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Peer influences on alcohol expectancies in early adolescence: A study of concurrent and prospective predictors in Taiwan

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HIGHLIGHTS

- Peer effects on alcohol expectancy varied by prior alcohol use and expectancy domain.
- For the alcohol naive, exposure to peer drinking was associated with expectancies.
- The association mentioned above was moderated by advanced pubertal development.
- For the alcohol-experienced, recent alcohol drinking is the most salient predictor.
- Bridge position in a network may slightly increase the negative alcohol expectancy.

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ABSTRACT

The effects of peers on three domains of alcohol expectancies through early adolescence were prospectively examined over 2 years. Information on pubertal development, parental drinking, peer characteristics, network structure, alcohol expectancies, and alcohol consumption was assessed in a three-wave longitudinal study of 779 6th graders (~12 years of age) randomly selected from northern Taiwan. Complex survey regression analyses, stratified by drinking experience in 6th grade, were performed to identify predictors of two positive (i.e., enhanced social behaviors and relaxation/tension reduction) and one negative alcohol expectancies (i.e., cognitive/behavioral deterioration) in 7th grade. The results showed that the effects of peer influence on adolescents' alcohol expectancies varied by prior drinking experiences and by expectancy domains. For the alcohol naive, recent exposure to peer drinking was significantly associated with positive and negative alcohol expectancies in grade 7, and this association was moderated by advanced pubertal development ($ESB_{late\ puberty}$: $ß_{wt} = 0.55$; $ESB_{early\ puberty}$: $ß_{wt} = -0.40$; $PRTR_{late\ puberty}$: $ß_{wt} = 0.01$; $PRTR_{early\ puberty}$: $ß_{wt} = 1.22$; $CBD_{late\ puberty}$: $ß_{wt} = -0.84$; $CBD_{early\ puberty}$: $ß_{wt} = 0.56$). For the alcohol experienced, neither peer drinking nor pubertal development showed any significant links with alcohol expectancies. Occupying a bridge position was slightly linked with negative expectancy ($ß_{wt} = 0.25$). Concurrent drinking serves as a strong predictor for the endorsed alcohol expectancy in both groups, particularly for the domain of enhanced social behaviors. If these effects are confirmed, knowledge of the effect of interplay between peer factors and pubertal development on alcohol expectancies in early adolescence can provide effective targets in prevention programs.

1. Introduction

Adolescence is characterized by dramatic changes in multiple domains (Steinberg, 2005), including cognitive processes and social attachment. These rapid changes, originally thought to be evolutionarily beneficial, have been linked to age-related increases in certain behavioral problems including alcohol drinking in modern society (Dahl, 2004; Spear, 2000; Steinberg, 2005; Witt, 2010). In Taiwan, the lifetime prevalence of underage drinking has risen from 16.7% in 1996 to 42.6% in 2006 (Chen et al., 2008, 2009, 2011; Chou, Liou, Lai, Hsiao, & Chang, 1999;

Abbreviations: AREC, Alcohol-Related Experiences among Children; CAEQ-C, The Chinese version of the Alcohol Expectancy Questionnaire-Child form; ESBs, Enhanced social behaviors; PRTR, Promoting relaxation or tension reduction; CBD, Cognitive and behavioral deterioration.

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Hung, Yen, & Wu, 2009). Studies in many parts of the world have indicated that early onset of drinking is significantly associated with increased risks of emotional and physical health problems, such as depression and motorcycle crashes (Hung et al., 2009; Lin, Chang, Pai, & Keyl, 2003; National Research Council & Institute of Medicine, 2004). These observations have prompted investigation in the emergence and evolution of drinking behaviors from a developmental perspective (Deas, Riggs, Langenbucher, Goldman, & Brown, 2000).

To date, several theoretical paradigms have been developed to explain the causes for early-onset alcohol use and the mechanisms underlying the progression of alcohol use disorders. The alcohol expectancy theory is one of the most promising paradigms (Goldman, Del Boca, & Darkes, 1999). Expectancies, acting as information templates, can process, categorize, and match various stimuli to tentative responses by anticipating future events. For alcohol expectancies, multiple pathways may be activated differentially depending on previous drinking experience (Donovan, Molina, & Kelly, 2009; Nicolai, Moshagen, & Demmel, 2012; Wardell, Read, Curtin, & Merrill, 2012). The perception of alcohol's effects prior to the initiation is often subject to uncertainty about the effects of alcohol and is susceptible to others' behaviors within a social context. After the first and subsequent drinks, one's expectations about alcohol may change, depending on individual physiological responses and social interaction reward (Thombs, 1993). For the alcohol experienced, alcohol can be a means to alleviate the uneasiness in social interactions, to fit in with the peer group, or to maintain position in the social network (Lewis & O'neill, 2000). Since the relationship between alcohol expectancy and drinking behaviors may be heterogeneous across the stage of alcohol involvement (e.g., lifetime abstinence, experimental drinking, regular drinking, and alcohol dependence) (Aas, Leigh, Anderssen, & Jakobsen, 1998; Cameron, Stritzke, & Durkin, 2003; Goldman et al., 1999; Smith, Goldman, Greenbaum, & Christiansen, 1995; Windle et al., 2008), it is vital to separate the alcohol naive and experienced when investigating predictors of endorsed alcohol expectancy (Martino, Collins, Ellickson, Schell, & Mccaffrey, 2006).

Peers have long been recognized as one of strongest predictors affecting drinking behaviors in adolescence (National Research Council & Institute of Medicine, 2004; Patrick & Schulenberg, 2013), especially for peer use of alcohol in cross-sectional studies. Peers indeed can exert their influences through multiple processes, including behavioral modeling, peer norms, and social relationship. For example, recent studies on peer effects reported that individuals having drinking peers or occupying a bridge position in the network are more likely to drink (Ennett et al., 2006; Mundt, 2011; Valente, Gallaher, & Mouttapa, 2004). Bridge status, the social tie connecting different subgroups, often provides the crucial route for information exchange between groups. Adolescents occupying a bridge position may have more opportunities to meet drinking peers, to observe effects of alcohol (on others), or to get alcoholic beverages from peers (Burt, 2000; Kreager & Haynie, 2011). Under the paradigm of alcohol expectancy, the salient effects of drinking peers and network position on underage drinking behaviors raise the possibility that peers' drinking behaviors or the connections to peers may affect one's endorsed alcohol expectancy (Martino et al., 2006; Pfaff, 2006).

The greatest variation of pubertal development generally emerges in the 7th grade (nearly the ages of 13–14 years) (Dorn, Crockett, & Petersen, 1988). The onset of puberty may mark a change not only in the nature of interpersonal relationship, but also in the response to alcohol. Recent reviews suggest that adolescents are extremely sensitive to certain rewarding effects of alcohol (e.g., alcohol-induced social activation) after consuming low-dose of alcohol (Peper & Dahl, 2013; Spear & Varlinskaya, 2005); meanwhile, they also become less sensitive to several adverse alcohol effects that may consequently moderate intake (e.g., social inhibition, sedation, and motor impairment) (Varlinskaya, Vetter-O'Hagen, & Spear, 2013). Similarly, several studies have reported the prominent change in alcohol expectancies during early adolescence (Bekman, Goldman, Worley, & Anderson, 2011; Cameron et al., 2003; Dunn & Goldman, 1998), suggesting that the observed differential perception of alcohol's effects may be related, at least in part, to development-related changes in emotional arousability and motivation regulation (Goldman et al., 1999; Read, Lau-Barraco, Dunn, & Borsari, 2009; Steinberg, 2005).

Although interests in the role of social contexts in alcohol expectancy in young populations are rising, some gaps in our knowledge remain. First, previous analyses often adopted a binary approach to conceptualizing alcohol expectancies in young population (i.e., positive and negative only) and gave little consideration to the multi-domain nature of alcohol expectancies. Considering that the connection between drinking behaviors and alcohol expectancy may differ by domain, understanding important factors involved in the formation of multi-domain expectancies toward alcohol is important in order to delay alcohol initiation and to reduce drinking in early adolescence (Steinberg, 2005). Second, during the transition from childhood into adolescence, the major social agent for involvement and interaction gradually shifts from parents to peers (Patrick & Schulenberg, 2013; Steinberg, Vandell, & Bornstein, 2010; Windle et al., 2008). Nevertheless, available evidence on the effects of social context on alcohol expectancy in young people has generally focused on concurrent family influence (e.g., parental drinking or family socioeconomic status) (Chen et al., 2011; Donovan et al., 2009; Shen, Locke-Wellman, & Hill, 2001; Smith & Goldman, 1994), relatively few studies have explored family's long-term effects. Even when peers are the primary interest on alcohol expectancy, the information was mostly restricted to variables concerning peer drinking behaviors (Cumsille, Sayer, & Graham, 2000; Martino et al., 2006), with little attention paid to the effects of peer structure during the transition (Dishion & Tipsord, 2011). Finally, although the nature of social context and the susceptibility to social influence depend on developmental stages (Steinberg, 2005), few studies on underage alcohol expectancy have investigated whether the connection between social influence and alcohol expectancy may vary by pubertal development.

To address these knowledge gaps, we conducted a longitudinal study following a cohort of school-aged children over the period from primary school into middle school in Taiwan. The present study aimed to (i) examine the extent to which social factors affecting the endorsed multi-domain alcohol expectancy may differ by prior experience of actual drinking during the transition into adolescence; and (ii) investigate whether pubertal developmental may differentially influence the effects of crucial social agent (i.e., peers and parents) on the endorsed alcohol expectancy. Given that the recognition of social stimuli and responses toward alcohol are development-dependent (Varlinskaya et al., 2013), we hypothesized that for the alcohol naive youngsters, their alcohol expectancies are strongly linked with drinking behaviors of peers and such relationship may differ by pubertal development. However, for the alcohol-experienced youngsters, the development of expectancy toward alcohol may be more affected by actual drinking experience. To take the best advantage of developmental variation, we obtained the assessment of peer drinking and pubertal development from the 7th grade.

2. Methods

2.1. Participants

The sample consisted of 779 6th grade students (aged 11–12) who provided parental and self-consents to participate in this prospective cohort study (i.e., the Alcohol-Related Experiences among Children, AREC) and completed three waves of interviews. In brief, the baseline samples were selected via the stratified multistage probability sampling. In each of the four strata defined by sizes of the school (e.g., number of students and teachers) and neighborhood characteristics (e.g., number of educational institutions in the area and the distance to the closest subway station), 4–8 schools were randomly chosen. Three 6th-grade classes were randomly selected in each school and all

students in the sampled classrooms were eligible and invited to participate in the study. Detailed sampling procedure has been described elsewhere (Chen et al., 2011). The baseline assessment was conducted during the first semester of the academic year 2006 (Wave 1, baseline assessment, 6th grade). Students in the 17 participating public schools were followed over the second semesters of the academic years 2006 (Wave 2, 6th grade) and 2007 (Wave 3, 7th grade). The time intervals between each successive wave were about 6–8 months; the 1-year follow-up rate was 86.6%. One half of the respondents were male and 78% were in advanced pubertal stage. Attrition analyses in the first and second follow-up status revealed no significant differences in sociodemographics (i.e., gender, pubertal level, monthly allowance, and living with parents), individual drinking behaviors, and peer drinking behaviors.

2.2. Measures

The participants completed paper-and-pencil, self-administered questionnaires during regular class hours. The questionnaires, not anonymous but confidential, included sociodemographic characteristics, drinking behaviors of family members, pubertal development, alcohol expectancies, course of alcohol consumption, and nominated friends. Each questionnaire usually took 30 min to complete. Alcohol expectancies and drinking behaviors were assessed on an annual basis (Wave 1, 6th grade and Wave 3, 7th grade); the assessment of significant social agent was designed on the basis of developmental context (i.e., parents for 6th grade and peers for 7th grade).

2.2.1. Alcohol expectancies

Alcohol expectancies, the primary outcome of the present study, were assessed with the Chinese version of the Alcohol Expectancy Questionnaire-Children form (CAEQ-C) (Chen et al., 2011). The form was previously translated and modified from the Alcohol Expectancy Questionnaire-Adolescent form by our research team (National Institute on Alcohol Abuse Alcoholism [NIAAA], 2003). Three domains of alcohol expectancies with high reliabilities were chosen: arousal, sedation and negative (Cronbach's alphas at Wave 1 are 0.69, 0.86 and 0.86, respectively; Cronbach's alphas at Wave 3 are 0.70, 0.89, and 0.80, respectively). These domains comprised enhanced social behaviors (ESB, 17 binary items), promoting relaxation or tension reduction (PRTR, 13 binary items), and cognitive and behavioral deterioration (CBD, 24 binary items) (Chen et al., 2011). The ESB domain emphasizes social facilitation and was assessed with questions such as "*Does alcohol consumption make people friendlier to interact with?*" PRTR was assessed with questions such as "*Does alcohol make people more relaxed?*" Finally, CBD, the only negative domain assessed, included questions such as "*Whether people are less aware of dangers?*" The scores were then calculated separately to reflect one's endorsement in three heterogeneous domains of alcohol expectancies. To understand the effects of peers and puberty on three domains of alcohol expectancies (Goldman & Darkes, 2004; Rather, Goldman, Roehrich, & Brannick, 1992), multidomain analyses were performed to estimate the potentially differential effects of developmental and contextual factors (Steinberg et al., 2010; Windle et al., 2008).

2.2.2. Alcohol use behaviors

We measured alcohol consumption every year (baseline in 6th grade and Wave 3 in 7th grade) with the following questions: "*Not including alcohol in food, have you drunk more than a few sips of any type of alcoholic beverage in your life*?" Based on self-reported alcohol experience at baseline, the participants were initially categorized into "alcohol-naive (n = 412)" if their response was "none" and "alcohol experienced (n = 367)" for a positive response. At Wave 3, recent alcohol consumption was assessed with the question "*In total, how many occasions have you drank alcoholic beverages in the past 12 months?*" Current alcohol consumption was defined as positive if one had drunk alcohol on one or more occasions in the past year (assessed at Wave 3).

2.2.3. Peer network structure and drinking behaviors

Friendship networks, assessed during the 2nd semester of the 6th grade (Wave 2), were constructed via the participants' nominations of their best friends (no more than three). Bridge status indicates a participant's network position in connection to other subgroups or peripheral individuals (De Nooy, Mrvar, & Batagelj, 2005). If a bridge position is removed from the structure of peer networks, certain subgroups became disconnected or isolated. Using the Pajek open-source network analysis software (De Nooy et al., 2005), the respondents in bridge position were coded as "1" and those not in the bridge position were coded as "0" (see Fig. 1). Direct observation of friends' drinking was coded as "1" if the respondents reported having ever observed any of their friends' drinking prior to the assessment at Wave 3 (7th grade).

2.2.4. Pubertal development

Pubertal development in 7th grade (approximately 13 year-old, the age when pubertal variation emerged in both genders) was measured via a self-rated scale of physical changes including height, hair, skin, voice/breast, and face hair/menarche (Petersen, Crockett, Richards, & Boxer, 1988). Based on these scores, participants were categorized into five developmental stages (i.e., pre-pubertal, early pubertal, mid-pubertal, late pubertal, and post-pubertal). In the present study, we combined the pre- and early- pubertal stages as the reference group and the other three stages as the group of advanced pubertal development.

2.2.5. Potential confounders

Information pertaining to the direct observation of paternal and maternal drinking was collected via two questions at Wave I (1st semester of the 6th grade). The parental drinking variable was coded as "1" if the participant had ever observed the drinking of either parent. Other covariates adjusted in the analyses, including gender and monthly allowance (as a proxy measure for family socioeconomic status), were all obtained from the baseline assessment in grade 6 (Wave 1).

2.3. Statistical analyses

The parameters of multi-stage sampling procedures were taken into account simultaneously by complex survey analyses. Given that alcohol

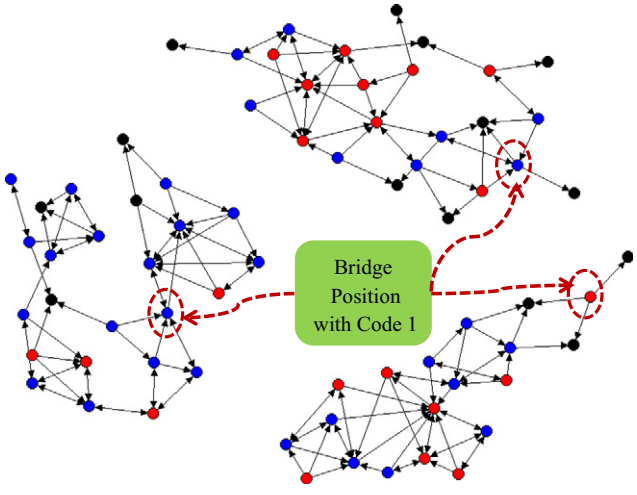

Fig. 1. Illustration of bridge positions in a peer network. Note: Data were derived from a subsample in the present study. The bridge position reflects a participant's network position in relation to separated subgroups or peripheral individuals and was calculated with the bi-components command of Pajek, an open-source network analysis software. If a person in a bridge position is removed, some subgroups become disconnected or isolated. Respondents in bridge positions were coded as "1" and others were coded as "0" using Pajek.

expectancies may differ before and after alcohol initiation (Goldman et al., 1999; Martino et al., 2006; Reese, Chassin, & Molina, 1994), the distribution of sociodemographic, pubertal development, parental drinking, peer drinking, and three-domain alcohol expectancy scores were summarized with stratification by prior history of alcohol consumption. We standardized the outcome variables (i.e., the AEQ scores in 7th grade) in order to evaluate and compare the relative contribution of peer influence across three domains. Inter-correlations were initially estimated among the variables of alcohol use (i.e., individual, peer, and parental drinking), alcohol expectancies (i.e. individual AEQ scores), pubertal development, and network structure. Models were first built on the basis of univariate analyses, followed by the addition of two arrays of variables (assessed in 6th grade and 7th grade) to reflect temporal sequence of assessment. For both the alcohol naive and alcohol experienced groups, we included the interaction term of pubertal development and observing peer drinking measured in 7th grade (middle school) in the final model to examine moderational effects of advanced pubertal development. The simple slope analysis was subsequently performed to test the slope coefficients of peer drinking on alcohol expectancies for youngsters by the stage of pubertal development.

Bonferroni correction was used to reduce possible errors from multiple comparisons for the three domains in two separated subgroups ($\alpha = 0.05/6$). For independent variables with missing data (i.e., baseline AEQ scores, pubertal level, and observed peer drinking, <9%), we used the PROC MI (Sas Institute Inc., 2004) to augment missing data, which iteratively imputed the predicted scores on the basis of complete data (Rubin, 2009). The PROC SURVEY procedure was used for complex survey analyses and multivariate regression modeling. Further post-hoc analyses on the sample composed of the alcohol naive and alcohol experienced (n = 779) was performed to evaluate whether the effects of social factors differ by alcohol drinking experiences via SAS with PROC SURVEY procedure. Cross-lagged panel models were performed to probe possible reciprocal relationship between alcohol use and expectancies for the entire sample set via Mplus 7 with multiple imputation procedure.

3. Results

Nearly half (48%) of the sampled students had consumed alcohol prior to the assessment in 6th grade (Wave 1), and most of them had only drunk on one to two occasions (Table 1). Compared with those who had never drunk, the alcohol-experienced students were more likely to have higher monthly allowances, to have watched parents or peers drink, and to have a higher ESB score at Wave 1 & 3. Of the alcohol-experienced, 53.2% continued drinking in 7th grade. The scores for the two positive domains of alcohol expectancy were higher in the alcohol-experienced, whereas the score for the negative expectancy was lower. The post-hoc comparison showed no appreciable differences in sociodemographic variables, family factors, and baseline drinking behaviors by follow-up status.

Over the 1 year of the study, the AEQ and alcohol use showed moderate stability (rs = 0.43–0.47 for AEQ, r = 0.46 for alcohol use, see

Table 1
Selected characteristics of 6th graders, by alcohol experience (n = 779).

	Alcohol-naive		Alcohol-experienced		Total		
Variables	n 412	% wt 52.1	n 367	% wt 47.9	n 779	% wt 100.0	p-Value[a]
Gender							
Male	189	46.0	197	54.4	386	50.0	0.104
Female	223	54.0	170	45.6	393	50.0	
Monthly allowance (W1)							
None	126	30.0	92	25.9	218	28.0	0.003
1–499 NTD[b]	216	54.8	184	52.1	400	53.6	
500 NTD or above	61	15.2	78	22.0	139	18.4	
Observing parental drinking (W1)							
No	121	29.8	50	12.4	171	21.5	< 0.0001
Yes	291	70.2	317	87.6	608	78.5	
Pubertal stage (W3)							
Pre & early	88	21.3	89	23.4	177	22.3	0.540
Mid to post	324	78.7	278	76.6	602	77.7	
Observing peers' drinking (W3)							
No	396	96.0	325	88.9	721	92.6	< 0.0001
Yes	16	4.0	42	11.1	58	7.4	
Cumulative drinking in 6th grade (W1)							
1–2 times	–	–	215	58.1			
3 times or more	–	–	152	41.9			
Current alcohol consumption in 7th grade (W3)							
No	318	76.6	179	46.8	497	62.3	< 0.0001
Yes	94	23.4	188	53.2	282	37.7	
Occupying bridge position in peer network (W2)							
No	354	85.7	326	89.0	680	87.3	0.273
Yes	58	14.3	41	11.0	99	12.7	
	Mean	**SE[c]**	**Mean**	**SE**	**Mean**		**SE**
Baseline alcohol expectancy (W1)							
Enhancing social behavior	−0.24	0.09	0.33	0.04	0.03	0.06	< 0.0001
Relaxation/tension reduction	−0.02	0.10	0.12	0.04	0.05	0.06	0.127
Cognitive/behavior deterioration	0.11	0.08	−0.04	0.04	0.03	0.05	0.124
Alcohol expectancy (W3)							
Enhancing social behavior	−0.23	0.06	0.29	0.06	0.01	0.05	< 0.0001
Relaxation/tension reduction	−0.06	0.07	0.10	0.05	0.01	0.04	0.094
Cognitive/behavior deterioration	0.10	0.06	−0.06	0.06	0.02	0.04	0.060

Note: Data were collected during the first semester of the 6th grade (W1), the second semester of the 6th grade (W2) and during 7th grade (W3).
[a] Chi-square tests were used for proportional comparisons between the alcohol-naive and alcohol-experienced groups, and t-tests were used for comparisons means.
[b] NTD: New Taiwan Dollar (1 USD = 30 NTD).
[c] SE: standard error.

Supplementary Table 1). Weak to moderate correlations existed across the domains of AEQ at Wave 1 (rs = −0.21 to 0.49) and Wave 3 (rs = −0.25 to 0.48). Concurrent inter-correlation between the AEQ and alcohol use was significant; as was the inter-correlation between baseline AEQs (i.e., ESB and CBD) and follow-up alcohol use.

With stratification by prior alcohol drinking in 6th grade, the relationship estimates linking peer characteristics and pubertal development with three domains of alcohol expectancies are summarized in Tables 2 and 3. For the alcohol naive in 6th grade (see Table 2), the baseline direct observation of parental drinking appeared to serve as a strong predictor of PRTR in 7th grade (Model 1: $\beta_{wt} = 0.27$), and remained significant after adjustment for current alcohol drinking, peer drinking, and pubertal development in 7th grade. After adding the interaction terms between peer drinking and pubertal development, we found that having observed peers drinking was a salient predictor of the AEQ endorsement (see Model 2), and the moderational effect of advanced puberty varied by domain (ESB: $\beta_{wt} = 0.96$; PRTR: $\beta_{wt} = -1.22$; CBD; $\beta_{wt} = -1.39$). The relationship estimates between peer drinking and individual expectancies in 7th grade, derived from the simple slope analysis, are shown in Fig. 2. The significant relationship between peer drinking and AEQ appeared at both pubertal stages for ESB and CBD, but only emerged at pre-to-early pubertal stage for PRTR. As to positive AEQ, peer drinking was positively correlated with ESB among adolescents at the mid-to-late pubertal stage, yet negatively correlated with PRTR domain among those at early pubertal stage.

Among the alcohol-experienced (see Table 3), recent alcohol consumption was the strongest predictor of ESB (Crude: $\beta_{wt} = 0.71$; Model 2: $\beta_{wt} = 0.50$). With statistical adjustment for other covariates, AEQ in 6th grade showed significantly predictive power for alcohol expectancies across three domains at follow-up (ESB: $\beta_{wt} = 0.34$; PRTR: $\beta_{wt} = 0.32$; CBD; $\beta_{wt} = 0.47$ in Model 2). With Bonferroni correction, direct observation of parental or peer drinking behaviors was not significantly related to the endorsed alcohol expectancies. Individuals having a bridge status in the network were more likely to have higher scores for negative AEQ (CBD: Crude: $\beta_{wt} = 0.34$ and Model 2: $\beta_{wt} = 0.25$), yet such relationship became less salient after correction for multiple testing. For the alcohol-experienced, neither advanced puberty nor interplay between pubertal development and peer drinking had significant relationship with AEQ.

We also used the cross-lagged panel model to evaluate potential reciprocal relationship between three-dimensional expectancies and alcohol use. The results indicated that, independent of other covariates, individual expectancies in 6th grade significantly predicted the increases in expectancies in 7th grade (i.e., ESB: ß = 0.27, PRTR: ß = 0.43, CBD: ß = 0.47). When three domains of alcohol expectancies and individual drinking were modeled, none of the cross-lagged predictors were statistically significant (all p-value > 0.05; see Fig. 3).

4. Discussion

In this prospective longitudinal study of students transitioning from primary- to middle-school (from grade 6 to grade 7) in urban Taiwan, 48% of our sample had consumed alcohol at least once prior to 6th grade and the 1-year incidence rate of alcohol initiation was 23%. Endorsed AEQ at late childhood appears to be the most salient predictor for AEQ in early adolescence. For the alcohol naive, concurrent peer drinking appeared to be an important correlate for three domains of alcohol expectancies (i.e., enhanced social behaviors, tension reduction, and cognitive/behavioral deterioration), and its relationship may be moderated by pubertal development. In contrast, none of the social factors examined had significant relationship with AEQ. Recent alcohol drinking was a strong correlate for the expectancy of "enhanced social behaviors" in 7th grade.

For adolescents who have never used alcohol prior to 6th grade, the direct observation of parental drinking seems to have long-term effects on their alcohol expectancies in tension reduction in 7th grade. Given

Table 2
Relationship coefficients linking puberty, family, and peer characteristics with the endorsed alcohol expectancies in 7th grade among the alcohol-naive children.

Variables	Enhanced social behaviors (ESB)						Promoting relaxation or tension reduction (PRTR)						Cognitive and behavioral deterioration (CBD)					
	Crude	Model 1		Model 2[b]			Crude	Model 1[a]		Model 2[b]			Crude	Model 1[a]		Model 2[b]		
	b_{wt}	b_{wt}	[95% CI]	b_{wt}	[95% CI]		b_{wt}	b_{wt}	[95% CI]	b_{wt}	[95% CI]		b_{wt}	b_{wt}	[95% CI]	b_{wt}	[95% CI]	
Male (W1)	−0.05	−0.03	[−0.17, 0.11]	0.12	[−0.10, 0.35]		−0.18	−0.17	[−0.38, 0.05]	−0.08	[−0.36, 0.19]		0.00	−0.02	[−0.21, 0.17]	−0.03	[−0.33, 0.26]	
Allowance (W1, ref: no)																		
1–499 NTD	−0.12	−0.14	[−0.28, 0.00]	***−0.24***	***[−0.37, −0.11]***	***	0.13[+]	0.06	[−0.09, 0.20]	0.02	[−0.12, 0.16]		0.04	−0.06	[−0.24, 0.12]	−0.01	[−0.19, 0.18]	
≥500 NTD	0.32	0.25	[−0.16, 0.66]	0.11	[−0.16, 0.39]		0.07	0.02	[−0.30, 0.33]	−0.04	[−0.33, 0.25]		−0.03	0.00	[−0.19, 0.20]	0.06	[−0.15, 0.26]	
Parental drinking (W1, ref: no)	0.17*	0.06	[−0.06, 0.18]	0.02	[−0.12, 0.16]		***0.38*** ***	***0.27***	***[0.15, 0.38]*** ***	***0.25***	***[0.13, 0.37]*** ***		0.07	0.05	[−0.16, 0.26]	0.08	[−0.13, 0.28]	
Bridge network position (W2)	0.07	0.12	[−0.15, 0.39]	0.08	[−0.17, 0.33]		0.10	0.15	[−0.10, 0.39]	0.14	[−0.12, 0.40]		0.03	0.08	[−0.10, 0.26]	0.12	[−0.07, 0.30]	
Baseline AEQ (W1)	***0.38*** ***	***0.38***	***[0.27, 0.48]*** ***	***0.37***	***[0.27, 0.46]*** ***		***0.51*** ***	***0.49***	***[0.43, 0.56]*** ***	***0.49***	***[0.43, 0.55]*** ***		***0.44*** ***	***0.45***	***[0.37, 0.52]*** ***	***0.44***	***[0.37, 0.51]*** ***	
Alc. drinking at 7th grade (W3)[c]	***0.68*** ***			***0.55***	***[0.33, 0.77]*** ***		0.21*			***0.21***	***[0.05, 0.37]*** **		−0.26*			−0.15	[−0.28, −0.02]*	
Puberty (W3, ref: pre & early)	***0.45*** **			***0.36***	***[0.12, 0.60]*** **		***0.36*** **			0.21	[−0.02, 0.44]		−0.10			0.00	[−0.32, 0.33]	
Peer drinking (W3, ref: no)	***0.81*** ***			***−0.40***	***[−0.67, −0.13]*** **		0.14			***1.22***	***[1.04, 1.40]*** ***		−0.87*			***0.56***	***[0.36, 0.76]*** ***	
Peer drinking × puberty				***0.96***	***[0.44, 1.47]*** ***					***−1.22***	***[−1.72, −0.71]*** ***					***−1.39***	***[−2.11, −0.68]*** ***	

Note: CI: confidence interval. *p < 0.05; **p < 0.01; ***p < 0.001; estimates are marked in bold italic style if p < 0.0083 (0.05/6) after Bonferroni correction.

[a] Coefficients were obtained via the analyses that simultaneously adjusted for gender, monthly allowance, and the variables measured in 6th grade (i.e., parental drinking, bridge network position, and baseline AEQ).

[b] Coefficients were obtained via the analyses that simultaneously adjusted for gender, monthly allowance, and all variables listed in the model.

[c] Having drunk on at least one occasion during the period of transition from 6th to 7th grade (ref: no).

Table 3
Relationship coefficients linking puberty, family, and peer characteristics with the endorsed alcohol expectancies in 7th grade among the alcohol-experienced children.

	Enhanced social behaviors (ESB)					Promoting relaxation or tension reduction (PRTR)					Cognitive and behavioral deterioration (CBD)				
	Crude	Model 1[a]		Model 2[b]		Crude	Model 1[a]		Model 2[b]		Crude	Model 1[a]		Model 2[b]	
Variables	b_{wt}	b_{wt}	[95% CI]	b_{wt}	[95% CI]	b_{wt}	b_{wt}	[95% CI]	b_{wt}	[95% CI]	b_{wt}	b_{wt}	[95% CI]	b_{wt}	[95% CI]
Male (W1)	−0.21	−0.31	[−0.58, −0.03]*	−0.25	[−0.50, 0.00]*	−0.15	−0.19	[−0.39, 0.01]	−0.12	[−0.37, 0.12]	−0.23	−0.16	[−0.42, 0.09]	−0.18	[−0.40, 0.04]
Allowance (W1, ref: no)															
1–499 NTD	−0.23*	***−0.29***	***[−0.49, −0.09]*****	***−0.30***	***[−0.49, −0.11]*****	0.08	0.03	[−0.15,, 0.21]	0.02	[−0.17, 0.21]	0.16^{+}	0.05	[−0.13, 0.23]	0.05	[−0.13, 0.23]
≥500 NTD	−0.01	−0.06	[−0.29, 0.16]	−0.03	[−0.22, 0.17]	0.19	0.14	[−0.06, 0.34]	0.15	[−0.06, 0.37]	0.16	0.10	[−0.17, 0.37]	0.10	[−0.15, 0.35]
Parental drinking (W1, ref: no)	0.05	−0.10	[−0.43, 0.23]	−0.19	[−0.51, 0.13]	−0.14	−0.27	[−0.58, 0.04]	−0.34	[−0.66, −0.02]*	0.08	0.04	[−0.16, 0.23]	0.05	[−0.19, 0.28]
Bridge network position (W2)	0.05	0.16	[−0.11, 0.44]	0.14	[−0.13, 0.40]	0.26	0.25	[−0.03, 0.54]	0.26	[−0.03, 0.56]	0.34*	0.22	[−0.02, 0.47]	0.25	[0.01, 0.50]*
Baseline AEQ (W1)	***0.39******	***0.41***	***[0.32, 0.51]******	***0.34***	***[0.25, 0.43]******	***0.33******	***0.34***	***[0.29, 0.39]******	***0.32***	***[0.26, 0.38]******	***0.48******	***0.47***	***[0.33, 0.61]******	***0.47***	***[0.34, 0.61]******
Alc. drinking at 7th grade (W3)[c]	***0.71******			***0.50***	***[0.36, 0.64]******	0.33*			0.28	[0.03, 0.53]*	−0.01			−0.02	[−0.20, 0.16]
Puberty (W3, ref: pre & early)	0.26			0.07	[−0.24, 0.39]	0.23*			0.14	[−0.10, 0.38]	0.16			−0.03	[−0.34, 0.28]
Peer drinking (W3, ref: no)	***0.53*****			−0.01	[−0.40, 0.38]	0.19			−0.26	[−0.58, 0.06]	−0.26			−0.16	[−0.86, 0.54]
Peer drinking × puberty				0.20	[−0.29, 0.69]				0.27	[−0.07, 0.61]				−0.17	[−1.11, 0.78]

Note: CI: confidence interval. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; estimates are marked in bold italic style if $p < 0.0083$ (0.05/6) after Bonferroni correction.
[a] Coefficients were obtained via the analyses that simultaneously adjusted for gender, monthly allowance, and the variables measured in 6th grade (i.e., parental drinking, bridge network position, and baseline AEQ).
[b] Coefficients were obtained via the analyses that simultaneously adjusted for gender, monthly allowance, and all variables listed in the model.
[c] Having drunk on at least one occasion during the period of transition from 6th to 7th grade (ref: no).

that most drinking behaviors (87.7%) observed by this study population were at family gathering (e.g., reunion), it is likely that pleasurable and relaxing feelings associated with such settings may facilitate the learning process of recognizing alcohol as a tool to promote relaxation. The pleasant atmosphere in these events probably enhances memory retention and therefore aids later memory retrieval (Cumsille et al., 2000; Martino et al., 2006). As to concurrent correlates, advanced pubertal development appeared to be in a positive relationship with the expectancies of enhanced social behaviors, consistent with prior research indicating that pubertal hormones may influence the processes of social reward and make adolescents more sensitive to social evaluation (Somerville, 2013). It is possible that advanced pubertal development among the alcohol naive may direct their cognitive processes more towards stimuli or information involving social interaction, resulting in a higher alcohol expectancy of enhanced social behaviors (Martino et al., 2006; Steinberg, 2005; Steinberg et al., 2010). Finally, the concurrent relationships between peer drinking with endorsed alcohol expectancy appear significant for all three domains, yet the relationships are differential by pubertal development. The post hoc analyses indicated that about one quarter of the alcohol naive in our study were in their earlier puberty and may be more likely drawn to the behaviors of mature peers during the transition. Since the alcohol-experienced peers of those in early puberty were mostly light drinkers, the first phase of alcohol effects (i.e., relaxation and euphoria) may increase the positive peer effects on the expectancy of "promoting relaxation or tension reduction." This explanation may also underlie the significant effect of the interplay between pubertal development and peer drinking behavior on negative alcohol expectancies. The nearly opposite effects of peer drinking suggest that the drinking behaviors of peers (e.g., experimental or heavy drinker) or the setting where the students observed the drinking may differ by pubertal stage.

Among the alcohol experienced, 6th grade alcohol expectancy and recent alcohol drinking appear to be the most prominent factors explaining alcohol expectancy in 7th grade, suggesting that once alcohol drinking was initiated, the development of alcohol expectancy in early adolescence was more affected by their actual experience with alcohol. The salient effects of recent alcohol drinking, which only appear in the expectancy of enhanced social behaviors, agreed with the observed increased sensitivity to alcohol's social-facilitating effects in adolescence and highlighted that the formation of alcohol expectancy can differ by one's development-dependent sensitivity toward alcohol (Peper & Dahl, 2013; Spear & Varlinskaya, 2005; Varlinskaya et al., 2013). Nevertheless, the analyses showed that occupying a bridge network position in 6th grade was slightly linked with subsequent increases in negative expectancy. Considering that drinking youngsters in a bridge position are more likely to have encountered friends from different subcultures, to have exchanged information concerning alcohol, and to engage in social activities involving alcoholic beverages (Valente et al., 2004), the heightened negative alcohol expectancy may partially be the result of increased exposure to drunken peers or scenes that can later modify youngster's cognitive template concerning detrimental effects of alcohol. The borderline significance for bridge position may be due to (i) undetected changes in their friendship network during the transition into middle school, and (ii) limited number of students occupying the bridge position which makes a stable estimation difficult.

Finally, the results from the cross-lagged panel analyses did not support the existence of bidirectional relationships between expectancies and drinking. This analysis was constrained by the limited waves of assessment (i.e., only two waves) in the present study, which makes variance relatively small. Additionally, when alcohol use and three-domain expectancies were all added into the model while taking concurrent inter-domain correlation into account, the multicollinearity may lead to less precise estimates.

The present study has several limitations. First, the participants came solely from public schools in the metropolitan Taiwan. Thus, our results may not be generalizable to other parts of Taiwan or even to

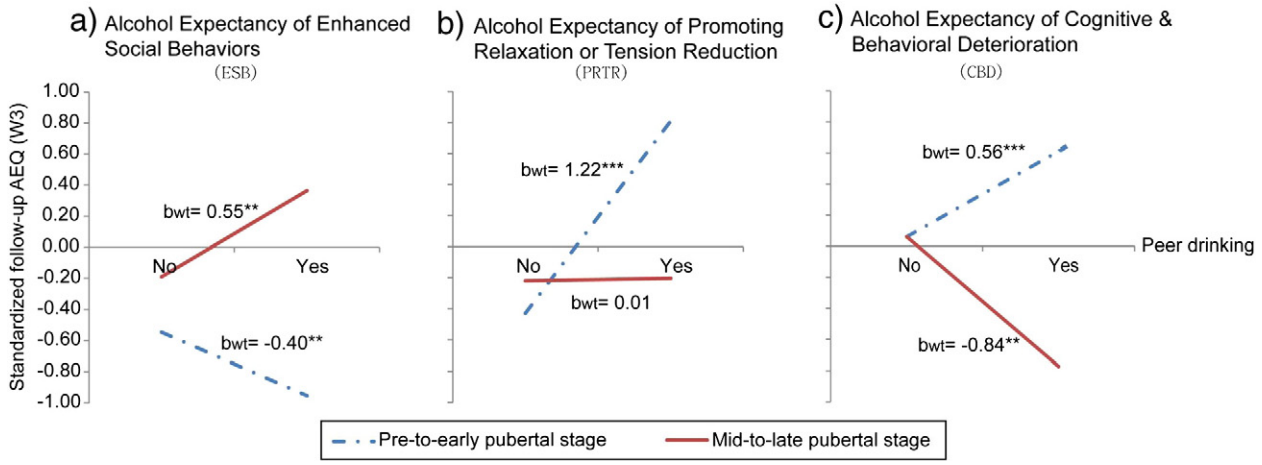

Fig. 2. The relationships between concurrent peer drinking and AEQ score at 7th grade among the alcohol-naive 6th graders, by pubertal development. Among the alcohol-naive 6th graders, all the slope coefficients reached the statistical significance when the post-hoc moderational effects were examined, except for the slope of peer drinking on the PRTR in the mid-to-late pubertal stage. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

the world. Second, there might be potential bias in the baseline enrollment and follow-up. Although the post-hoc comparison showed no appreciable differences in baseline drinking behaviors and peer factors, a higher follow-up rate during the transition from primary to middle schools would allow a more accurate estimation of the association of interest. Third, it is possible that the observed positive peer effects were spurious due to the connection between the baseline drinking and the nomination of friends. However, our post-hoc analyses showed no association between an individual's baseline alcohol use and observing peer drinking, ruling out a possible reverse association with individual drinking status. Finally, although confidentiality was guaranteed for our participants, the occurrence of alcohol consumption was probably under-reported. When underestimation occurs, it is difficult to predict the direction of bias in the relationship estimates since it is unclear whether the under-reported alcohol use is independent of advanced puberty development and peer network position.

Notwithstanding these limitations, the present study has several strengths. The collection of longitudinal data from a large cohort of primary school children, the consistent assessments of alcohol expectancy, the development-tailored measures of social context, and the consideration of important confounders allowed us to examine development-dependent contextual influences on endorsed alcohol expectancy during the transition from late childhood into adolescence. Additionally, the integration of the social network approach extended our research on contextual influences from the behavior modeling (e.g., peer drinking) to the relationship structure (e.g., network position) and advanced our

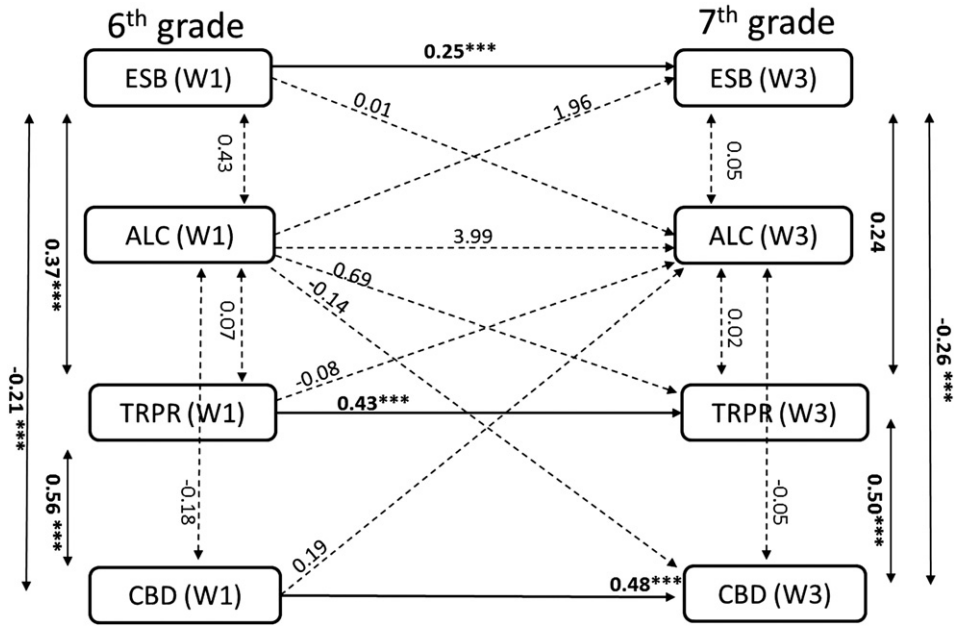

Fig. 3. Cross-lagged panel models for endorsed three domains of alcohol expectancies. This model adjusted for gender, monthly, parental drinking, peer drinking, bridge position, and pubertal development. All cross-lagged predictors did not reach statistical significance (marked in dashed line, "- - -"), when three-domain alcohol expectancies, and individual drinking were modeled at both W1 and W3. Variables reaching the statistical significance ($p < 0.05$) were shown in solid arrow lines. Model fit indicators show adequate explanation (i.e. RMSEA = 0.022; CFI = 0.968). Regression coefficients and covariances (i.e., equivalent to correlations) are standardized. ALC = individual alcohol use; ESBs = enhanced social behaviors; PRTR = promoting relaxation or tension reduction; CBD = cognitive and behavioral deterioration. $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

understanding of different pathways through which peers may affect youngster's endorsed alcohol expectancy in early adolescence.

In summary, our longitudinal analyses highlight the salience of peers as important social contextual features that may affect the endorsed alcohol expectancies during the transition from primary- to middle-school, which is especially true for the alcohol naive. The observed effects of parental and peer drinking and moderational effects of advanced pubertal development may be useful in guiding intervention programs that aim to modify alcohol expectancies and to further reduce the initiation or escalation of alcohol drinking. Future epidemiological and laboratory-based studies are required to confirm and expand these results and to explain the observed domain related heterogeneity in the social factors shaping the endorsement of alcohol expectancy in early adolescence.

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Contributors

CYC, WJC, and CYL designed the study. TTT conducted literature searches and the statistical analysis and wrote the first draft of the manuscript. YCL assisted in the data collection in the file. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All the authors declare that they have no conflicts of interest.

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