

The Prospective Relation Between Dimensions of Anxiety and the Initiation of Adolescent Alcohol Use

Julie B. Kaplow

Department of Psychology, Duke University

Patrick J. Curran

Department of Psychology, University of North Carolina, Chapel Hill

Adrian Angold and E. Jane Costello

Developmental Epidemiology Center, Department of Psychiatry and Behavioral Sciences, Duke University

Examined the relation between early anxiety symptomatology (generalized and separation) and initiation of alcohol use 4 years later in an epidemiological sample of 936 children (45% girls), assessed at ages 9, 11, and 13, while controlling for the effects of depression. Although earlier overall anxiety symptomatology was unrelated to later onset of drinking, children with early symptoms of generalized anxiety were found to be at increased risk for initiation of alcohol use, whereas children with early symptoms of separation anxiety were at decreased risk. The magnitude of these relations was equally strong for boys and girls. In addition, early depressive symptomatology was associated with increased risk for initiation of alcohol use in adolescence. Results indicate that it is important to consider specific dimensions of anxiety symptomatology when attempting to identify those individuals at risk for early initiation of alcohol use.

Most adolescents tend to begin using alcohol between the ages of 13 and 15 (O'Malley, Johnston, & Bachman, 1998). Studies have also found that the earlier a child initiates the use of alcohol, the greater is his or her risk of alcohol abuse in adolescence, as well as other problem outcomes such as later aggression, school failure, and delinquency (Jackson, Henriksen, Dickinson, & Levine, 1997; Kandel & Yamaguchi, 1985; McCord, 1995). Consequently, there is a great need for research that identifies potential risk factors for early initiation of alcohol use. Many prior studies examining predictors of alcohol use have focused on retrospective accounts from adult clinical populations, such as recovering alcoholics (e.g., Chambless, Cherney, Caputo, & Rheinstein, 1987; Weiss & Rosenberg, 1985). Recently, prospective longitudinal studies have begun to identify risk factors for adolescent alcohol use, including negative emotions such as

anxiety and depression (e.g., Bukstein, Glancy, & Kaminer, 1992; Rohde, Lewinsohn, & Seeley, 1996). Because most of the studies examining the relation between negative emotions and alcohol use have used concurrent research designs, data investigating the prospective prediction of alcohol use are limited. This study uses a longitudinal design to examine the role of one type of negative emotion, namely anxiety, in the initiation of adolescent alcohol use.

Emotional Disorders and Alcohol Use

The majority of earlier studies have focused on the relation between negative emotions and alcohol use in adults (e.g., Chambless et al., 1987; Weiss & Rosenberg, 1985). More recent studies that have focused on alcohol use in adolescent populations have provided mixed results, with some supporting (Colder & Chassin, 1993; Newcomb & Harlow, 1986) and others refuting (Clark, Parker, & Lynch, 1999; Swaim, Oetting, Edwards, & Beauvais, 1989) the importance of negative emotions as predictors of alcohol use. One possible reason for this controversy is that many of these studies utilized a wide variety of emotional experiences, including anger, depression, anxiety, loss of control, and meaninglessness to create a single measure of negative affective reactions. However, by pooling different types of negative emotions into a single construct, it is difficult to determine which specific types of

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Requests for reprints should be sent to Patrick J. Curran, University of North Carolina, Chapel Hill, Department of Psychology, Chapel Hill, NC 27599–3270. E-mail: curran@unc.edu

symptoms may play a critical role in predicting initiation of alcohol use. It is necessary to differentiate between types of internalizing symptoms to fully understand their respective relations to alcohol use in adolescence (Hussong & Chassin, 1994).

Anxiety and Alcohol Use

The few studies that have examined the relation between anxiety and alcohol use in adolescence have provided mixed results. Whereas some conclude that anxiety is an important risk factor for alcohol use (e.g., Clark & Sayette, 1993), others conclude that anxiety is not related to alcohol use in adolescence (e.g., Biederman, Wilens, Mick, & Faraone, 1997; Hussong, Curran, & Chassin, 1998). Although studies have found that alcohol use and anxiety disorders are frequently comorbid (Kushner, Abrams, & Borchardt, 2000), the directionality of this relation is often unclear, which may contribute to the confusion in the literature regarding the role of anxiety as a risk factor for later alcohol use. Unfortunately, few prospective studies currently exist, thereby limiting our understanding of how anxiety may play a role in the *initiation* of children's alcohol use (Kushner et al., 2000).

Given the lack of prospective data on this topic, studies examining the relation between anxiety and externalizing behaviors in general may offer important information concerning the ways in which anxiety may impact initiation of alcohol use. These studies suggest that the presence of anxiety may actually delay, reduce, or even prevent the onset of behavioral problems, which likely includes the initiation of alcohol use. A recent study found that children with an anxiety disorder began smoking cigarettes later than children without an anxiety disorder (Costello, Erkanli, Federman, & Angold, 1999). Studies have also shown that children with emotional disorders (in the absence of conduct disorder) are less likely to develop later antisocial behaviors than the general population (Graham & Rutter, 1973; Kohlberg, Ricks, & Snarey, 1984). Other research has demonstrated a moderating effect of anxiety on conduct-disordered behavior, such that children with conduct disorder and anxiety display fewer problem behaviors than children with conduct disorder alone (e.g., Walker et al., 1991).

Researchers have generated a number of potential explanations for an inverse relation between anxiety and problem behaviors. These mechanisms include anxious social cognitions that serve as reminders of possible negative consequences for risk-taking behaviors (Dodge, 1986), disengagement from the peer group (Hussong et al., 1998), or the temperamental trait of behavioral inhibition (Masse & Tremblay, 1997; Wills, Vaccaro, & McNamara, 1994). Taken together, these findings suggest that a child's anxiety may inhibit prob-

lem behaviors in youth. Because early initiation of alcohol use is most often considered to be a problem behavior, one might also expect to see an inverse relation between anxiety and initiation of alcohol use. Not only is the literature limited with regard to this area of research, but with few exceptions (i.e., Biederman et al., 1997; Hussong et al., 1998), studies that have examined the relation between anxiety and alcohol use have focused on one time point only (Weinberg & Glantz, 1999). Consequently, little is known about the role of earlier anxiety as a predictor of initiation of alcohol use.

Confounding Issues

Besides utilizing a prospective, longitudinal design, this study builds on previous research by addressing several potentially confounding issues that may be related to discrepant findings with regard to the association between anxiety and alcohol use. First, research has found that over one third of adolescents with an anxiety disorder have a depressive disorder as well (Clark, Smith, Neighbors, Skerlec, & Randall, 1994). When studies examining the relation between anxiety and alcohol use fail to control for depression, it is impossible to ascertain whether increases in drinking are due to the anxiety, the depression, or some combination of the two. Thus, this study examines the relation between anxiety and initiation of alcohol use while controlling for the comorbid effects of depression.

Second, studies of adults suggest that different forms of anxiety (e.g., agoraphobia, social anxiety) may play unique roles in relation to alcohol use (Kushner, Sher, & Beitman, 1990; Rohsenow, 1982). One might also expect to see differences between particular dimensions of anxiety and their respective relations to alcohol use in childhood. For example, children with separation anxiety may fail to affiliate with a peer group due to excessive fears about separating from their caregiver (Albano, Chorpita, & Barlow, 1996), which may preclude them from drinking, because alcohol use most often occurs in a social environment (Oetting & Beauvais, 1987). Children with generalized anxiety disorder, however, are considered "chronic worriers" who are often preoccupied with various concerns, including feeling accepted by peers (Albano et al., 1996). It is likely that these children will begin to use more alcohol in an attempt to feel affiliated with their peers and possibly to "self-medicate" for their excessive worrying and physiological tension.

It is also possible that the clusters of symptoms found in each of these dimensions of anxiety (generalized versus separation) are actually tapping into distinct temperamental traits that may give rise to different patterns of behavior. Because early behavioral inhibition has been associated with later separation anxiety (Biederman et al., 1993), but not generalized anxiety (Biederman et al.,

1990), children with separation anxiety symptoms may be more avoidant of novel stimuli and situations such as alcohol consumption compared to children with generalized anxiety symptoms. Given evidence, albeit limited, that generalized and separation anxiety may be differentiated by their respective relations to behavioral inhibition as well as peer affiliation, this study distinguishes between these two dimensions of anxiety to understand their potentially distinct roles in relation to the initiation of adolescent alcohol use.

Third, many previous studies have utilized measures of anxiety *diagnoses* as opposed to measures of anxiety *symptomatology*. The use of continuous measures of anxiety symptomatology could help to target a significant proportion of the adolescent population that has often been overlooked through the use of more stringent diagnostic criteria (Angold, Costello, Farmer, Burns, & Erkanli, 1999). Thus, this study utilizes measures of anxiety symptomatology in the prediction of initiation of alcohol use.

Finally, there are theoretical reasons to believe that the nature of the relation between anxiety and alcohol use may vary as a function of sex. Research on this topic has produced conflicting results with some studies indicating that boys may be more likely than girls to use alcohol as a means of alleviating negative affect (Henry et al., 1993; Smail, Stockwell, Canter, & Hodgson, 1984) and vice versa (Clark et al., 1997; Deykin, Levy, & Wells, 1987). In an effort to help clarify these mixed results, this study tests the moderating effects of sex on the relation between anxiety and initiation of adolescent alcohol use.

Research Hypotheses

In sum, this study was designed to empirically evaluate the following theoretically derived hypotheses:

1. It is predicted that the number of overall anxiety symptoms (combined generalized and separation anxiety symptoms) at the initial time period will not be significantly related to the onset of alcohol use (above and beyond depressive symptoms) 3 years later.
2. It is predicted that the number of generalized anxiety symptoms at the initial time period will be uniquely and *positively* related to the onset of alcohol use (above and beyond depressive and separation anxiety symptoms) 3 years later.
3. It is predicted that the number of separation anxiety symptoms at the initial time period will be uniquely and *negatively* related to the onset of alcohol use (above and beyond depressive and generalized anxiety symptoms) 3 years later.
4. It is predicted that the unique relations of both generalized and separation anxiety symptoms and alcohol use will vary as a function of sex. Due to the limited

research on the moderating effects of sex, the nature of this interaction is unclear. It is hoped that this study will help to elucidate this question.

Method

Sample

This study utilized data from a subsample of children ($N = 936$) drawn from the Great Smoky Mountains Study of Youth who were initially interviewed at ages 9, 11, and 13 and followed for 4 years. The Great Smoky Mountains Study of Youth is a longitudinal epidemiological study of children living in a predominantly rural area of the southeastern United States (see Costello et al., 1996, for full details regarding study design and instruments). The initial representative sample consisted of 1,420 children recruited from 11 counties in western North Carolina. The response rate of those initially recruited was 80% ($N = 1,420$), and between 80% and 95% have been reinterviewed each year. Children with behavior problems and American Indian youth were oversampled. For analytic purposes, all participants were given a weight inversely proportional to their probability of selection, so that the results presented would be representative of the population from which the sample was drawn.

Inclusion criteria for the analyses consisted of having completed child or parent report measures of the child's generalized anxiety, separation anxiety, and depressive symptomatology at the first time point, as well as child or parent report measures of the child's alcohol use at the first, second, third, and fourth time points (Waves 1 through 4). For all analyses, parent and child reports were combined in an either-or fashion such that if either the parent or child reported a symptom, it was considered present to maximize all available information and take into account each source, both of which were considered important. All children who had used alcohol at the first time point were omitted from the analyses to prospectively evaluate *initiation* of alcohol use (e.g., Brook, Kessler, & Cohen, 1999). Of the original 1,420 children recruited, 429 participants (30%) were eliminated due to missing information on alcohol use over the four waves of data collection. An additional 55 children were eliminated because they had reported already having initiated alcohol use at the first time point. Among the 936 children included in the final subsample, 45.4% were girls, 70.3% were Caucasian, 6.0% were African American, and 23.7% were American Indian.

Attrition and Missing Data

Potential bias due to attrition was assessed by comparing the demographic and predictor variables of the

participants included in the analyses with those that had been excluded from the analyses. A series of chi-square tests and multiple regression models were estimated for this purpose. The results of these analyses indicated that the participants who were excluded from the study did not differ significantly from those who were included in terms of race, $\chi^2(1, N = 1,338) = .48, p = .49$; sex, $\chi^2(1, N = 1,338) = 1.29, p = .26$; depressive symptoms, $F(1, 1336) = .04, p = .83$; generalized anxiety symptoms, $F(1, 1336) = 0.00, p = .96$; or separation anxiety symptoms, $F(1, 1336) = .32, p = .57$.¹ There was a significant age difference between samples such that a smaller proportion of 13-year-olds was retained in the final sample as compared to the initial sample, $\chi^2(2, N = 1,338) = 13.47, p = .001$. Overall, the sample analyzed in this study does not appear to differ significantly from the initial sample, except in the inclusion of somewhat fewer of the oldest cohort (age 13 at intake).

Interview Measures

The Child and Adolescent Psychiatric Assessment (CAPA; Angold & Costello, 1995) is an interview used to elicit information regarding symptoms that contribute to a wide range of symptom scales and diagnoses according to the taxonomies in *The International Statistical Classification of Diseases* (10th ed., World Health Organization, 1992) and *The Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev., and 4th edition [DSM-IV]; American Psychiatric Association, 1987, 1994). One of the unique features of the CAPA is that it combines characteristics of both an "interviewer-based" and a "respondent-based" interview (Costello et al., 1996). Specifically, the CAPA utilizes a highly structured protocol with required questions and probes, much like a respondent-based interview. However, just as in an interviewer-based interview, the interviewer is responsible for ensuring that participants understand the questions, provide clear information on behavior or feelings related to the symptom, and have the symptom at a clinical level of severity. The CAPA is thus more adaptable to the ways in which different ethnic groups think about mental illness than is a respondent-based interview that asks the identical questions of every child, regardless of age, developmental level, or culture. Symptoms are coded using an extensive glossary.

The CAPA has been shown to have good test-retest reliability in use with Caucasian and African American children (Angold & Costello, 1995), but its test-retest

reliability in American Indian populations has not been established. James E. Sanders, director of the Bureau of Indian Affairs Social Services, served as consultant to the study on the appropriateness and cultural competence of the interview. All interviewers were required to meet an interrater reliability criterion of ICC = .85 during training before beginning the interview process. This study primarily utilized the psychiatric disorders and substance use sections of the CAPA. The specific measures used within each section are described briefly here. For further psychometric information, see Angold and Costello.

Psychiatric Disorders

Depression. Depression was assessed using a 9-item measure of depressive symptoms that the child has experienced within the previous 3 months. Scores ranged from 0 to 6 with a mean of .64 ($SD = .89$). Approximately 57% of the sample reported zero symptoms, 29% of the sample reported one symptom, and 14% reported two or more symptoms. Sample questions include, "Have you been feeling down at all?" and "Can you have fun or enjoy yourself?"

Generalized anxiety. Generalized anxiety was assessed using an 18-item measure of the number and type of generalized anxiety symptoms that the child has experienced within the previous 3 months. The retest reliability figures for all anxiety items (including generalized and separation) are based on 92 test-retest interviews about 2 weeks apart in an outpatient clinic sample. The retest reliability for all anxiety items in a single scale is high (ICC = .85). The retest reliability for overanxious disorder² is somewhat lower (ICC = .60). Scores on the generalized anxiety measure ranged from 0 to 11 with a mean of 1.06 ($SD = 1.98$). Approximately 62% of the sample reported zero symptoms, 17% reported one symptom, and 21% reported two or more symptoms. Sample questions include, "When you're worried, anxious or frightened, does it affect you physically at all?" and "Do you ever feel frightened without knowing why?"

Separation anxiety. Separation anxiety³ was assessed using a 9-item measure of the number and type of separation anxiety symptoms that the child has experienced.

¹Although not of direct interest to this study, the initial and final samples were also compared on a measure of disruptive behavior. The samples did not differ significantly on this measure, indicating that the children who were omitted from the sample were not at greater "risk" in terms of externalizing behavior problems.

²The test-retest study was conducted in the early 1990s, before DSM-IV, so generalized anxiety disorder for children did not yet exist.

³Although children with social anxiety may demonstrate behaviors similar to those of children with separation anxiety, social anxiety is rarely diagnosed in children under the age of 10 (Vasey, 1995). Likewise, only 1% of the children in this study demonstrated any symptoms of social anxiety at the first wave of data collection. Thus, social anxiety was not examined as a predictor.

experienced within the previous 3 months. The ICC for retest reliability on this measure is 0.60. Scores on this measure ranged from 0 to 8 with a mean of 0.39 ($SD = 1.30$). Approximately 82% of the sample reported zero symptoms, 8% reported one symptom, and 10% reported two or more symptoms. Sample questions include, "When you're away from your parents, do you worry that they might come to some harm?" and "Do you try to avoid being on your own?"

Substance Use

Alcohol use. Alcohol use was counted if either the child or the parent reported that the child ever had a drink of alcohol (not just a sip) without parental permission at the second, third, or fourth wave of assessment. This is a dichotomous measure in which an endorsement of having ever used alcohol by the fourth time point is coded as 1, and having never used alcohol is coded as 0. Approximately 7% of the participants reported initiation of alcohol use in Wave 2, 9% reported initiation in Wave 3, and 8% reported initiation in Wave 4. In total, 17% of the sample of children abstaining at Wave 1 reported having initiated alcohol use by Wave 4.

Procedure

Children were initially interviewed as close as possible to the birthday on which they turned 9, 11, or 13. Two interviewers visited each family, either at home (approximately 77% of the families) or at another convenient location. Interviewers were residents of the area in which the study is situated, and all interviewers had at least a bachelor's-level degree. They each received 1 month of training followed by constant quality control, which consisted of postinterview reviews by experienced interviewer supervisors. Before the interviews began, both the parent and the child signed con-

sent forms. They were interviewed in separate rooms, and each was given \$10 after the interview was completed. Subsequent annual interviews were conducted as close as possible to the next birthday. Data collected from the first four waves of interviews (1993 to 1997) were used to test the research hypotheses proposed here.

Data Analytic Strategy

A series of longitudinal logistic regressions were used to test the unique relations between several categorical and continuous predictors and initiation of alcohol use. The dichotomous dependent variable (any alcohol use by the fourth interview) was regressed on four covariates (age, sex, race, depression) and three predictors (overall anxiety symptoms, generalized anxiety symptoms, separation anxiety symptoms). In addition, the moderating effect of sex was tested (overall anxiety by sex, generalized anxiety by sex, separation anxiety by sex).

Results

Descriptive Statistics

Table 1 shows descriptive statistics and bivariate correlations for all measures. As expected, all symptomatology measures were positively correlated with one another. A positive relation was found between generalized anxiety symptomatology and separation anxiety symptomatology ($r = .43, p = .001$), generalized anxiety symptomatology and depressive symptomatology ($r = .30, p = .001$), and separation anxiety symptomatology and depressive symptomatology ($r = .24, p = .001$). *T* tests revealed that the likelihood of initiation of alcohol use increased with both age, $t(251) = 12.00, p < .0001$, and depressive symptoms, $t(207) = 3.25, p = .0013$. The other bivariate correlations be-

Table 1. Means, Standard Deviations, and Correlations for All Measures

	1	2	3	4	5	6	7	8
1. Age		-.01	-.01	.00	-.04	.00	-.10**	.34**
2. Sex ^a			.02	-.01	-.07*	-.07*	-.06	.01
3. Race ^b				-.16***	-.09**	-.12***	.00	-.02
4. Depressive Symptoms					.33***	.30***	.24***	.12***
5. Overall Anxiety Symptoms						.93***	.73***	.01
6. Generalized Anxiety Symptoms							.43***	.03
7. Separation Anxiety Symptoms								-.04
8. Alcohol Use (Waves 2 to 4)								
<i>M</i>	10.77	0.55	0.30	0.64	1.44	1.06	0.39	0.17
<i>SD</i>	1.59	0.50	0.46	0.89	2.59	0.98	1.03	0.38

Note: *N* = 936. Overall anxiety = sum of generalized and separation anxiety symptoms (27 items).

^aFemale = 0; Male = 1. ^bCaucasian = 0; Other = 1.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 2. Logistic Regression Predicting Initiation of Alcohol Use by Wave 4 From Overall Anxiety Symptoms at Wave 1

Step	Variable	Standardized β	Odds Ratio	95% CI	<i>p</i>
1	Age	0.62	1.98	1.74–2.28	.0001
	Sex	–0.02	0.93	0.64–1.35	.70
	Race	0.09	1.73	0.95–3.06	.07
	Omnibus Model $\chi^2(3) = 125.73, p < .0001$				
2	Depression	0.21	1.60	1.29–1.99	.0001
	Omnibus Model $\chi^2(4) = 143.02, p < .0001$				
	χ^2 Change = 17.29, $p = .001$				
3	Overall Anxiety	0.05	1.03	0.96–1.11	.36
	Omnibus Model $\chi^2(5) = 143.82, p < .0001$				
	χ^2 Change = .80, $p = .50$				
4	Anxiety by Sex	–0.03	0.97	0.84–1.12	.72
	Omnibus Model $\chi^2(6) = 143.94, p < .0001$				
	χ^2 Change = .12, $p = .75$				
Final Model					
	Age	.63	2.02	1.76–2.33	.0001
	Sex	–.01	0.96	0.63–1.48	.85
	Race	.09	1.70	0.92–3.03	.08
	Depression	.20	1.56	1.25–1.96	.0001
	Overall Anxiety	.07	1.05	0.95–1.15	.35
	Anxiety by Sex	–.03	0.97	0.84–1.12	.72
	Omnibus Model				
	$\chi^2(6) = 143.94, p = .0001$				

Note: All analyses based on 936 participants. CI = confidence interval.

tween symptomatology (generalized and separation anxiety) and initiation of alcohol use were nonsignificant, $t(934) = .88, p = .38$; $t(934) = -1.13, p = .26$, respectively.

Test of Hypothesis 1

The first hypothesis predicted that the number of overall anxiety symptoms at Wave 1 would not be significantly related to initiation of alcohol use (above and beyond depressive symptoms) by Wave 4. A hierarchical logistic regression model was estimated to test this hypothesis (see Table 2). In the first step, the dependent variable (initiation of alcohol use by Wave 4) was regressed on the set of covariates (age, sex, and race). Consistent with the bivariate analyses, results showed that age was positively related to initiation of alcohol use $\chi^2(3, N = 936) = 125.73, p < .0001$; odds ratio (OR) = 1.98, 95% confidence interval (CI) = 1.74–2.28, $p = .0001$, but no effect was found for sex or race. An OR approximates the likelihood of the outcome of interest being higher in the group exposed to a particular risk factor than in those not exposed. Thus, on average, a child was almost twice as likely to initiate alcohol use with each unit increase in age. In the second step, depressive symptomatology was added to the model as a predictor variable. Both age (OR = 2.01, 95% CI = 1.76–2.32, $p < .0001$) and depressive symptoms (OR = 1.60, 95% CI = 1.29–1.99, $p < .0001$) were positive predictors of initiation of alcohol use, indicating that, while controlling for age, those with higher levels of

depressive symptoms had a significantly higher probability of initiation of alcohol use, $\chi^2(4, N = 936) = 143.02, p = .0001$; χ^2 change = 17.29, $p = .001$. In the third step, an overall measure of anxiety symptomatology (the sum of generalized anxiety symptoms and separation anxiety symptoms) was added to the model. Both age (OR = 2.02, 95% CI = 1.76–2.33, $p < .0001$) and depressive symptoms (OR = 1.56, 95% CI = 1.24–1.95, $p < .0001$) were again positive predictors of initiation of alcohol use. However, as hypothesized, the unique relation between overall anxiety symptomatology and alcohol use was nonsignificant, $\chi^2(5, N = 936) = 143.82, p < .0001$; χ^2 change = .80, $p = .50$; OR = 1.03, 95% CI = .96–1.11, $p = .36$, while controlling for demographics and depressive symptoms. In the final step, the interaction term between overall anxiety and sex was added to the model, and was nonsignificant, omnibus $\chi^2(6, N = 936) = 143.94, p < .0001$; χ^2 change = .12, $p = .75$; OR = .97, 95% CI = .84–1.12, $p = .72$, indicating that this relation does not differ for boys and girls. In conclusion, age and depressive symptomatology positively predicted initiation of alcohol use by Wave 4, whereas overall anxiety symptomatology was not significantly related to initiation of alcohol use.

Tests of Hypotheses 2 and 3

The second hypothesis predicted that the number of generalized anxiety symptoms at Wave 1 would be uniquely and positively related to initiation of alcohol

Table 3. Logistic Regression Predicting Initiation of Alcohol Use by Wave 4 From Generalized and Separation Anxiety Symptoms at Wave 1

Step	Variable	Standardized β	Odds Ratio	95% CI	<i>p</i>
1	Age	0.63	2.01	1.76–2.32	.0001
	Sex	–0.03	0.91	0.63–1.33	.63
	Race	0.09	1.67	0.91–2.98	.09
	Depression	0.21	1.60	1.29–1.99	.0001
	Omnibus Model $\chi^2(4) = 143.02, p < .0001$				
2	Generalized Anxiety	0.14	1.14	1.03–1.25	.01
	Separation Anxiety	–0.18	0.71	0.51–0.94	.03
	Omnibus Model $\chi^2(6) = 151.65, p < .0001$				
3	χ^2 Change = 8.63, $p = .025$				
	Generalized Anxiety by Sex	–0.07	0.91	0.74–1.11	.35
	Separation Anxiety by Sex	0.15	1.47	0.80–2.73	.21
	Omnibus Model $\chi^2(8) = 153.44, p < .0001$				
	χ^2 Change = 1.79, $p = .50$				
Final Model					
	Age	.62	2.00	1.74–2.32	.0001
	Sex	–.02	0.94	0.61–1.46	.78
	Race	.10	1.81	0.97–3.26	.05
	Depression	.22	1.62	1.29–2.04	.0001
	Generalized	.18	1.18	1.04–1.33	.008
	Separation	–.28	0.60	0.36–0.89	.02
	Generalized Anxiety by Sex	–.07	0.91	0.74–1.11	.35
	Separation Anxiety by Sex	.15	1.47	0.81–2.73	.21
	Omnibus Model				
	$\chi^2(8) = 153.44, p = .0001$				

Note: All analyses based on 936 participants. CI = confidence interval.

use (above and beyond depressive and separation anxiety symptomatology) by Wave 4. The third hypothesis predicted that the number of separation anxiety symptoms at Wave 1 would be uniquely and negatively related to initiation of alcohol use (above and beyond depressive and generalized anxiety symptomatology) by Wave 4. To test these hypotheses, initiation of alcohol use by Wave 4 was regressed on the four covariates (age, sex, race, and depressive symptoms) in the first step and the two measures of anxiety symptomatology (generalized and separation) in the second step. Table 3 shows the results from this model. With generalized and separation anxiety added to the model, age and depressive symptoms were again positively and significantly associated with initiation of alcohol use by Wave 4, $\chi^2(6, N = 936) = 151.65, p < .0001$; χ^2 change = 7.84, $p = .03$; OR = 1.99, 1.62, 95% CI = 1.74–2.30, 1.29–2.03, $p < .0001$, respectively. Additionally, the relation between race and initiation of alcohol use was positive and significant (OR = 1.85, 95% CI = 1.00–3.33, $p = .04$), indicating that children who were not Caucasian were slightly more likely to have initiated alcohol use by Wave 4.

Consistent with the second hypothesis, the unique relation between generalized anxiety and initiation of alcohol use was positive and significant (OR = 1.14, 95% CI = 1.03–1.25, $p = .01$), indicating that children with higher levels of generalized anxiety symptoms at Wave 1 were more likely to have initiated alcohol use by Wave 4. Also as predicted, the unique relation be-

tween separation anxiety and alcohol use was negative and significant (OR = .71, 95% CI = .51–.94, $p = .03$), indicating that children with higher levels of separation anxiety symptomatology at Wave 1 were less likely to have initiated alcohol use by Wave 4.⁴ In sum, age, race, depressive symptomatology, and generalized anxiety symptomatology positively predicted the initiation of alcohol use by Wave 4, whereas separation anxiety symptomatology was negatively related to initiation of alcohol use by Wave 4.⁵

Test of Hypothesis 4

The fourth and final hypothesis predicted that the unique relations of both generalized and separation anxiety symptoms and alcohol use would vary as a function of sex. To test this final hypothesis, two inter-

⁴Recent research has noted a nonsignificant relation between anxiety and alcohol use when disruptive behaviors are included in the regression model (Greene et al., 1999). To test this potential confound, a composite measure of oppositional defiant disorder and conduct disorder symptoms was added to the model and all results remained unchanged, indicating that both generalized and separation anxiety disorders exert unique effects above and beyond that of disruptive behavior disorders.

⁵Logistic regression analyses were also estimated using generalized and separation anxiety disorder diagnoses. These results were nonsignificant, indicating that the significant findings related to generalized and separation anxiety symptomatology were not limited only to the most severely impaired children.

action terms were added to the previous model: generalized anxiety by sex and separation anxiety by sex. Neither interaction was significant, omnibus $\chi^2(8, N = 936) = 153.44, p < .0001$; χ^2 change = 1.79, $p = .50$; OR = .91, 1.47, 95% CI = .74–1.11, .81–2.72, $p = .35, .21$, respectively, indicating that the unique relations between these dimensions of anxiety and alcohol use did not vary as a function of sex.

Discussion

Weinberg and Glantz (1999) noted that few studies have yet to examine the unique relation between anxiety and alcohol use, and those utilizing prospective data are especially limited. They also suggested that there is a need for studies that differentiate between subtypes of disorders as well as discriminate possible differences in alcohol use as a function of sex. This study was conducted in an attempt to address these issues.

Depressive Symptomatology

Consistent with previous studies that have shown an association between depression and substance use in adolescence (e.g., Bukstein et al., 1992; Deykin, Buka, & Zeena, 1992; Rohde et al., 1996), this study found that children reporting higher rates of earlier depressive symptomatology were significantly more likely to report having initiated alcohol use at a later time point. Because of the high comorbidity rates of depression and anxiety, it is important that future studies control for depression when attempting to decipher the relation between anxiety and alcohol use.

Overall Anxiety Symptomatology

In support of the first hypothesis, no relation was found between overall anxiety symptomatology and the initiation of alcohol use while controlling for depression. This finding is consistent with other studies that have also failed to find a relation between anxiety and alcohol use in adolescence (e.g., Costello et al., 1999; Hussong & Chassin, 1994). It is noteworthy that these studies also combined different forms of anxiety either directly, by pooling various types of anxiety, or indirectly, through the use of a general measure of anxiety. Thus, it is possible that the opposite effects of different dimensions of anxiety may have been offsetting, resulting in nonsignificant findings.

Generalized and Separation Anxiety Symptomatology

Consistent with other studies that have found evidence for a positive relation between anxiety and adolescent alcohol use (e.g., Clark & Sayette, 1993; Clark et

al., 1997), this study found that children with elevated levels of earlier generalized anxiety symptomatology while controlling for depressive symptomatology were at an increased risk of later initiation of alcohol use. Generalized anxiety symptoms often involve excessive and uncontrollable worrying about any number of events or activities, including fears of social competence and acceptance (Clark et al., 1994). It may be that these children initiate alcohol use at an earlier age to "fit in" with a peer group. In addition, once involved in social situations, they may use the alcohol as a means of alleviating their constant worries and physical tension, much like the self-medication model of the adult literature (Khantzian, 1997).

However, results of this study suggest that separation anxiety may actually reduce the likelihood of a child initiating alcohol use. Children with separation anxiety symptoms are often reluctant to go to school, display excessive distress on separation from an attachment figure, and have significant impairment in social functioning (Clark et al., 1994). These children often fail to engage in social activities for fear of leaving their primary caregiver, resulting in social disconnection and removal from the peer environment in which most youth begin to experiment with alcohol (Hussong et al., 1998). It may be that the social withdrawal associated with separation anxiety symptomatology may account for the decreased risk of initiation of alcohol use evidenced in these children.

Another explanation for the inverse relation found between separation anxiety symptoms and initiation of alcohol use is that separation anxiety symptomatology may be a manifestation of the temperamental trait of behavioral inhibition. It has been found that children who are behaviorally inhibited are likely to develop separation anxiety disorder, whereas this relation is not as strong for generalized anxiety disorder (Biederman et al., 1993). Because children who are behaviorally inhibited are often shy, withdrawn, and afraid of unfamiliar situations (Garcia-Coll, Kagan, & Reznick, 1984), these children may be more likely to avoid novel stimuli such as experimentation with alcohol. In fact, several studies have demonstrated that inhibited children are not at risk for substance abuse and may actually be protected from alcohol use in adolescence (Masse & Tremblay, 1997; McCord, 1988; Windle & Windle, 1993).

These findings speak to the relevance of differentiating particular dimensions of anxiety as separate and distinct syndromes. There appears to be no clear consensus in the literature as to whether anxiety is best construed as unidimensional or multidimensional (Tuma & Maser, 1985). However, this study provides evidence that there may be crucial differences between the specific dimensions of generalized and separation anxiety symptomatology, at least in relation to the initiation of alcohol use, that produce diverging pathways to

adolescent drinking. Although future research is needed to determine the clinical relevance of these findings, the results of this study suggest that these two dimensions of anxiety have meaningful and unique influences on the initiation of alcohol use in adolescence. Consequently, future studies that differentiate generalized from separation anxiety are of key importance.

Moderating Effects of Sex

Contrary to studies that have found sex to moderate the relation between negative affect and adolescent alcohol use (e.g., Clark et al., 1997; Deykin et al., 1987; Henry et al., 1993), this study found that the unique relations between dimensions of anxiety and initiation of alcohol use did not vary as a function of sex. Given these conflicting findings, it can only be speculated as to why the results of this study failed to support a moderating effect of sex. It may be that a differential pattern of drinking between boys and girls develops at a later age than that which was assessed here. It is also possible that sex differences in the antecedents of drinking are only evident when the outcome is severe drinking problems as opposed to the initiation of alcohol use, also as was studied here. In sum, the results of this study suggest that the function of anxiety symptomatology in the prediction of initiation of alcohol use actually does not vary for boys and girls. More studies that attempt to replicate this finding are clearly needed before a relatively firm conclusion can be reached.

Limitations and Future Directions

This study is unique in several ways. The longitudinal design provides strong evidence for a prospective relation of early anxiety symptomatology predicting later initiation of alcohol use. It has been argued that subtypes of a given disorder may be differentially related to alcohol use, a finding that may easily be lost if these subtypes remain undifferentiated in research (Weinberg & Glantz, 1999). This study addresses this issue by distinguishing between generalized and separation anxiety symptomatology. In addition, the sample used in this study is unique in that it includes American Indians and girls and is based in a predominantly rural area of the United States, all of which are often neglected populations in empirical studies of adolescent alcohol use.

Several limitations of this study should be noted. First, the small African American sample limits the generalizability of these findings to this particular population. Additionally, although the incorporation of a large number of American Indian children is unusual, it is unclear whether this sample is representative of other

American Indian samples. Future studies are needed to determine the generalizability of these results to other minority populations. Second, many questions remain regarding potential mediating mechanisms of the relation between anxiety and alcohol use. One of the primary mechanisms hypothesized in this study is the extent of social withdrawal associated with each symptom cluster. Data collected for this study utilized individual home-based interviews rather than interviews conducted in schools, thereby making it difficult to study peer interaction and social contact. Future research that examines the possible mediating role of social withdrawal from the peer group is of great importance.

Third, although this study examined two important dimensions of anxiety (generalized and separation) in relation to initiation of alcohol use, other important dimensions were not included. Social anxiety may be particularly important to consider in relation to alcohol use initiation due to its association with behavioral inhibition in childhood (Turner, Beidel, & Wolff, 1996), as well as its frequent co-occurrence with alcoholism in adulthood (Merikangas, Stevens, & Fenton, 1996). Unfortunately, the CAPA does not tap a sufficient number of social phobia symptoms, thereby precluding the examination of this issue in this study. It is possible that the unique relations between certain dimensions of anxiety and alcohol use may vary as a function of the individual's developmental stage. Prospective studies that track alcohol usage in relation to different dimensions of anxiety over long periods of time are greatly needed.

Finally, the sample of children involved in this study was assessed for initiation of use, but not quantity or frequency of drinking thereafter. It should be kept in mind that predictors of initiation of alcohol use might be different from predictors of quantity of alcohol use. Because it has been found that children who begin drinking earlier are at greater risk for problematic use in adolescence (Kandel & Yamaguchi, 1985), the assumption of this study was that children who initiate alcohol use at an earlier age will also be likely to consume greater quantities of alcohol. However, additional research is needed to verify whether the same predictors of initiation of use hold for quantity of use as well.

Implications for Prevention

The results of this study have important implications for the development and implementation of prevention programs. Children exhibiting symptoms of depression or generalized anxiety should be identified and targeted as high risk groups for early initiation of alcohol use. On the other hand, children with symptoms of separation anxiety seem to be somewhat protected from early initiation of drinking. Studies that are able to identify

the mechanisms mediating this relation may be able to provide crucial information to those involved with the prevention or delay of early alcohol use. Although children with separation anxiety symptoms may not exhibit overt problem behaviors, it is likely that they are suffering internally and may be at risk for developing other forms of psychopathology such as panic disorder, agoraphobia, or social phobia (Ollendick & Huntzinger, 1990). Therefore, even though this particular subgroup appears to be buffered from early alcohol use, it is crucial that other problems resulting from their anxiety receive attention. In conclusion, it is hoped that in discriminating between two important dimensions of anxiety, intervention and prevention programs will be more effectively tailored toward those children that appear to be at greatest risk of becoming involved with alcohol at an early age.

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