcohol use to facilitate a collective understanding of alcohol prevention and the role parental rule-setting plays in prevention. The online modules covered a range of topics about alcohol and cannabis use (getting the facts about alcohol and cannabis use, prevalence and harms), as well as parenting strategies and communication (parental attitudes and rule-setting, parental supply and use, communication and parental involvement).

Engagement strategies included email and text prompts, and an 'invite your parent' button (for more information on program content and delivery see Thornton et al. (2018a)). Following low parental engagement in Year 8, we implemented a homework task in Year 9 where students were asked to engage with a parent, log into the program and complete one of the key components (rule-ranking around alcohol use). Whilst not mandatory, this was designed as an interactive activity to facilitate a conversation around alcohol use and increase engagement with the program.

### 2.3.2. Control

Schools assigned to the control condition implemented their regular PDHPE alcohol and other drug lessons over the same period.

## 2.4. Measures

Outcomes were assessed via online self-report questionnaire at baseline, 12- and 24-months post-baseline. All primary and secondary outcomes were student reported (see 2.4.1 and 2.4.2 below). Student questionnaires were completed in class and parent questionnaires were completed at home.

### 2.4.1. Primary outcomes

Primary outcomes were adolescent alcohol use (1+ standard alcoholic drink; yes/no), and heavy episodic drinking (5+ standard drinks on 1+ occasion; yes/no) measured over the previous 12 months.

### 2.4.2. Secondary outcomes

Secondary outcomes were *Alcohol-related harms* (23-item Rutgers Alcohol Problem Index (RAPI) (van der Vorst et al., 2005); *Parent-adolescent communication* (20-item Parent-Adolescent Communication Scale, Barnes and Olson, 1985); *Parental supply of alcohol* (2-question scale from the Australian Parental Supply of Alcohol Study (Aiken et al., 2017). *Students' alcohol knowledge* (16-item scale from the 'Knowledge about Alcohol' scales adapted from the School Health and Alcohol Harm Reduction Project (SHAHRP) and used in previous trials (Champion et al., 2016; Newton et al., 2009; Newton et al., 2010a; Newton et al., 2014; Teesson et al., 2017; Vogl et al., 2009; Vogl et al., 2014).

### 2.4.3. Parent evaluation and engagement

Parents in the CSP group were invited to complete an evaluation of the CSP program approximately eight weeks after registering, to allow them time to complete all components of the program. We included the System Usability Scale (SUS) (Sauro, 2011). and questions about the usefulness and acceptability of the program, barriers to engagement and suggestions for improvement. We collected data on the number of parents who engaged with each element of the parent program (i.e., the webinars, the rule ranking and the modules). An index of parent engagement was also generated to capture the extent to which parents engaged in any element of the program. This index assigned each parent a score from 0 to 6 based on how many elements of the program with which they engaged.

## 2.5. Statistical analysis

Three-level mixed effects regression was used to analyse outcomes with repeated measurements nested within students and students nested within schools. Linear mixed-effects models were used for continuous outcomes, and generalised linear mixed-effects models with a logit link were used for binary outcomes. Random intercepts were included at both individual and school-levels to account for correlation between repeated measurements of each individual and clustering within schools. Models included group, time and group  $\times$  time terms. Time was coded as a continuous variable representing years since baseline assessment. Group was dummy coded (0 = control, 1 = intervention). Intervention effects were assessed by the group  $\times$  time interaction, representing the year-by-year change in each outcome for the intervention group relative to the control group. To provide an indication of the size of any intervention effect, predicted (i.e. model-based) marginal effects were calculated at 24 months. These took the form of predicted group differences in the prevalence of categorical outcomes and standardized mean differences between groups in continuous outcomes. Models were fitted using the *melogit* command and effect sizes calculated using the *margins* command, both in Stata version 15. Analyses were conducted according to the intention-to-treat principle, including all available observations in the intervention group to which they were originally allocated. Missing data are accommodated in these models using all available data through full maximum likelihood (FML) estimation. Sensitivity analyses (reported in supplementary materials) reran models controlling for school type and student age.

## 3. Results

### 3.1. Descriptive data and attrition

562 secondary school students and 78 parents/guardians of these students completed baseline assessments. The CONSORT diagram (Fig. 1) summarises participant flow and retention rates throughout the study.

The mean age of students and parents at baseline was 13.5 years (SD = 0.5) and 46.7 years (SD = 4.8), respectively. Participant characteristics are presented in Table 1.

Attrition analyses were conducted to assess comparability of students in the CSP and control groups who were present only at baseline compared to students who completed follow-up assessments. Survey non-response resulted from students being absent on the day of the survey, technological issues on the day preventing them from accessing the online survey or answering fewer than 80 % of the items on any scale. The majority of students (80.4 %) were present for baseline and at least one follow-up occasion. Sex, school grades and truancy were not associated with attrition. Compared to participants who provided follow-up data, participants who were present at baseline only were less likely to be in the intervention group [odds ratio (OR) = 0.64, 95 % confidence interval (CI) = 0.42, 0.99].

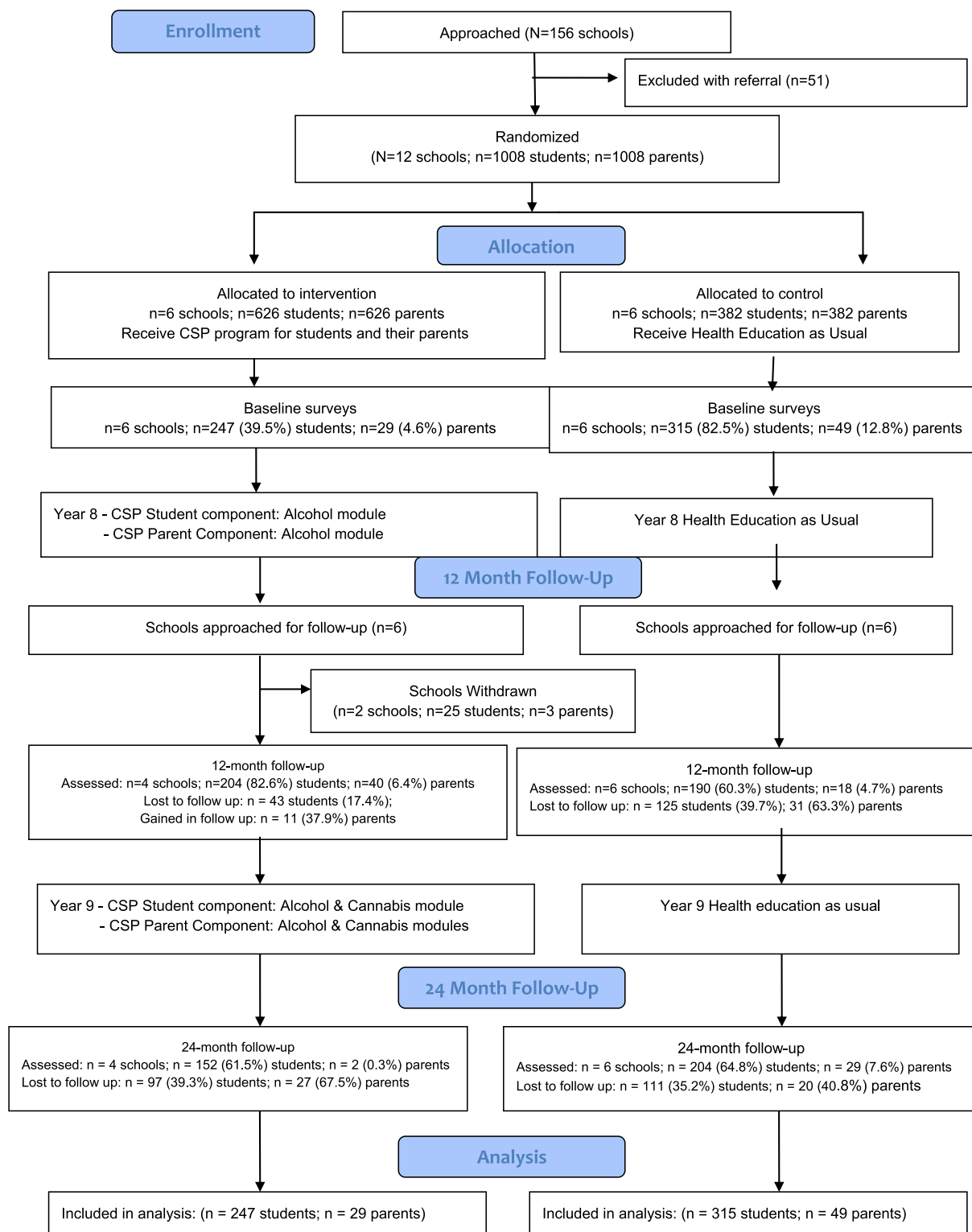


Fig. 1. Consolidated Standards of Reporting Trials (CONSORT) diagram for participant flow in the CSP trial.

### 3.2. Primary outcomes

Results of the multi-level modelling for the primary outcomes of alcohol use and heavy episodic drinking are shown in Table 2. Coefficients for the mixed effects regression models for the primary outcomes are shown in Table 3. Compared to student in the intervention group, more students in the control group reported having at least one standard alcoholic drink and engaging in heavy episodic drinking in the

previous 12 months at both 12- and 24-month follow up, however, these differences were not statistically significant. The model-predicted odds of any drinking at 24-month follow-up were lower in the intervention group compared to the control group, however the confidence intervals around this estimate were wide (OR = 0.51, 95 % confidence interval (CI) = 0.09–2.90). Similarly, the model-predicted odds of binge drinking at 24-month follow-up were lower in the intervention group compared to the control group, however this estimate had wide confidence

**Table 1**  
Baseline characteristics of the student sample.

	Control	CSP	Overall
n (student participants)	315	247	562
n (schools)	6	6	12
Gender Identity			
Male	141 (45.0 %)	86 (35.2 %)	227 (40.8 %)
Female	170 (54.3 %)	157 (64.3 %)	327 (58.7 %)
Non-binary/gender fluid	2 (0.6 %)	0	2 (0.4 %)
Different Identity	0	1 (0.4 %)	1 (0.2 %)
Missing	2 (0.6 %)	3 (1.2 %)	5 (0.9 %)
Age (yrs), mean, SD	13.68 (0.50)	13.25 (0.47)	13.49 (0.53)
Country of Birth (% within trial group)			
Australia	274 (87.8 %)	228 (94.2 %)	502 (90.6 %)
Other English Speaking	13 (4.2 %)	2 (0.8 %)	15 (2.7 %)
Non-English Speaking	25 (8.0 %)	12 (5.0 %)	37 (6.7 %)
Missing	3 (1.0 %)	5 (2.0 %)	8 (1.4 %)
School Type: (Independent)	88 (27.9 %)	44 (17.8 %)	132 (23.5 %)

intervals (OR = 0.15, 95%CI = 0.02–10.08).

### 3.3. Secondary outcomes

The results for the secondary outcomes are presented in [Tables 2 and 3](#). More students in the control group reported that they had experienced alcohol-related harms at both 12- and 24-month follow-up, compared to students in the intervention, however, there was little evidence of significant group differences in the change in alcohol-related harm over time. There was little evidence of differences between groups in the change in the odds of parental supply of alcohol, both in terms of frequency and quantity. There was a statistically significant group by time interaction for knowledge scores where increase knowledge scores was greater in students from intervention compared to control schools. The standardized mean difference in knowledge scores between groups at 24-month follow-up timepoint was 1.52 points (95 % confidence interval: 0.57, 2.46). Lastly, there was little evidence of significant differences between groups in change in communication quality over time. Sensitivity analyses controlling for school type and student age did not change the magnitude or direction of results (see supplementary materials).

### 3.4. Parental engagement and program evaluation: exploratory analysis

[Table 4](#) presents demographic and parent engagement data in the form of ‘dyads’ where only parents whose child also completed the study have been included. Of the 29 eligible parents whose child also participated in the active intervention group, 48.39 % viewed the Year 8 Webinar, 20.7 % viewed the Year 9 Webinar, 55.2 % completed the Year 8 rule ranking, 17.2 % completed the Year 9 rule-ranking, 34.5 % viewed part of the Year 8 modules and 6.9 % viewed part of the Year 9 modules. One in five (20.7 %) received an engagement score of one, 13.8 % received scores of two, three and four respectively and 3.4 % received scores of five and six respectively, reflecting the number of parent components completed. We also examined parental engagement among all parents who engaged with the program, regardless of whether they were part of a matched student/parent dyad. We found that after the rule-ranking homework task was assigned at the beginning of Year 9, the number of parents who participated in this component of the parent program more than doubled (Year 8:  $n = 31$ ; Year 9:  $n = 66$ ).

Twenty-three parents completed the parent program evaluation (SUS total score = 79 % indicating good to strong performance) and 95 % of these parents said they would recommend the program to others. All

**Table 2**  
Primary and secondary outcomes by group for all assessment occasions.

	Control (n = 315)	CSP (n = 247)
Primary outcomes	n (% of trial group)	n (% of trial group)
Drinking (full standard drink) in past 12 months		
Baseline	30/311 (9.6 %)	14/239 (5.9 %)
12 month Follow Up	35/184 (19.0 %)	26/185 (14.1 %)
24 month Follow Up	67/201 (33.2 %)	30/145 (20.7 %)
Heavy episodic Drinking (5+ drinks on one occasion) in past 12 months		
Baseline	5/311 (1.6 %)	2/239 (0.8 %)
12 month Follow Up	7/184 (3.8 %)	4/185 (2.2 %)
24 month Follow Up	24/201 (11.9 %)	9/145 (6.2 %)
Secondary Outcomes		
Any alcohol-related harms in the past 12 months	n (% of trial group)	n (% of trial group)
Baseline	54/312 (17.3 %)	33/238 (13.9 %)
12 month Follow Up	24/182 (13.2 %)	21/178 (11.8 %)
24 month Follow Up	46/195 (23.6 %)	32/142 (22.5 %)
Parent Supply (frequency-based)	n (% of trial group)	n (% of trial group)
Baseline	103/311 (33.1 %)	66/235 (28.1 %)
12 month Follow Up	61/181 (33.7 %)	64/171 (37.4 %)
24 month Follow Up	69/195 (35.4 %)	41/138 (29.7 %)
Parent Supply (quantity-based)	n (% of trial group)	n (% of trial group)
Baseline	132/311 (42.4 %)	83/235 (35.3 %)
12 month Follow Up	71/181 (39.2 %)	77/171 (45.0 %)
24 month Follow Up	82/195 (42.1 %)	53/138 (38.4 %)
Alcohol knowledge	M (SD)	M (SD)
Baseline	7.200 (2.632)	8.109 (2.866)
12 month Follow Up	7.560 (3.058)	10.430 (3.072)
24 month Follow Up	8.358 (3.030)	10.170 (3.294)
Communication Quality	M (SD)	M (SD)
Baseline	50.297 (13.799)	50.714 (12.987)
12 month Follow Up	46.689 (15.200)	48.647 (12.786)
24 month Follow Up	46.009 (15.115)	48.344 (13.672)

parents reported the program was informative and easy to understand with the right amount of information: “*simple to read, clear. As a busy parent I could read them without just skimming*”. Just over half of parents ( $n = 13$ ; 57 %) reported that they watched the webinar and all reported it as useful. Nineteen parents (83 %) completed the rule ranking task and 95 % enjoyed it (“*I thought it was clever and a good way for parents to collaborate and set agreed rules*”, “*... all the rules were ones I consider to be important so very thought provoking*”). Similarly, 83 % of parents accessed the parent summaries and all reported them as useful. Time was most commonly mentioned as a barrier for parents engaging in a program like CSP ( $n = 7$ ); “*busy parents find it hard to follow-up on a program like this*”. Aspects that parents reported working best included online flexible format, clear information, real life examples and encouragement to talk with their child about alcohol. Aspects that parents thought might improve the program included more practical tools to help parents, an

**Table 3**

Fixed-effects coefficients from the mixed-effects regression models for any alcohol use, heavy episodic drinking and alcohol-related harms in the total sample ( $n = 561^*$ ).

Primary Outcomes				
Alcohol Use (Any vs None)	B (SE)	P	OR	95 % CI
Intercept	-5.12 (0.76)	<0.001		
<b>Main Effects</b>				
Group (Intervention vs. Control)	-0.35 (1.01)	0.730	0.71	0.10, 5.18
Time	1.44 (0.21)	<0.001	4.24	2.80, 6.41
<b>Interaction effects</b>				
Group x time	-0.22 (0.29)	0.451	0.80	0.45, 1.43
<b>Heavy episodic Drinking (Any vs None)</b>				
Intercept	-11.77 (3.43)	0.001		
<b>Main Effects</b>				
Group (Intervention vs. Control)	0.08 (2.16)	0.97	1.08	0.02, 75.32
Time	2.52 (0.73)	0.001	12.37	2.96, 51.72
<b>Interaction effects</b>				
Group x time	-0.64 (0.72)	0.375	0.53	0.13, 2.16
<b>Secondary categorical outcomes</b>				
<b>Alcohol-related harms (Any vs None)</b>				
Intercept	-2.23 (0.37)	<0.001		
<b>Main Effects</b>				
Group (Intervention vs. Control)	-0.43 (0.54)	0.424	0.65	0.23, 1.87
Time	0.27 (0.13)	0.040	1.31	1.01, 1.71
<b>Interaction effects</b>				
Group x time	0.01 (0.21)	0.960	1.01	0.67, 1.52
<b>Parent Supply – frequency based (Any vs Never)</b>				
Intercept	-0.97 (0.40)	0.015		
<b>Main Effects</b>				
Group (Intervention vs. Control)	-0.41 (0.60)	0.497	0.67	0.21, 2.16
Time	0.14 (0.12)	0.269	1.15	0.90, 1.46
<b>Interaction effects</b>				
Group x time	0.08 (0.19)	0.677	1.08	0.74, 1.59
<b>Parent Supply – quantity based (None vs Some)</b>				
Intercept	-0.32 (0.39)	0.408		
<b>Main Effects</b>				
Group (Intervention vs. Control)	-0.73 (0.57)	0.205	0.48	0.16, 1.49
Time	0.08 (0.13)	0.504	1.09	0.85, 1.39
<b>Interaction effects</b>				
Group x time	0.20 (0.20)	0.306	1.22	0.83, 1.79
<b>Secondary continuous outcomes</b>				
<b>Alcohol Knowledge</b>				
Intercept	6.95 (0.37)	<0.001		
<b>Main Effects</b>				
Group (Intervention vs. Control)	0.26 (0.56)	0.644		
Time	0.58 (0.11)	<0.001		
<b>Interaction effects</b>				
Group x time	0.63 (0.17)	<0.001		
<b>Communication Quality (continuous)</b>				
Intercept	52.42 (0.99)	<0.001		

**Table 3 (continued)**

Primary Outcomes				
Alcohol Use (Any vs None)	B (SE)	P	OR	95 % CI
<b>Main Effects</b>				
Group (Intervention vs. Control)	-0.03 (1.51)	0.985		
Time	-2.31 (0.39)	<0.001		
<b>Interaction effects</b>				
Group x time	0.37 (0.61)	0.540		

\*  $n = 561$  due to missing data: OR = odds ratio, SMD = standardized mean difference.

**Table 4**

Demographics and program component engagement of parents from consenting 'parent-child dyads' who participated in the trial.

	Control	CSP	Overall
n (participants)	49	29	78
<b>Gender Identity</b>			
Male	20.4 %	17.2 %	19.2 %
Female	79.6 %	82.8 %	80.8 %
Age (yrs), mean, SD	48.06 (4.23)	45.72 (5.98)	47.19 (5.00)
<b>Country of Birth (% within trial group)</b>			
Australia	78.0 %	96.2 %	85.1 %
Other English Speaking	7.3 %	0 %	4.5 %
Non-English Speaking	14.6 %	3.8 %	10.4 %
<b>Parent Program Engagement</b>			
Year 8 webinar	-	48.4 %	-
Year 8 alcohol use rule-ranking	-	55.2 %	-
At least 1 Year 8 module	-	34.5 %	-
Year 9 webinar	-	20.7 %	-
Year 9 alcohol use rule-ranking	-	17.2 %	-
At least 1 Year 9 module	-	6.9 %	-

interactive parent forum, and a co-ordinated approach from the school to publicise and support the program. One parent reported that they were encouraged to engage with the program by their child's teacher at parent teacher night which they said was very useful.

#### 4. Discussion

This study was the first in Australia to evaluate a novel, eHealth combined parent and student alcohol use prevention program. Primary outcomes of any alcohol use and heavy episodic drinking were lower in the intervention group at the end of the trial however, the mixed effects regression modelling did not reveal group differences in the change in outcomes over time. A significant between group difference was detected for changes in student alcohol-related knowledge, with students in the CSP group reporting greater increases in knowledge about alcohol and related harms, including ways to minimise harm by 24-month follow-up compared to students in the control condition. Low parent engagement in the program and low parent completion of measures prohibited quantitative examination of parent data.

Qualitative data indicated parents who did engage in the program found it acceptable and useful. Specifically, parents reported enjoying the interactive components, style and content of the program. This feedback combined with the increase in student knowledge of alcohol suggests the CSP program is acceptable for students and parents.

##### 4.1. Strengths

###### 4.1.1. Online platform

The online format allowed for increased accessibility and flexibility and Qualitative feedback from parents indicated that they valued the ability to access the content online at their convenience. The advantages

of online accessibility were particularly relevant during the COVID-19 pandemic, which prompted schools to move to online platforms across a range of subjects. The increase in student questionnaire follow-up rates during 2020 may reflect this.

#### 4.1.2. Incorporation of parent feedback

The CSP program was developed based on feedback from over 200 parents (Thornton et al., 2018a) and qualitative feedback from parents who engaged with the program, was positive. It would be beneficial to conduct a trial of the parent program within the context of less restrictive parental consent procedures to evaluate engagement and to assess strategies to increase parent engagement.

#### 4.1.3. Parent homework task

A spike in parent engagement was observed with the rule-ranking activity which was assigned as homework in 2019. The number of parents who engaged in the task when it was assigned as homework, doubled from the previous year when the same activity was available, but not assigned for homework. Whilst it wasn't a mandatory task, it was designed as an interactive activity which prompted adolescents and their parents to talk about alcohol use and to engage with each other. Interactivity and communication between parents and adolescents is a component of several successful substance use prevention programs (Yap et al., 2017). This is a valuable insight, as it suggests that a successful method for engaging parents may be to incorporate elements such as a homework task that encourage interaction between parents and adolescents. This is an important insight for the broader parent engagement literature (Finan et al., 2018; Yap et al., 2016).

## 4.2. Limitations

### 4.2.1. Parent engagement

The number of parents taking part in the study was limited, despite efforts to encourage participation. While regrettable, the low level of parent engagement is consistent with previous research involving universal prevention programs targeting parents (Crowley et al., 2014; Dadds et al., 2018; Finan et al., 2018; LoBraico et al., 2021; Spoth et al., 2017; Tanner-Smith et al., 2018; Yap et al., 2016). A recent study conducted by Dadds and colleagues found a significant attrition rate in parents who were asked to engage in a free, online parenting program, in which over half of registered parents (55 %) dropped out between the pre-intervention questionnaire and Module One of the program (Dadds et al., 2018). Similarly, Morgan et al. (2019) highlighted a lack of power as a primary reason for their inability to detect changes in adolescent mental health from a parent-delivered mental health first aid training intervention (Morgan et al., 2019). Indeed there are many potential factors that predict parental engagement in adolescent prevention programs (Finan and Yap, 2021).

It is also possible that although the online format afforded parents flexibility, connection to the program or intention to complete it may have been lower than it would be for face-to-face programs where social desirability may play a role in increasing parents' commitment to the program. The PAS program on which the current program was based required parents to attend a session at the school and rank rules together as a group (Koning et al., 2009, 2011, 2013). Whilst we originally intended to replicate this component online via a live webinar with parents interacting with the rule-ranking component live as a group, time and resource restraints meant this was not feasible to implement across participating schools. Incorporating components such as this may be useful for future program development. However, it should be noted that two schools in the current study withdrew their participation prior to follow-up data collection, citing time constraints as the main reason for withdrawal. This indicates that care must be taken not to overburden schools when designing prevention programs.

### 4.2.2. Active consent procedures

Due to changes to the Australian National Statement on Ethical Conduct in Human Research, the current project was required to obtain active parental consent from parents for their adolescent to take part in the trial. This requirement significantly limited the student data that could be collected, reducing the sample size and limiting power to detect between group differences. Cooperation from teachers at each school was sought to encourage parents/guardians to provide this consent, however, 44 % of student data still had to be excluded from analyses due to students not returning their permission forms. Previous research has observed similar rates of data loss due to active parental consent procedures. A previous study conducted by our team (Newton et al., 2012) found that schools requiring passive parental consent had <5 % of parents decline to participate, whereas those requiring parents to actively consent had 55 % of students not return the required form. Future studies would benefit, where appropriate, from the use of passive parental consent procedures.

## 4.3. Social changes and context of study

Recent Australian data has found that current drinking among 12–15 year-olds has declined since 2002 and rates of heavy episodic drinking (i.e., 5 or more standard drinks on the one occasion) significantly declined from 2002 to 2014 (Guerin and White, 2018). Furthermore, the average age of onset for drinking alcohol in Australia has been increasing and according to the National Drug Strategy Household Survey, the average age of alcohol initiation for 14–24 year olds is 16.2 years of age (AIW, 2019). The low incidence of drinking behaviours reported in the current trial (only 9.5 % reported heavy episodic drinking at 24 months) is also in line with these national trends (AIW, 2019). Whilst the reasons for these trends are inconclusive, it has been speculated that increases in parental monitoring and reduced periods of unsupervised time among recent cohorts of adolescents could be contributing to the older age of onset of drinking (Larm et al., 2018; Lee and Vandell, 2015; Odukoya et al., 2018; Toumbourou et al., 2018). It is possible that these broad trends contributed to the low rates of parent engagement, if parents are focused on current issues and concerns rather than the prevention of future behaviours. This could also have contributed to the lack of intervention effects, if either the intervention was not delivered during the most effective developmental window, or the follow-up period was not long enough to capture onset of risky alcohol use.

## 4.4. Conclusion

The current study reports results from an RCT of the first web-based universal combined student and parent alcohol prevention program. Difficulties engaging schools and parents limited power to detect intervention effects, with the exception of improvements in alcohol related knowledge. Qualitative feedback from participants confirmed the usefulness of the CSP program and higher engagement in a parent homework task suggests this is a successful method of increasing parent engagement. Future programs may benefit from incorporating aspects of parent prevention programs as homework tasks assigned by schools and may also benefit from implementation studies that allow parent engagement without barriers such as consent procedures and lengthy questionnaires. Research that explicitly examines which strategies are most effective in engaging parents in alcohol use prevention would be of value to optimize the critical role parents play in preventing alcohol related harms among young people.

## Declaration of competing interest

This study is supported by funding from the Australian Government Department of Health and the Australian National Health and Medical Research Council (NHMRC) through the NHMRC Centre of Research

Excellence (APPI041129). The authors declare no conflicts of interest.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.invent.2023.100648>.

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