Early alcohol experiences and adolescent mental health: A population-based study in Taiwan[☆]

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Abstract

In this study, we examine whether adolescent emotional and behavior problems vary by history of early alcohol experiences. A national sample of 6974 alcohol-naïve and 4337 alcohol-experienced youths aged 15–18 years were identified within the 2004 National Survey of Illegal Drug Use among Adolescents in Taiwan. Four alcohol experience groups were created based on recency and frequency of alcohol use: (1) naïve; never drank alcohol, (2) trial use; first and only consumption of alcohol occurred more than 6 months preceding the assessment, (3) past use; alcohol used on more than one occasion but had not had a drink in the 6 months prior to the assessment, and (4) current use; consumed alcohol more than once and drank within the 6 months preceding the interview. A Chinese adaptation of the Youth Self-Report (YSR) assessed eight behavior syndromes: withdrawn, anxious/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behavior, and aggressive behavior. Multivariate response models (GLM/GEE) were used to examine the relationship of alcohol experiences with emotional and behavior problems. Alcohol-using youth were more likely to experience several specific emotional or behavioral syndromes than their alcohol-naïve counterparts. For example, youth with a history of alcohol use had an estimated 30–60% increase in the odds of experiencing items within the aggressive behavior syndrome as compared with alcohol-naïve youth. The type of early alcohol involvement in adolescence may exert differential effects on emotions and behaviors expressed across and within syndromes; these may warrant distinctions in informing etiological research and preventive efforts.

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1. Introduction

Most individuals with alcohol problems initiate drinking during adolescence, a period when not only the body is changing dramatically, but behavioral, cognitive, emotional, and attitudinal changes also take place (Dawson, 2000; Grant et al., 2006; Maggs and Schulenberg, 2005; Semlitz and Gold, 1986). Repeatedly using alcohol (frequency or quantity) at such a crit-

ical stage in life may result in detrimental effects on brain development. For example, alcohol exposure in adolescence has been associated with a greater risk of disrupted hippocampus functions, including memory, in animal models (e.g., Spear, 2002; Spear and Varlinskaya, 2005; White and Swartzwelder, 2005). These alcohol-related cognitive, emotional, and behavioral impairments may then furthermore exert a cascading effect on subsequent health and adjustment (National Research Council, 2004).

Psychiatric problems are apparent among youth with alcohol disorders and episodic heavy drinking patterns (Kumpulainen, 2000; Tapert et al., 2002; Townshend and Duka, 2005). A prospective follow-up of a community sample of 2500 adolescents found that social phobia and panic disorders were not

[☆] Supplementary information on the C-YSR questionnaire is provided with the online version of this paper. Please see Appendix B for more information.

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only associated with persistent alcohol abuse/dependence but also predicted the onset of regular alcohol use, defined as having alcohol at least three times a week (Zimmermann et al., 2003). Several explanations have been suggested for the apparent excess of mental health problems among alcohol users. The “shared vulnerability model” posits that there are underlying genetic or other general susceptibility traits that contribute to both alcohol use and observed psychological or behavioral disturbances (Baigent, 2005). Other explanations either assume that some psychiatric disturbances might prompt alcohol taking (e.g., individuals with depressed moods might use alcoholic beverages to self-medicate) (Bolton et al., 2006; Crum et al., 2008; Kumpulainen, 2000) or that alcohol consumption gives rise to or exacerbates the emergence of psychiatric disturbances (Haynes et al., 2005). However, the observed co-occurrence may be a mix of two-directional processes. Although there is a growing body of evidence suggesting a link between alcohol abuse/dependence or heavy drinking with mental health problems, there are reasons to believe that the observed association may hold for those with less problematic alcohol involvement (e.g., experimenters or occasional users) (Poulin et al., 2005; Saluja et al., 2004). For instance, in a sample of adolescents aged 14–18 years recruited in western Oregon, the lifetime prevalence rate of depression was 17% among alcohol abstainers, whereas the corresponding estimates for experimental, social, and problem drinkers were 23%, 21%, and 39%, respectively (Rohde et al., 1996).

In order to assess a broad spectrum of maladaptive functioning and psychological problems in adolescents, Achenbach et al. (1991) have developed widely used instruments that at low cost obtain standardized data. One of the instruments is the Youth Self-Report (YSR), which seeks information from youth themselves and assesses eight emotional and behavioral syndromes (Achenbach, 1995). Until recently, many studies either have totaled YSR item scores to create scale scores that are then gauged by some cut-point criteria (e.g., *T*-scores or percentiles) or have compared mean scores within a particular syndrome for subgroups of individuals with different substance-using experiences (Rey et al., 2002; Ernst et al., 2006). One limitation of these scoring approaches is that they fail to take into account the interdependencies that exist within the patterns of an individual’s response to the YSR items (e.g., individuals who report the experiences of “would rather be alone” may be more likely to report the presence of other items in the withdrawn syndrome). Another possible limitation is they do not capture the link between substance use and the individual YSR items within the syndromes. Thus, these types of analyses are unable to distinguish whether the observed substance use-associated elevated risk of mental health problems is a result of a few high-scored items, or due to a general increase in all of the items within a syndrome. Alternative statistical approaches that emphasize the contribution of specific items within a scale may be useful in identifying mental health disturbances among youth in early stages of alcohol involvement because these youth may not experience a syndrome-level effect of their alcohol use yet, but their alcohol use may trigger the onset of specific reactions at a subthreshold level. Such distinctions would be useful for identifying individuals at risk for alcohol-related cognitive,

emotional, and behavioral impairments within a developmental framework.

To address the gap in literature on the link between early alcohol experiences and mental health disturbances, we turned to epidemiological survey data collected from a nationally representative sample of Taiwanese youth. With a primary focus on early alcohol use in a social context wherein alcohol initiation occurs mostly at family social events by late childhood or early adolescence (Chen et al., *in press*), the aim of this study was to examine the extent to which different types of early alcohol involvement were associated with emotional and behavioral indicators across and within syndromes. Considering that the association between alcohol use and mental health problems can be more complicated when multiple alcohol intake parameters are taken into account (e.g., drinking frequency and length of abstinence), the profile of mental health indicators were examined in relation to four subgroups of alcohol experiences: naïve, experimenters, past use only, and current use. Observed alcohol-related variation in the experience of mental health indicators between alcohol-naïve (never drank alcohol) and alcohol experienced youth may provide some etiological and preventive suggestions regarding alcohol initiation; whereas a comparison between alcohol experimenters with past- and current- alcohol users (used alcohol on more than one occasion but differ on the timing of the last drink relative to the date of assessment) may indicate possible changes and stability of mental health problems in relation to increase or discontinuity of alcoholic beverage consumption.

2. Methods

2.1. Sampling and data collection

The data for this study are drawn from the 2004 National Survey of Illegal Drug Use among Adolescents (NSIDA) a cross-sectional school survey of a nationally representative sample of youth between the ages of 12–18 years in Taiwan. From lists obtained from the Ministry of Education, 133 schools were randomly selected using multistage sampling procedures, with school type (i.e., middle school, senior high school, and vocational/technical high school) and region (defined by geographic characteristics, urbanicity level, and population composition) as strata. When one sampled vocational high school refused to participate, a replacement school of the same type was selected from the same region. Within each school, two classes were randomly selected from grades 7, 9, 10, and 12. All the students in the sampled classes were eligible to participate in the survey. Response rates for school-level and for individual-level were estimated at 99% and 90%, respectively. The present analyses focuses on youth between the ages of 15–18 years attending senior high and vocational/technical high schools ($n = 12,791$). Participants with missing data (77 did not answer substance questions and 43 did not answer any of the emotional or behavioral mental health items) or those deemed to not be answering honestly (e.g., 9 reported use of a fake drug) were excluded; 11,943 youth comprised the analytic sample.

Generally the 2004 NSIDA was completed during a regular class session. Teachers left the room, but research assistants were present to answer questions, keep order, and promote trust and assure confidentiality. The paper and pencil self-administered questionnaire consisted of a fixed sequence of standardized pre-worded and pre-coded questions that assessed sociodemographic background, drug-related experiences, life events, and psychological functioning. Data were collected anonymously, i.e., no identifiers (e.g., names or identification numbers) were included in the questionnaire. The survey took on average 20–30 min to complete and participants were offered a set of stationery as an incentive to complete the survey. The study was reviewed and approved by the institutional review board of College of Public Health, National Taiwan University.

2.2. Measurement

Mental health problems experienced in the 6 months prior to the survey were appraised by the Chinese version of the YSR (C-YSR) based on a back-translation (Yang et al., 2000) of the 1991 YSR (Achenbach, 1995). In this study, the C-YSR item responses were used as binary indicators (“0” for not true and “1” for “somewhat or sometimes true” and “very true or often true” responses) to reflect the occurrence or positive experience of each item (no/yes) rather than the frequency or intensity. The items covered the following eight syndromes scales: (1) withdrawn, 7 items, $\alpha = 0.69$; (2) somatic complaints, 8 items, $\alpha = 0.78$; (3) anxious/depressed, 13 items, $\alpha = 0.86$; (4) social problems, 8 items, $\alpha = 0.62$; (5) thought problems, 6 items, $\alpha = 0.61$; (6) attention problems, 9 items, $\alpha = 0.73$; (7) rule-breaking behaviors, 10 items, $\alpha = 0.71$; and (8) aggressive behaviors, 19 items, $\alpha = 0.84$. Of note, the item “*I used alcohol or drugs for nonmedical purposes*” was not included in the rule-breaking behavior syndrome score.¹ Traditionally, a standard score (*T*-score) for each syndrome is assigned to each youth that compares the youth’s standing on a distribution of scores obtained from a normative sample of youth, with a *T*-score above 70 demarcating the clinical range (Achenbach, 1995). Two broad groupings reflect problems within the self (internalizing behaviors: withdrawn, anxious/depressed, and somatic complaints) and conflicts with other peoples and their expectations (externalizing behaviors: rule-breaking and aggressive behaviors). The YSR has been shown to have good reliability and its syndrome structure has cross-cultural generalizability in as many as 23 societies, including those in Asia such as Hong Kong, Japan, and Korea (Achenbach and Rescorla, 2001; Ivanova et al., 2007).

In the 2004 NSIDA, the question “*Have you ever used alcohol in the past?*” assessed adolescent involvement with alcohol. If the response was “*Yes*,” a series of alcohol-related questions would be asked to assess age at first use, situation at first use, average frequency and cumulative occasions of consumption, and recency of use. An estimated 42% ($n = 4884$) of youths aged 15–18 years had consumed alcohol on at least one occasion prior to their assessment. On the basis of cumulative occasion and recency of alcohol use, “*trial use*” was defined as those who drank alcohol only once and this occurrence had to have been more than 6 months prior to the assessment ($n = 562$). Recent alcohol initiates who did not continue drinking solely due to the limited time period between first drink and the assessment were excluded from the subsequent analyses ($n = 547$). Youth who used alcohol more than once were categorized into one of two other subgroups of alcohol experience distinguished by the recency of use: past use (drank alcohol on at least two occasions yet had not drunk within 6 months of being assessed, $n = 1022$) and current use (drank on at least two occasions and had at least one drink during the 6 months preceding the interview, $n = 2753$).

Based on prior work, variables potentially confounding the association between alcohol involvement with mental health problems were taken into account by statistical adjustment, including sociodemographics (e.g., gender, type of school attendance, and weekly allowance), family background (i.e., family structure and cohabitation with family), and lifetime drug experiences (i.e., tobacco, betel nut, and other drugs that included use of ecstasy (MDMA), glue, methamphetamine, ketamine, flunitrazepam (so-called FM2), cannabis, heroin or morphine, phencyclidine (PCP), or gamma hydroxybutyrate (GHB)). Sets of drug-specific questions analogous to the ones described above for alcohol were asked for each drug.

2.3. Statistical analyses

All analyses were performed in STATA, Version 9 using survey command options to take into account the multistage probability sampling design (Stata Corp., 2005). Initial standard survey analysis procedures were performed to describe sociodemographic characteristics and psychoactive drug experiences, with stratification by experiences of alcohol involvement. To take into account item interdependence possibly existing within each of the eight mental health

problem syndromes, we turned to the multivariate response profile regression approach based upon the generalized linear model and generalized estimating equations (GLM/GEE).

We began by using the “common slope” approach to simultaneously take into account individual interdependencies between items on any given C-YSR syndrome. In these models, the observed alcohol-related risk of experiencing each item within each of the eight syndromes is held constant; namely, we assumed that, for any given syndrome, the effects of alcohol drinking would be the same on each of the items within the syndrome. In one series of analyses, the odds of experiencing any item within a particular syndrome for the various alcohol-using groups is contrasted with the corresponding odds for the non alcohol using group as the reference. A robust odds ratio (OR) estimate is derived on the basis of a GLM/GEE regression slope model with the variance estimation based upon the GEE working correlation structure and robust specification (Liang et al., 1992; Chen and Anthony, 2003). By limiting to alcohol-experienced subjects, two different sets of models were carried out separately to examine possible age-at-onset and recency-related variation in the link between alcohol use and the experience of mental health problems. The first set of models explores the odds of experiencing any item within a particular syndrome for alcohol drinkers with early age of onset (age 12 or younger) versus that for those with late-onset (age 13–18 years), whereas the second set of models examines the odds for current alcohol users versus that for alcohol drinkers who had not consumed alcohol in the 6 months preceding the assessment (i.e., trial and past users combined). Given that alcohol initiation may give rise to the onset of tobacco, betel nut, and other drugs, the composite alcohol experience-associated odds was estimated in a GLM/GEE statistical model that adjusted for sociodemographic characteristics and tobacco, betel nut, and other drugs. In this series of “common slope” analyses, a *p*-value of less than or equal to 0.01 was set for type I error to avoid rejecting the null hypothesis too easily given the numerous model comparisons.

Finally, a “single slope” multivariate GLM/GEE approach was used to capture the item-to-item variations due to different experiences of alcohol involvement within each of eight syndromes. In this series of models, we allow the observed alcohol-related risk of experiencing each item to vary—that is, the effects of alcohol intake on the individual items can be heterogeneous across items within any given syndrome. The different slopes are captured by introducing product-terms between every combination of alcohol subgroups and each C-YSR item. Using the alcohol-naïve as referent, alcohol exposure-related association estimates of each C-YSR item were obtained by summing the main effect of the alcohol subgroup and the interactive effects between the individual items. For example, the observed odds ratio of experiencing the item of “*rather be alone*” in the withdrawn syndrome among youth trying alcohol was the sum of the estimate of the main effect for this subgroup of alcohol users (i.e., trial users) and the product term between trial use and “*rather be alone*” as estimated by the ‘*lincom*’ procedure in STATA software. The summarized 95% confidence intervals of alcohol experience-associated risks of individual mental health items were then depicted in a figure, with point estimates connected to provide a visual impression of risk trends across the three groups of alcohol users.

3. Results

A description of demographic characteristics and lifetime drug-related experiences is presented for each of the alcohol involvement subgroups in Table 1. In general, alcohol using adolescents were more likely to be male, to come from single-parent households, to have more allowance, to live separately from their family, and to use drugs, as compared with their alcohol-naïve counterparts. The proportion of youth initiating alcohol use before the age of 13 years did not vary across the three subgroups of alcohol users ($p = 0.27$).

As indexed by the summation of syndrome-specific binary scale scores, alcohol using youth generally reported experiencing more items as compared with alcohol naïve youth (see Table 2). The average number of items was higher for

¹ Detailed presentation of Cronbach’s alpha values for the syndromes is provided as supplementary material (Appendix A) by accessing the online version of this paper at <http://dx.doi.org> by entering doi:10.1016/j.drugalcdep.2008.01.018.

Table 1
Selected characteristics by alcohol involvement among high school attendants, the 2004 National Survey of Illegal Drug Use among Adolescents (NSIDA) in Taiwan

Variable ^{a,b}	Alcohol-naïve	Alcohol experienced youth ^c (<i>n</i> = 4337)			<i>p</i> -Value ^d
	(<i>n</i> = 6974) <i>n</i> (% _{wt})	Trial use (<i>n</i> = 562) <i>n</i> (% _{wt})	Past use (<i>n</i> = 1022) <i>n</i> (% _{wt})	Current use (<i>n</i> = 2753) <i>n</i> (% _{wt})	
Demographics					
Gender					
Female	3541 (48.0)	241 (41.3)	466 (44.0)	1119 (38.9)	<0.001
Male	3431 (52.0)	321 (58.7)	556 (56.0)	1634 (61.1)	
School type					
Senior high (academic)	3800 (54.1)	326 (61.4)	537 (53.3)	1368 (52.1)	0.32
Vocation/technical	3174 (45.9)	236 (38.6)	485 (46.7)	1385 (47.9)	
Family structure					
Two parents	6107 (88.1)	498 (84.9)	845 (82.0)	2333 (85.0)	0.023
Single parent	752 (10.1)	57 (11.6)	161 (16.2)	362 (12.2)	
Weekly allowance (NTD) ^e					
0–500	4254 (56.9)	301 (48.7)	533 (48.5)	1185 (40.6)	<0.0001
501–1500	2110 (31.5)	212 (42.2)	362 (38.5)	1206 (43.7)	
1501 or above	296 (0.4)	31 (4.2)	70 (8.2)	229 (11.1)	
Living with family					
Yes	6750 (96.7)	536 (93.6)	981 (95.0)	2620 (95.5)	0.0035
No	140 (2.0)	17 (2.3)	34 (3.8)	100 (3.4)	
Substance use history					
Age at first alcohol use					
12 or under	NA	129 (22.7)	262 (27.6)	685 (23.7)	0.27
13–18		420 (75.7)	730 (68.6)	1989 (74.0)	
Lifetime tobacco use					
No	6305 (91.0)	392 (69.9)	568 (55.9)	1300 (46.6)	<0.0001
Yes	669 (9.0)	163 (28.8)	446 (43.5)	1429 (52.7)	
Lifetime betel nut use					
No	6873 (98.7)	527 (95.6)	899 (89.6)	2214 (78.7)	<0.0001
Yes	95 (1.2)	28 (3.5)	109 (9.0)	486 (19.4)	
Lifetime drug use ^f					
No	6895 (96.0)	546 (98.0)	969 (94.8)	2512 (89.8)	<0.0001
Yes	25 (0.5)	5 (0.7)	33 (3.0)	166 (7.3)	

^a The columns may not add up to 100% due to missing.

^b Estimated percentages are derived based on complex survey analyses (weighted data with Taylor series linearization).

^c Trial use defined as drank alcohol only once >6 months ago, past use defined as ≥2 uses all more than 6 months ago, current use defined as ≥2 uses with at least one within the past 6 months.

^d Design-based Pearson's chi-square test.

^e NTD: New Taiwan Dollar. US\$ 1 = 30 NTD.

^f Include ecstasy (i.e., MDMA), glue, amphetamine, ketamine, flunitrazepam, cannabis, heroin or morphine, Phencyclidine (PCP), and gamma hydroxybutyrate (GHB).

alcohol users on almost every syndrome, except for social problems, but in particular for aggressive behaviors. After we took intra-syndrome inter-item correlation into account using the “common slope” multivariate GLM/GEE model, youth who had tried alcoholic beverages only once were found to have a modest increase in experiencing items of externalizing behaviors than their alcohol-naïve counterparts (rule-breaking behaviors: aOR = 1.2, 95% CI: 1.0–1.4, $p = 0.02$; aggressive behaviors: aOR = 1.3, 95% CI: 1.1–1.5, $p < 0.001$). Consistent with the pattern seen in the mean scores, a trend of increased odds emerges as the alcohol involvement reflects drinking in greater quantity for somatic complaints and thought problems. While youth with alcohol involvement remained consistently at higher odds to experience items in the aggressive behavior

syndrome as compared with alcohol naïve youth ($p < 0.001$), this was not the case for all the other syndromes. Regardless of recency and cumulative occasions of alcohol use, among drinkers there was a 20–70% increase in the odds of externalizing behaviors than those with no alcohol use. The strongest adjusted odds ratios occur between items associated with current drinking in the rule-breaking behavior (aOR = 1.7) and aggressive behavior (aOR = 1.6) syndromes as compared with nondrinkers.

Next, we explored the effect of age of onset with experiencing any item within a particular syndrome. Among those who had tried alcohol at least once in their lifetime, the association estimates linking alcohol-onset age and alcohol involvement with having at least one item for each of the eight YSR syn-

Table 2

Estimated association linking adolescent alcohol involvement with items within each YSR syndrome, under the ‘common slope’ Generalized Linear Model with General Estimation Equations (GLM/GEE), the 2004 NSIDA, Taiwan

YSR syndrome	Type of alcohol experience									
	Alcohol-naïve	Trial use			Past use			Current use		
	Mean	Mean ^a	aOR (95% CI) ^b	p-Value	Mean ^a	aOR (95% CI) ^b	p-Value	Mean ^a	aOR (95% CI) ^b	p-Value
Withdrawn	3.68	3.89	1.2 (1.0–1.5)	0.04	3.95**	1.2 (1.0–1.3)	0.02	3.83**	1.2 (1.1–1.4)	0.02
Somatic complaints	2.41	2.44	1.1 (0.9–1.3)	0.37	2.74**	1.2 (1.0–1.4)	0.006	2.80**	1.4 (1.3–1.5)	<0.001
Anxious/depressed	6.30	6.69	1.2 (1.0–1.5)	0.08	6.86**	1.1 (1.0–1.3)	0.02	6.81**	1.2 (1.1–1.4)	<0.001
Social problems	3.24	3.37	1.2 (1.0–1.3)	0.04	3.29	1.0 (0.9–1.2)	0.43	3.25	1.0 (1.0–1.1)	0.20
Thought problems	1.53	1.64	1.0 (0.9–1.1)	0.52	1.73**	1.2 (1.1–1.3)	0.005	1.84**	1.3 (1.2–1.4)	<0.001
Attention problems	5.68	5.99**	1.2 (1.0–1.4)	0.07	6.16**	1.2 (1.1–1.3)	0.001	6.03**	1.2 (1.1–1.4)	<0.001
Rule-breaking problems	2.02	2.51**	1.2 (1.0–1.4)	0.02	2.77**	1.3 (1.2–1.5)	<0.001	3.22**	1.7 (1.6–1.8)	<0.001
Aggressive behaviors	7.40	8.51**	1.3 (1.1–1.5)	<0.001	8.98**	1.4 (1.2–1.5)	<0.001	9.37**	1.6 (1.4–1.7)	<0.001

Mean = average of the sum of positive items (0/1) within the syndrome. ** $p < 0.001$.

^a Student *t*-test with the reference group as alcohol-naïve (non-drinkers).

^b aOR = adjusted odds ratio estimated from model including covariates: male gender, school type, weekly allowance, family structure, not living with family, lifetime tobacco, betel nut, and other drug use; 95% CI = 95% confidence interval.

dromes are summarized in Table 3. With statistical adjustment for sociodemographic background and lifetime tobacco, betel nut, and other drug experiences (Table 3, adjusted model set 1), the elevated odds of experiencing individual emotional or behavioral items for youths consuming their first alcoholic beverage before the age of 13 years was salient for

“Thought Problems” (aOR = 1.19, 95% CI: 1.06–1.34, $p < 0.01$), while less striking for “Social Problems” (aOR = 1.11, 95% CI: 0.99–1.23). Results from models where current users were compared with alcohol drinkers who had not consumed alcoholic beverages in the 6 months preceding the assessment indicate the importance of recency of use in the associations

Table 3

Estimated association^a linking alcohol-onset age and alcohol involvement with the YSR syndrome among alcohol-experienced youths, under the ‘common slope’ model, the 2004 NSIDA, Taiwan

Variables	Internalizing Syndrome			Social Problems aOR (95% CI)
	Withdrawn aOR (95% CI)	Somatic Complaints aOR (95% CI)	Anxious/Depressed aOR (95% CI)	
Adjusted model set 1^b				
Type of alcohol use				
Trial use	1.0	1.0	1.0	1.0
Past use	0.96 (0.77- 1.19)	1.10 (0.88- 1.40)	0.96 (0.76- 1.19)	0.91 (0.78- 1.06)
Current use	0.95 (0.78- 1.14)	1.27 (1.02- 1.59)*	1.05 (0.86- 1.29)	0.92 (0.80- 1.05)
Age at first alcohol use				
Age 12 or under	1.10 (0.96- 1.27)	1.02 (0.89- 1.17)	1.04 (0.91- 1.19)	1.11 (0.99- 1.23)
Adjusted model set 2^c				
Type of alcohol use ^e				
Trial and past use	1.0	1.0	1.0	1.0
Current use	0.97 (0.86- 1.10)	1.20 (1.05- 1.37)*	1.08 (0.96- 1.23)	0.98 (0.89- 1.07)
	Externalizing Syndrome			
	Thought Problems ^d aOR (95% CI)	Attention Problems aOR (95% CI)	Rule-breaking Behavior aOR (95% CI)	Aggressive Behavior aOR (95% CI)
Adjusted model set 1^b				
Type of alcohol use				
Trial use	1.0	1.0	1.0	1.0
Past use	1.19 (1.02- 1.38)	1.04 (0.88- 1.23)	1.13 (0.94- 1.36)	1.06 (0.89- 1.26)
Current use	1.31 (1.15- 1.50)**	1.08 (0.93- 1.27)	1.44 (1.23- 1.69)**	1.22 (1.04- 1.43)
Age at first alcohol use				
Age 12 or under	1.19 (1.06- 1.34)*	1.03 (0.92- 1.15)	1.02 (0.90- 1.16)	1.02 (0.91- 1.14)
Adjusted model set 2^c				
Type of alcohol use				
Trial and past use	1.0	1.0	1.0	1.0
Current use	1.17 (1.06- 1.29)**	1.05 (0.95- 1.17)	1.33 (1.19- 1.49)**	1.17 (1.06- 1.31)*

* $p < 0.01$, ** $p < 0.001$. ^aEstimated OR based on odds ratio from Generalized Linear Models with General Estimation Equations (GLM/GEE) to estimate 95% confidence intervals (CI). ^bStatistical adjustment for male gender, school type, weekly allowance, family structure, not living with family, lifetime tobacco, betel nut, and other drug use. Reference group for age at first alcohol use: had the first drink at age 13–18 years. ^cReference group: alcohol trial use and past use. Statistical adjustment for male gender, school type, weekly allowance, family structure, not living with family, lifetime tobacco, betel nut, other drug use, and age at first alcohol use. ^dDue to model inconvergence, “Thought Problem syndrome” excluded “mind off” given its higher prevalence as compared with other items.

between history of alcohol use and the mental health items (Table 3, adjusted model set 2). For example, compared with those trial and past users, current drinkers had an approximate 20% increase in the odds of experiencing these items within “Somatic Complaints” (aOR = 1.20; 95% CI: 1.05–1.37, $p < 0.01$) and “aggressive behaviors” (aOR = 1.17, 95% CI: 1.06–1.31, $p < 0.001$).

To address aim 2, a single slope model was used to estimate the associations between each item within each syndrome for the three alcohol drinking subgroups as compared with youth with no alcohol drinking history prior to the assessment (Fig. 1). With statistical adjustment for gender, school type, family structure, weekly allowance, living with family, lifetime use of tobacco, betel nut, and other drug use, the results suggest that, even within the same syndrome, there seems to be item variation among the alcohol using youth. For example within the Withdrawal syndrome, alcohol triers were an estimated 1.6 times more likely to report the item “won’t talk” (95% CI: 1.1–2.2, $p < 0.01$), while there was no difference among past and current alcohol users when compared with nondrinkers. An opposite pattern can be seen for other items within the Withdrawal syndrome. The strongest magnitude of association appears to link current alcohol use (aOR = 1.5, 95% CI: 1.4–1.8) and past alcohol use (aOR = 1.3, 95% CI: 1.1–1.7) with the “lack energy (under-active)” item, something not seen among youth with trial use (aOR = 1.2, 95% CI: 0.9–1.6) (left hand side of first panel of Fig. 1).

Item variation in the syndromes of social problems and anxious/depressed were not as large as in the other syndromes. In general, items within the syndromes of somatic complaints, thought problems, attention problems, rule-breaking behaviors, and aggressive behaviors were associated with the two alcohol subgroups with greater alcohol involvement, especially among the current drinkers. For example, of all the somatic complaints, nausea was more common among youth who drank on more than two occasions, which was particularly true for current drinkers. This was particularly salient for items like “hangs around kids who get in trouble (badcompan)” and “truancy” in the rule-breaking syndrome and “disobeys at school,” “fighting,” and “teases” in the aggressive behavior syndrome (the lower panel of Fig. 1).²

4. Discussion

Our findings indicate that among a national sample of high school-attending youths in Taiwan, the youth who had the experience of drinking alcohol were more likely to experience several specific emotional or behavioral syndromes and items within those syndromes than their alcohol-naïve counterparts. For example, youth with a history of alcohol use had an estimated 30–60% increase in the odds of experiencing items within the

aggressive behavior syndrome as compared with alcohol-naïve youth. In addition, both current and past drinkers had roughly an estimated 20–40% increase in odds of experiencing items in the somatic complaints, thought problem, and attention problem syndromes. Finally, the observed associations linking the type of alcohol involvement and mental health items appears to be heterogeneous across items within any given syndrome, suggesting that alcohol intake may exert differential effects not only on a syndrome-level, but also on an item-level.

The current findings suggest that, even in early stages of alcohol involvement, significant associations exist between alcohol consumption and mental health items in both of the externalizing behavioral syndromes and the observed odds of experiencing rule-breaking and aggressive behavioral items appear more salient with greater alcohol involvement, current occasional use rather than merely experimental use. The association between greater alcohol involvement and greater mental health disturbance may reflect different complex processes. For instance, longitudinal evidence has shown that aggressive or rule-breaking behaviors in early life may play a strong role in accelerating one’s progression from alcohol initiation to heavy or problematic drinking (Kumpulainen, 2000; Sartor et al., 2007). However, the observed strong links may be, in part, explained by some unobserved or unmeasured factors. For example, alcohol use may increase the chance that a youth associates with drinking and drug-using peers who may reinforce the manifestation of externalizing or deviant behaviors (Oetting and Donnermeyer, 1998).

Consistent with the results derived from animal models (Spear, 2002; Spear and Varlinskaya, 2005; White and Swartzwelder, 2005), adolescents with more alcohol experiences were more likely to experience items within the attention, thought, and somatic syndromes as compared with their alcohol-naïve counterparts, and, noticeably, the modest association remained significant for those who had not consumed any alcoholic beverage in the 6 months prior to the assessment (Table 2). This observation may raise the possibility that certain mental health syndromes or items within a syndrome (such as vomiting or stomach ache in “somatic problems”) might emerge in response to recent or acute alcohol consumption. Prior research has found elevated occurrences of diagnosed mental disorders among alcohol-using youths (Sbrana et al., 2005; Valentinier et al., 2004), which our results suggest is also seen at the item-level. The observed heterogeneity in the odds across items within any given syndrome may imply the possibility of differential sensitivity to ethanol exposure and subthreshold comorbidity. Explicit evaluation of alcohol exposure-related influences on the indicators of cognitional, affective, or behavioral domains may be needed in future research to probe possible variation due to alcohol exposure timing and change/or stability in alcohol-related developmental influences from early adolescence to adulthood (Brown and Tapert, 2004; Field et al., 2007).

Assessing the links between alcohol drinking-level and mental health problems at the item-level creates a unique opportunity to evaluate possible effects of alcohol on the emergence or manifestation of certain emotional, behavioral, or cognitive problems. Our analyses indicated that the experiences of a few, not all,

² Question wording for individual items in the eight behavioral syndromes is provided as supplementary material (Appendix B) by accessing the online version of the paper at <http://dx.doi.org> by entering doi:10.1016/j.drugalcdep.2008.01.018.

Fig. 1. Estimated association linking adolescent alcohol involvement with YSR symptom, under the 'single slope' model, the 2004 NSIDA, Taiwan. ●: T(alcohol trial); —: P(past alcohol use); ×: C(current alcohol use). Note, *withdrawn*: rather be alone, won't talk, secretive, shy, underactive, sad, withdrawn; *somatic complaints*: dizzy, aches, headaches, nausea, eye, skin, stomach, vomit; *anxious/depressed*: lonely, cries, fear do bad, perfect, unloved, out to get, worthless, nervous, fearful, self-conscious, suspicious, sad, worries; *somatic problems*: acts young, clings, not get along, teased, not liked, clumsy, prefers young, withdrawn; *thought problems*: hears things, repeats acts, sees things, strange behave, strange ideas; *attention problems*: acts young, concentrate, sit still, confused, daydream, impulsive, nervous, poor school, clumsy; *rule-breaking behaviors*: noguilt, badcompanion, liecheat, preolder, runaway, setfires, stealhome, stealout, swear, truant; *aggressive behaviors*: argues, brags, mean, demattn, destown, desothr, disobsch, jealous, fights, attacks, screams, showoff, stubborn, moodchng, talkmuch, teases, temper, threaten, and loud.

mental health items seem more associated with the experimentation or trial use of alcohol. Although it is plausible that the differences we are detecting existed before using alcohol, this observation may suggest that youths may try alcohol to disinhibit or alleviate particular mood symptoms, such as would rather be alone or won't talk, nervous in the "withdrawn" or "anxious/depressed" syndromes (Kaplow et al., 2001; Quitkin et al., 1972). By contrast, the advanced or current involvement of alcohol intake was shown to be more associated with some items (e.g., underactive in "withdrawn" and impulsive in "attention problem" syndromes) whose appearance may be more susceptible to alcohol exposure in childhood or adolescence, or may serve as a risk factor leading a youngster from alcohol initiation to occasional or heavy use (Buckner et al., 2008).

A few limitations merit attention. First, the use of observational data with a cross-sectional and retrospective design constrains any causal inference. Prospective studies with multiple assessments of alcohol consumption and emotional/behavioral problems over the period of adolescence are needed to understand processes operating on alcohol-using behaviors and mental health problems from onset of alcohol use to subsequent alcohol use consumption patterns (e.g., reciprocal or mediational effects). In studies collecting data via self-report, there is always a potential for information biases, particularly if the validity for recency and cumulative days of alcohol use differs by a youth's emotional or behavioral condition. The unavailability of detailed information regarding alcohol drinking patterns, such as amount and intensity, limited our ability to evaluate associations among binge or heavy drinkers. Even though underage alcohol drinking is generally tolerated in Taiwan, we also cannot dismiss the possibility of under-reported alcohol drinking among our young participants due to social desirability. Since our analyses were syndrome-oriented, we did not examine in detail how association estimates may differ when the other seven C-YSR syndromes are taken into account. For example, it is very possible that youth experiencing a lot of the items in the Withdrawal syndrome may also be experiencing many of the items in the anxious/depressed syndrome, and non-adjustment may lead to the direction of overestimating the association between alcohol involvement and Withdrawal syndrome. Finally, the present study's data were primarily collected from high school-attending youths in Taiwan, thus our results may not be generalizable to school dropouts or adolescent populations in other societies.

Notwithstanding limitations such as these, our analyses provide new evidence on the relationship between early alcohol experiences and mental health problems. Prior research has noted that the occurrence of psychiatric disorders was disproportionately distributed among different subgroups defined by alcohol use disorder diagnoses (Buckner et al., 2008; Stinson et al., 2005). However, only a handful of studies have explored such links among youths who are in the earliest stages of alcohol use (e.g., alcohol triers or occasional drinkers). Given the cultural context of Taiwan, in which alcoholic beverages are commonly perceived as food and family events provide ample opportunities for alcohol use at young

ages, the large number of early-stage alcohol drinkers has allowed us to examine the links between alcohol use and mental health symptomatology in greater detail than has been possible in prior work. Moreover, the multivariate response models (GLM/GEE) took intra-individual item correlation and individual response tendencies into account, thus providing a greater degree of precision and validity in the estimated associations.

In summary, while previous research has found a higher co-occurrence of psychiatric symptoms and syndromes among youth with substance use disorders, this study found that even among youth with very little alcohol involvement (i.e., in the earliest stages of initiation), those with more alcohol involvement were more likely to report the presence of several emotional and behavioral disturbances. It is imperative to understand correlates more likely to appear during specific developmental stages so that we can begin to identify youth at greater risk of transitioning into stages of greater alcohol involvement (e.g., binge, alcohol abuse/dependence) and intervene to decrease alcohol-related cognitive, emotional, and behavioral impairments. Primary care physicians can screen for alcohol use and use instruments that easily collect information on a range of externalizing and internalizing problems, such as the YSR to help determine the impact of alcohol and other drug use on the youth's mental well-being (Achenbach, 1995). Our findings emphasize the need to consider mental health symptoms as indicators themselves, rather than relying on diagnostic thresholds of psychiatric disorders alone. Alcohol-using youth were more likely to experience certain emotional or behavioral "items" than their alcohol-naïve counterparts and once alcohol drinking was started, the emergence of certain mental health syndromes was more sensitive to the increased consumption of alcoholic beverages. Future epidemiological, clinical, and laboratory studies are needed to confirm, and extend these results, and to probe more deeply into explanations for the possible heterogeneity found at the item-level of adolescent emotional and behavior problems as they vary by history of early alcohol experiences.

Conflict of interest

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

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agement and analysis. C.K. Hsiao assisted with the sampling design and data management. W.J. Chen was the principal investigator, contributed to the conceptualization of the original research, and oversaw all aspects of its implementation. All authors contributed to and have approved the final manuscript.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.drugalcdep.2008.01.018](https://doi.org/10.1016/j.drugalcdep.2008.01.018).

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