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Highlights

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Very young adolescents and alcohol: Evidence of a unique susceptibility to peer alcohol use

Adrian B. Kelly [a,*], Gary C.K. Chan [a], John W. Toumbourou [b,c,d], Martin O'Flaherty [a], Ross Homel [f], George C. Patton [c,d,e], Joanne Williams [c,d]

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Q4

► Having one friend who consumed alcohol was uniquely risky for 10–12 year olds. ► This effect was significant for 10–12 year olds but not for older adolescents. ► This effect was independent of the overall size of peer drinking networks. ► The study controlled for puberty, exposure to high school, and other factors. ► Vigilance to even minor contact with peers who drink may be important. ► Prevention programs need to prepare children for major developmental changes.

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Addictive Behaviors

Very young adolescents and alcohol: Evidence of a unique susceptibility to peer alcohol use

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ABSTRACT

Aim: The aim of this study is to examine the susceptibility of very young adolescents (10–12 years of age) to peer alcohol-related influences, compared to older adolescents (13–14 years of age).
Methods: The analysis sample consisted of 7064 adolescents in grade 6 (modal age 11) or grade 8 (modal age 13) from 231 schools in 30 communities across three Australian States. Key measures were adolescent reports of alcohol use (past 30 days) and the number of peers who consume alcohol without their parent's awareness. Control variables included parent alcohol use, family relationship quality, pubertal advancement, school connectedness, sensation seeking, depression, length of time in high school, as well as age, gender, father/mother education, and language spoken at home. A multi-level model of alcohol use was used to account for school-level clustering on the dependent variable.
Results: For both groups, the number of peers who consumed alcohol was associated with alcohol use, but Grade 6 students showed a unique susceptibility to peripheral involvement with peer drinking networks (having one friend who consumed alcohol).
Conclusion: The results point to the importance of monitoring and responding to comparatively minor shifts in the proportion of peers who use alcohol, particularly among very young adolescents.

1. Introduction

By the late-teens, the majority of adolescents have tried alcohol, most consume alcohol at least occasionally, and about one quarter of adolescents drink heavily at least occasionally (Toumbourou, Hemphill, McMorris, Catalano, & Patton, 2009; Toumbourou et al., 2005). While many studies have established that occasional or more frequent alcohol consumption is prevalent among high school adolescents, relatively little large scale survey data is available on use among very young adolescents (10–12 years old) (Donovan et al., 2004). In the United States, prevalence estimates of alcohol use (more than a few sips) vary between 20 and 35% for very young adolescents (Donovan, et al., 2004). In Australia, available data indicates that around 40% of 12 year olds have consumed an alcoholic drink in the past year (Hayes, Smart, Toumbourou, & Sanson, 2004). The prevalence of alcohol use among very young adolescents is a significant public health concern, given that early adolescent alcohol use is associated with later alcohol-related injury and assault (Kypri et al., 2009), early sexual debut (Rothman, Wise, Bernstein, & Bernstein, 2009), and long term problem drinking and alcohol dependence (Palmer et al., 2009).

A large body of literature now confirms peer alcohol and other drug use as a key social context associated with the initiation and development of substance use (e.g., Ali & Dwyer, 2009; Ali & Dwyer, 2010; Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2006; Biglan, Duncan, Ary, & Smolkowski, 1995; Curran, Stice, & Chassin, 1997). Both the processes of peer selection and socialization account for the association of peer substance use and adolescent substance use. Adolescents who affiliate with substance-using friends are at increased risk of substance use (Trucco, Colder, & Wieczorek, 2011), and adolescents who initiate substance use tend to select friends who are similar in terms of substance use (Curran, et al., 1997; Kobus, 2003). As adolescents sort

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themselves into groups, there is intensifying pressure (real or perceived) to adopt the values and interests of the group, which has the function of preserving peer similarity and distinctiveness from other groups (Kandel, Davies, & Baydar, 1990; Steinberg & Monahan, 2007; Verkooijen, de Vries, & Nielson, 2007).

There are varying perspectives and research findings on the extent to which exposure to peers who consume alcohol is related to alcohol use in the very early adolescent years (10–12) through to the early-to-middle adolescent years (13–14 years). It is possible that 13–14 year old students may be more vulnerable to peer influences because this is the period when adolescents have typically and recently transitioned to high school. Transitions to high school are often accompanied by substantive shuffling of peer groups, potentially increasing the exposure of individuals to risky peer groups (Monahan, Steinberg, & Cauffman, 2009). It may also be the case that very young adolescents may be different from older adolescents in their susceptibility to peer alcohol use. The available evidence is mixed in this regard. On one hand, 13–14 year olds may be more vulnerable because school transitions can be accompanied by psychosocial adjustment problems (Martínez, Aricak, Graves, Peters-Myszak, & Nellis, 2011) and these problems may increase the risk of alcohol use and misuse (the 'transition proneness' hypothesis; Donovan & Jessor, 1985). On the other hand, there is evidence that resistance to peer influence is lower for very young adolescents compared to older adolescents (Steinberg & Monahan, 2007). As adolescents move through their teenage years, the number of friends who consume alcohol increases, but their emotional autonomy also increases, leading to growth in resistance to peer influences (Steinberg & Monahan, 2007). Finally, pubertal stage predicts substance use generally, but early pubertal maturation is uniquely associated with increased risk of substance use (Patton et al., 2004).

The aim of the present study was to examine the relative susceptibility of very young adolescents (10–12 years of age) to peers who consume alcohol compared to older adolescents (13–14 years of age). In Australia, these age groups capture the transition from primary school to high school. Our previous research using the same dataset as this study has established that the number of peers who consume alcohol linearly predicts alcohol use (Kelly, O'Flaherty, Toumbourou, Homel, Patton, White, et al., 2011) and tobacco use (Kelly, O'Flaherty, Connor, Homel, Toumbourou, Patton, et al., 2011). The present study extends these findings by examining unique age-related susceptibilities to peers who consume alcohol. In particular, the present study examined whether there is age-related variation in how minor involvement in peer drinking networks (where only a small proportion of friends consume alcohol) are associated with alcohol use. Susceptibility to peer influences should be most evident under these conditions, compared to conditions where the majority of friends consume alcohol (in which case the odds of alcohol use are likely to be very high even for adolescents without other risk indicators for alcohol use).

To isolate age-related susceptibilities, the study controlled for a range of individual and family factors known to be associated with adolescent substance use and peer affiliation. These included the unique effects of pubertal development (Patton, et al., 2004), adolescent gender (Kelly, O'Flaherty, Toumbourou, Connor, Hemphill & Catalano, 2011; Steinberg & Monahan, 2007), parental alcohol use and family relationship quality (Kelly, O'Flaherty, Toumbourou, Connor, Hemphill & Catalano, 2011; Kelly, Toumbourou, O'Flaherty, Patton, Homel, Connor, et al., 2011), sensation seeking (George, Connor, Gullo, & Young, 2010), depression (Fergusson, Boden, & Horwood, 2009), cultural background (Gazis, Connor, & Ho, 2010), school connectedness, and parent education (Kelly, O'Flaherty, Toumbourou, Homel, Patton, White, et al., 2011). Because there is variation across Australian States in the grade at which adolescents move from primary school to high school (in some states adolescents move to high school in Grade 7 and in others Grade 8) and this may have resulted in statistical error in models of peer drinking network exposure, we included a proxy control for exposure to high school. Finally, we controlled for school-level effects, given that school-level variation in substance use partially accounts for substance use at the individual level and significant associations may simply reflect communalities within schools than within individuals (Ennett et al., 2008; Kelly, O'Flaherty, Toumbourou, Connor, Hemphill & Catalano, 2011).

2. Method

2.1. Survey procedure

The original survey involved a two-stage sampling strategy (community and school) in which 231 schools in 30 communities in three States of Australia were selected (Victoria, Queensland, and Western Australia). The community sampling frame consisted of Statistical Local Areas (ABS, 2009) with greater than 17,000 inhabitants. These SLAs were stratified into quartiles of socioeconomic disadvantage based on Socio-Economic Indexes for Areas (SEIFA) (ABS, 2009). Eligible communities were randomly selected from SEIFA quartiles to represent State distributions in advantage/disadvantage as well as urban and nonurban locations (Hemphill, Toumbourou, Smith, et al., 2010). Within each community, primary ($n=164$) and secondary schools ($n=82$) were randomly selected. Of the schools invited to participate, 83% ($n=443$) responded, and of these, 52% agreed to participate (59% and 43% at Grade 6 and 8 levels respectively). Participants only participated if signed parent consent was obtained (67% response rate). The survey was web-based and completed during school class time (paper copies were provided when computer resources were not available). The survey was approved by the University of Melbourne Human Research Ethics Committee and use of the survey data was approved by the University of Queensland Research Ethics Committee. Further details of the survey methods are described elsewhere (Hemphill, Toumbourou, Smith, et al., 2010).

2.2. Sample

The analysis sample consisted of 7064 adolescents in Grades 6 (last year of primary school in the State of Victoria and second last year of primary school in Queensland and Western Australia, modal age 11) and Grade 8 (second year of high school in Victoria and first year of high school in Queensland and Western Australia, modal age 13). The analysis sample excluded participants who were positively identified as recording unreliable responses ($n=151$) or who had missing data on one or more of the measures ($n=478$ participants, see Results).

2.3. Measures

The measures were based on the Communities That Care (CTC) youth survey, an epidemiological assessment instrument, which was developed in the United States (Arthur, Hawkins, Pollard, Catalano & Baglioni, 2002) and adapted for Australian youth populations (Beyers, Toumbourou, Catalano, Arthur, & Hawkins, 2004; Bond, Thomas, Toumbourou, Patton, & Catalano, 2000; Hemphill, Toumbourou, R.S., G.E, K., Rowland, Freiberg, et al., 2010). The Australian survey scales demonstrate similar reliability to US populations with alpha coefficients for multi-item scales generally above 0.70 (Hemphill, Toumbourou, R.S., G.E, K., Rowland, Freiberg, et al., 2010; Kelly, O'Flaherty, Connor, Homel, Toumbourou, Patton, et al., 2011; Kelly, O'Flaherty, Toumbourou, Connor, Hemphill & Catalano, 2011; McMorris, Hemphill, Toumbourou, Catalano, & Patton, 2007).

2.3.1. Key variables

Alcohol use was measured with the item 'In the past 30 days have you had more than just a few sips of an alcoholic beverage?' ('No', '1 or 2 times', '3–5 times', '6–9 times', '10 or more times'). Single-item

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measures of alcohol use have established reliability and validity for young people (Dollinger & Malmquist, 2009; Koning, Harakeh, Engels, & Vollebergh, 2010). Due to low frequencies at the higher levels of alcohol use, particularly for year 6 children, we opted to recode the outcomes to 'No', '1 or 2 times', '3 or more times'. Peer alcohol use (our index of an individual's peer drinking network size) was assessed with the item "In the past year (12 months), how many of your 4 best friends have tried alcohol when their parents didn't know about it?" ('0 friends'–'4 of my friends'). Grade level was dummy coded as 0 = Grade 6 and 1 = Grade 8.

2.3.2. Control variables

Pubertal development was measured using 7 items [e.g., Would you say that your growth in height (growth spurt)…..] from the Pubertal Development Scale (Petersen, Crockett, Richards, & Boxer, 1988). This scale has established validity and reliability and correlates well with other established measures (Patton et al., 2008). Items were rated on a 4-point scale (1 'Has not started yet', 2 'Has barely started', 3 'Has definitely started', and 4 'Seems complete'), with the exception of the item assessing if girls have started to menstruate (yes/no). *Family relationship quality* was measured using 9 items (4-point Likert scales: 1 'YES!', 2 'yes', 3 'no', 4 'NO!') that targeted emotional closeness to mothers/fathers and family conflict. The emotional closeness items included 6 items: 'Do you feel close to your mother/father?', 'Do you share your thoughts and feelings with your mother/father?' and 'Do you enjoy spending time with your mother/father?' The family conflict scale included 3 items: 'We argue about the same things in my family over and over', 'People in my family often insult and yell at each other' and 'People in my family have serious arguments'. The alpha for the combined scale was 0.80, indicating good internal consistency. *Sensation seeking* was measured using a 3-item scale (e.g., "How many times have you… done something dangerous because someone dared you to do it", "… done what feels good, no matter what") (alpha = 0.66). *Depression* was measured using the Short Moods and Feelings Questionnaire (Angold et al., 1995), which is a 13-item scale assessing negative feelings over the past fortnight (1 'Not true'; 2 'Sometimes true'; 3 'True'). Example items included 'I felt miserable or unhappy', 'I thought nobody really loved me'. An alpha of 0.91 indicated very good reliability for this scale.

School connectedness was measured using 7 items assessing absenteeism, effort, enjoyment, interest and perceived importance of school (e.g. "How interesting are your subjects to you?", "Now thinking back over the past year in school, how often did you try to do your best"). Items were rated on a 5-point scale (0 'Almost always' to 5 'Never'), and the alpha for the scale was acceptable (0.77). Students who reported speaking a language other than English at home were coded 1; English only was coded as 0. *Parents education* was asked separately for mothers and fathers, and coded as 'Less than complete high school', 'Complete high school' 'Postsecondary qualification' and 'Don't know/unsure'. *Parents' alcohol consumption* was asked separately for mothers and fathers as "Does your mother/father drink alcohol?" (1 'Never', 2 'Occasionally', 3 'Most days', 4 'Everyday'). Sex was coded as Female = 1 and Male = 0.

Because children at different states enter high school at different grade levels (see above), a proxy for exposure to high school was included. Participants from the State of Victoria were dummy coded as 0 (where high school starts in Grade 7) and participants from Queensland and Western Australia were coded as 1 (where high school starts in Grade 8). As a check on the reliability of responses there were two questions asking about the use of a fictitious drug and each participant was asked "How honest were you in filling out this survey?" (5-point Likert scale; 1 'I was honest all of the time' to 5 'I was not honest at all').

2.4. Analysis

Statistical analyses were performed with STATA Release 11 (StataCorp, 2007). The statistical design was a 2-level ordinal logistic regression model [individuals ($n = 7237$) nested within schools ($n = 231$)], with random effects estimation for school, and adolescent alcohol use ('No', '1 or 2 times', '3 or more times') as the dependent variable (Long & Freese, 2003). The key analysis examined the association of peer use with alcohol use and the interaction between grade level and peer use with all control variables in the model.

3. Results

Prior to the key analyses, tests for differences between the analysis sample and the cases excluded due to missing data were conducted. Excluded cases were more likely to speak another language other than English at home, χ^2 (1) = 8.56, $p<0.01$, less likely to have parents with post-secondary education (Mother's education: χ^2 (3) = 72.28, $p<0.001$; Father's education: χ^2 (3) = 128.47, $p<0.001$), more likely to report their father drank alcohol never or frequently, χ^2 (3) = 21.33, $p<0.001$ and more likely to report having one drinking friend, χ^2 (4) = 10.43, $p<0.05$. The particular strong effect of parents' education should be treated with caution as they were probably artificially inflated by the high rates of participants recording a response of 'don't know'. Excluded cases on average reported lower family relationship quality, $t = 5.74$, $p<0.001$, more depressive symptom, $t = 3.43$, $p<0.001$ and lower school connectedness, $t = 3.99$, $p<0.001$. There was no difference between the analysis sample and the excluded cases in terms of sensation seeking, grade level, mother's alcohol consumption and their own alcohol consumption. There was no significant violation of the parallel regression assumption for any predictor, $\chi^2(30) = 17.87$, $p = 0.96$.

For the analysis sample, tests (simple t tests or chi-squares) were conducted on differences between grades for all variables (see Table 1). As expected, Grade 8 reported significant differences in alcohol use/nonuse ($p<0.001$). Nonuse of alcohol in the past month was 85% and 74% for Grade 6 and Grade 8 students respectively. One or two instances of alcohol use were reported by 10% and 17% of Grade 6 and Grade 8 students respectively. Three or more instances of alcohol use were reported by 4.4% and 9.4% of Grade 6 and Grade 8 students respectively. Grade 6 students had fewer friends who consumed alcohol ($p<0.001$). Of the analysis sample, 85% and 53% of Grade 6 and Grade 8 students reported no friends who consumed alcohol. Respectively, 8% and 15% of Grade 6 and Grade 8 students reported that one of their four best friends who consumed alcohol. Also, 2% and 15% of Grade 6 and Grade 8 students reported that all of their four best friends consumed alcohol. Compared to Grade 6, Grade 8 students reported significantly lower family relationship quality ($p<0.001$) and school connectedness ($p<0.001$). Grade 8 students reported significantly higher sensation seeking ($p<0.001$) and depression ($p<0.001$). As expected, Grade 8 had higher pubertal advancement ($p<0.001$) and reported lower prevalence rates of zero alcohol use and higher prevalence rates of alcohol use in the past 30 days than Grade 6 students ($p<0.001$). There were no significant differences across the two grades in the association of gender with alcohol use. Compared to Grade 6 students, Grade 8 students reported that their mothers were less likely to have completed secondary school, though this result should be treated with caution for the reason previously noted. A similar effect was evident for grade level differences on father's education. In terms of zero use of alcohol by mothers and fathers, Grade 6 students reported higher prevalence rates than Grade 8 students.

For the key analysis, all main effects were entered first [see Table 2 Column 2 for unadjusted odds ratios (OR) and 95% confidence intervals]. In the next step, the interaction terms were added to the main effects model (see Table 2 Column 4 for the adjusted ORs). There was a very strong association between number of peers who consumed alcohol and adolescent alcohol use, with adjusted *OR*s ranging from 2.83 to 6.60 for having one to four drinking peers ($p<0.001$). The interaction term of having one peer who consumed alcohol and

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Table 1
Key variables split by Grade (6/8).

	Grade 6 ($n=3848$)	Grade 8 ($n=3216$)	t
	Mean (SD)	Mean (SD)	
Family relationship quality	3.33 (0.49)	3.10 (0.55)	18.60***
Sensation seeking	1.29 (0.70)	1.54 (0.82)	14.12***
Depression	5.99 (5.68)	6.70 (6.09)	5.05***
School connectedness	3.45 (0.46)	3.27 (0.47)	16.36***
Puberty	2.02 (0.50)	2.40 (0.46)	33.60***
	Frequency (%)	Frequency (%)	χ^2
Personal alcohol use in the past 30 days			
No occasions	3288 (85.48%)	2368 (73.63%)	157.18***
1–2 occasions	389 (10.11%)	545 (16.95%)	
3 + occasions	171 (4.44%)	303 (9.42%)	
Peer alcohol use			
Zero friend	3284 (85.34%)	1718 (53.42%)	962.93***
One friend	317 (8.24%)	472 (14.68%)	
Two friends	123 (3.20%)	344 (10.70%)	
Three friends	38 (0.99%)	193 (3.27%)	
Four friends	86 (2.23%)	489 (15.21%)	
Gender			
Male	1871 (48.62%)	1514 (47.08%)	1.68**
Female	1977 (51.38%)	1702 (52.92%)	
Language spoken at home			
English only	3388 (88.05%)	2887 (89.77%)	5.25*
Other language/other plus English	460 (11.95%)	329 (10.23%)	
Mothers' education			
Less than complete secondary	507 (13.31%)	709 (22.15%)	224.58***
Complete secondary	1154 (30.29%)	1010 (31.55%)	
Post secondary	886 (23.25%)	878 (27.43%)	
Don't know/missing	1263 (33.15%)	604 (18.87%)	
Fathers' education			
Less than complete secondary	565 (14.84%)	807 (25.24%)	204.25***
Complete secondary	958 (25.16%)	824 (25.77%)	
Post-secondary	886 (23.27%)	823 (25.74%)	
Don't know/missing	1399 (36.74%)	743 (23.24%)	
Mothers' alcohol consumption			
Never	1010 (26.25%)	706 (21.95%)	37.65***
Occasionally	2491 (64.73%)	2102 (65.36%)	
Most days	270 (7.02%)	335 (10.42%)	
Every day	77 (2.00%)	73 (2.27%)	
Fathers' alcohol consumption			
Never	610 (15.85%)	409 (12.72%)	33.54***
Occasionally	2374 (61.69%)	1913 (59.48%)	
Most days	665 (17.28%)	683 (21.24%)	
Every day	199 (5.17%)	211 (6.56%)	
State			
Victoria	1805 (46.91%)	1530 (47.57%)	101.79***
Queensland	993 (25.81%)	1189 (34.11%)	
Western Australia	1050 (27.29%)	649 (18.31%)	

* $p<0.05$.
** $p<0.01$.
*** $p<0.001$.

Table 2
Odds ratios for alcohol use in past month.

	Unadjusted ORs	95% CI	Adjusted ORs	95% CI
Grade 8 (ref. Grade 6)	**2.09*****	**(1.87–2.34)**	**0.95**	**(0.77–1.18)**
Female (ref. Male)	0.59***	(0.53–0.66)	0.66***	(0.58–0.77)
Number of drinking peers (DP) (ref. No drinking peers)				
One	**3.11*****	**(2.62–3.69)**	**2.84*****	**(2.15–3.74)**
Two	**5.04*****	**(4.16–6.13)**	**4.36*****	**(2.96–6.42)**
Three	**6.88*****	**(5.32–8.90)**	**4.37*****	**(2.24–8.55)**
Four	**14.66*****	**(12.34–17.41)**	**6.55*****	**(4.21–10.17)**
Grade 8 One DP			**0.66***	**(0.45–0.97)**
Grade 8 Two DP			0.70	(0.44–1.13)
Grade 8 Three DP			0.87	(0.41–1.83)
Grade 8 Four DP			1.01	(0.61–1.66)
Puberty	1.70***	(1.52–1.90)	1.16**	(1.01–1.33)
Family relation quality	0.65***	(0.61–0.68)	0.91*	(0.85–0.98)
Sensation seeking	1.97***	(1.87–2.08)	1.41***	(1.32–1.51)
Depression	1.43***	(1.36–1.51)	1.16***	(1.08–1.24)
School connectedness	0.55***	(0.52–0.58)	0.81***	(0.75–0.87)
Language other than English	0.61***	(0.50–0.75)	0.83	(0.65–1.06)
Mother's education (ref. Did not complete high school)				
Completed high school	0.91	(0.77–1.07)	1.08	(0.89–1.30)
University degree	0.76**	(0.64–0.90)	0.86	(0.69–1.07)
Don't know	0.69***	(0.58–0.81)	0.93	(0.73–1.18)
Father's education (ref. Did not complete high school)				
Complete high school	0.75**	(0.64–0.89)	0.99	(0.81–1.20)
University degree	0.67***	(0.56–0.79)	0.91	(0.73–1.13)
Don't know	0.65***	(0.55–0.75)	0.93	(0.74–1.15)
Mothers drinking (ref. Never drinks)				
Occasionally	2.41***	(2.04–2.84)	1.79***	(1.46–2.18)
Most days	4.22***	(3.39–5.27)	2.36***	(1.79–3.12)
Everyday	7.99***	(5.73–11.15)	3.12***	(2.05–4.75)
Father drinking (ref. Never drinks)				
Occasionally	2.33***	(1.87–2.91)	1.67***	(1.28–2.17)
Most days	4.43***	(3.50–5.61)	2.13***	(1.59–2.85)
Everyday	6.27***	(4.74–8.32)	2.28***	(1.60–3.24)
State (ref. Victoria)				
Queensland and Western Australia	0.75***	(0.67–0.83)	0.81**	(0.70–0.94)
			Estimate	Standard error
School level variance			0.049 [a]	0.025

Notes. *$p<0.05$; **$p<0.01$; ***$p<0.001$; OR — Odds ratio; CI — Confidence intervals.
[a] Compared to a single level model, the multilevel ordinal logistic regression model indicated that there were significant variations in alcohol consumption across different schools, $\sigma^2=0.049$, $\bar{\chi}^2(1)=6.85$, $p<0.05$.

Grade 8 was significant (OR = 0.66, $p<0.05$), which indicated that the effect of having one peer who consumed alcohol was significantly smaller in Grade 8 than in Grade 6 (adjusted $OR=0.66$, $p<0.05$). Although there was a consistent trend towards a significant association between two ($OR=0.70$, $p>0.05$) and three peers ($OR=0.86$, $p>0.05$) who consumed alcohol and adolescent alcohol use, the related interaction terms were non-significant.

Pubertal development, sensation seeking and depression were associated with significantly increased odds of alcohol use (respective ORs were 1.16, $p<0.01$; 1.41, $p<0.001$; 1.56, $p<0.001$). Being female, reporting higher family relationship quality, and higher school connectedness were associated with reduced odds of adolescent alcohol use (respective ORs were 0.66, $p<0.001$; 0.91, $p<0.05$; 0.81, $p<0.001$). At the univariate level, higher parental education level and speaking a language other than English were generally associated with reduced odds of alcohol use ($p<0.01$), but these relationships became non-significant after adjusting for other variables ($p>0.05$). In the main effects model and in the full model (including the interaction terms), mothers' and fathers' alcohol use were significantly related to adolescent alcohol use (mostly at $p<0.001$). Greater exposure to high school (measured using the proxy variable based on State of residence) was associated with increased odds of alcohol use ($p<0.01$) when all variables were in the model.

4. Discussion

The novel finding of this study was that Grade 6 students showed a significantly greater risk of alcohol use when one peer consumed

alcohol compared to Grade 8 students. This finding held after accounting for several other significant predictors of alcohol use, including pubertal development, family relationship quality, sensation seeking, depression, school connectedness, parent education, parent alcohol use, cultural background, and exposure to high school. Consistent with earlier research showing that very young adolescents have low resistance to general peer influence (Steinberg & Monahan, 2007), the results of this study point to a particular vulnerability among very young adolescents to peers who consume alcohol. The number of friends who consume alcohol is a strong general risk factor, but very young adolescents who have even peripheral involvement in peer drinking networks (i.e., one friend among four who consumes alcohol) may be at additional risk of alcohol use.

We state at the outset that the cross-sectional design of the study precludes any statements about the role that peripheral involvement in peer drinking networks may have in driving alcohol use among early adolescents. The study cannot disaggregate the effects of peer selection, peer socialization, or the role of third factors in driving peer selection/socialization processes. It may be the case that very young adolescents who consume alcohol are especially likely to begin forming friendships with others who consume alcohol, or that susceptibility to the influence of others who consume alcohol is high, or that third factors (e.g., conduct disorder) predict both alcohol use and initial selection into friendships where alcohol use occurs. The present study controlled for several factors that are likely to drive rather than be driven by alcohol-related variables, including sensation seeking personality traits, low school connectedness, and low family relationship quality. Nevertheless, temporally preceding variables like these may yet predict the susceptibility of very young adolescents to peripheral involvement in peer drinking networks. It is also likely that the relative importance of peer selection and socialization processes varies across the age groups in this study, given other research showing that as adolescents get older, peer selection effects weaken and peer socialization processes strengthen (Monahan, et al., 2009). Longitudinal research on the role of initial friendship dynamics and contextual factors that may increase alcohol-related risks among very young adolescents is needed.

The focus of the study on "underground" alcohol use (i.e., peers who consume alcohol use without parental awareness) also points to the likelihood that the parents of very young adolescents who consume alcohol are often unaware of alcohol-related events (Barnes, et al., 2006; Beck, Boyle, & Boekeloo, 2004; Dick et al., 2007). This is consistent with Australian data on parental disapproval of alcohol use by very young adolescents. Parental approval and supply of alcohol before the age of 12 is rare in Australia [less than 5% of parents allow their adolescent to have a glass of alcohol (Hayes, et al., 2004)]. The results of this study would suggest that a substantial number of very young adolescents are exposed to significant risk factors for long term alcohol problems, including the previously established effects for alcohol use and peer drinking network exposure, but also subtle changes in the proportion of friends who consume alcohol. For parents where supervision and monitoring of alcohol use is low, subtle changes in the proportion of friends who consume alcohol may go undetected. The results emphasize the importance of vigilance by parents to even minor shifts in engagement with peers who consume alcohol.

The findings of this study have several implications for prevention programs that target alcohol use and misuse among early adolescents. First, peer drinking friendships and more extended drinking networks may be influential long before conventional prevention programs are typically implemented. Many prevention programs begin in the middle teenage years, but the findings of this study indicate that key risk factors addressed in many prevention programs (e.g., resisting peer influences) may be instituted too late to address important transitions in alcohol use for many children. Indeed, the prevalence of alcohol use among very young adolescents, the strong effects for peer drinking networks, combined with the alcohol-related risks associated with school transitions and puberty, reinforce the potential value of alcohol-related prevention in primary school. Very young adolescents who have preceding experience with alcohol may increase their alcohol use in response to the challenges of these transitions. Alcohol-related prevention programs that prepare adolescents for and support them through these important social/developmental transitions are likely to be important.

As previously noted, the findings of the present study are limited by the cross-sectional design of the study, so it is plausible that causal directions go in other directions to those hypothesized or that the associations are epiphenomenal. Because age-related findings are based on cohorts, it is possible that the groups differ on variables that are not encompassed within the developmental trajectories of children. Excluded cases for the Grade 6 subsample had higher levels of peer use and depression, lower family relationship quality and lower school connectedness, and the findings of this study may not generalize to families with more significant problems than the analysis sample in these areas. Also, the parental consent mechanism is likely to have resulted in the nonparticipation of adolescents with more significant family/school problems (Kelly & Halford, 2007). The rate of exclusion because of no parental consent was higher than the rate of exclusion because of missing values, so it is likely that the biases associated with the parental consent may be stronger than any biases associated with missing data. The finding that exposure to high school should be treated with caution, given that other potential factors in addition to exposure to high school that might impact on adolescent alcohol use across the three Australian States. While we excluded participants on the basis of honesty estimates, the study relies on self-report data.

5. Conclusion

Very young adolescents showed a greater susceptibility to peripheral involvement in peer drinking networks compared to older adolescents. This effect was independent of the established finding that alcohol use is predicted by the number of peers who consume alcohol, regardless of grade/age. The results point to the importance of prevention programs that address both peer and family factors, and that prepare adolescents for the challenges of major biopsychosocial transitions. Longitudinal research on peer processes that predict very early alcohol use is needed.

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Contributors

A. B. Kelly wrote the first draft of the manuscript and coordinated analyses. G.C.K. Chan and M. O'Flaherty conducted the analyses. J. Williams, J.W. Toumbourou, G.C. Patton, and R. Homel led the data collection and helped develop the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of interest

There are no conflicts of interest by any author.

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