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Substance Use, Suicidal Ideation and Attempts in Children and Adolescents

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Abstract

Using data from a community sample of youth (*N* = 1,458; ages 9–17), this study assessed the association between adolescent substance use/abuse and suicidal behaviors. Suicide attempts were strongly associated with alcohol abuse and dependence, followed by frequent cigarette smoking. The associations remained significant even after controlling for depression. The associations between substance use/abuse and suicidal ideation were no longer significant after controlling for depression. These findings highlight the important role that substance use plays in adolescent suicidal behaviors.

Suicide in adolescents is a national tragedy and a major public health problem. It is the third most common cause of death in adolescents (Anderson, 2002). Although studies have shown that substance abuse is a risk factor for completed suicide (Brent, 1995; Shaffer, 1988; Shaffer & Fisher, 1981; Shaffer, Gould et al., 1996), as well as for suicide attempt and ideation (Goldman & Beardslee, 1999; Gould et al., 1998; Levy & Deykin, 1989), rarely have the independent contributions of specific substances been the focus of inquiry (Garrison, McKeown, Valois, & Vincent, 1993; Kandel, 1988; Kandel, Raveis, & Davies, 1991). Studies on completed suicide have not had sufficient statistical power to detect differences between types of drugs used, due to small sample sizes (Shaffer, Gould et al., 1996). In some epidemiological studies of suicidal behaviors and substance use (Garrison et al., 1993; Kandel, 1988; Kandel et al.,1991), psychiatric disorders, highly associated with both suicidal behaviors and substance use/abuse, were not assessed or taken into account. To date, little is known about the independent contribution of each substance to suicidal behaviors (e.g., cigarettes, alcohol), controlling for the use of other substances and other psychiatric disorders. Such knowledge would help us to understand the etiology of suicide and consequently, to facilitate its prevention. It is hoped that by using large-scale epidemiological survey data with detailed measures of suicidal behaviors, substance use/abuse, and psychiatric disorders, this study will make a contribution toward filling this knowledge gap.

There are several theories regarding the relationship between suicidal behaviors and substance abuse, including: (1) The effects of acute intoxication lead to high-risk behavior; (2) substance abuse disorders in youthful suicide completers may be secondary to affective illnesses, such as depression (Berman & Schwartz, 1990; Bukstein et al., 1993; Deykin, Levy, & Wells, 1987); and (3) as self-destructive behaviors, suicidal behaviors and substance abuse share common biological, behavioral, and environmental origins or result from common vulnerabilities (Forman & Kalafat, 1998). Risk factors that are associated

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with suicidal behaviors include psychopathology, stressful life events, physical/sexual abuse, poverty, and family history of suicidal behaviors and psychiatric disorders, as well as biological factors such as serotonergic abnormalities (Gould et al., 2003; Shaffer & Greenberg, 2002). Many of these are also risk factors for adolescent substance use and abuse (Giovino, Henningfield, Tomar, Escobedo, & Slade, 1995; Hawkins, Catalano, & Miller, 1992; Kaminer, 1994; Virkkunen & Linnoila, 1993; Weiss & Hufford, 1999).

Using data from a community sample, we address the following questions: (1) How is the use of different substances (e.g., cigarettes, alcohol) associated with adolescent suicidal behaviors (ideation and attempts)? (2) Do certain substances have a stronger association with suicidal behaviors compared to others? (3) Is the association of substance use/abuse with suicidal behaviors mediated by other co-existing psychiatric disorders, especially depression, or does substance use/abuse independently contribute to suicidal behaviors? Other potential shared risk factors, such as sociodemographic ones and parental psychopathology, were controlled for in the analysis.

Methods

Samples

Data are from two epidemiological studies in the United States. The NIMH Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) Study (Lahey et al., 1996) is a multi-site collaborative survey of 1,285 children and adolescents (ages 9–17) from four geographic areas: Hamden, East Haven, and West Haven, Connecticut (n = 314); Dekalb, Rockdale, and Henry counties, Georgia (n = 299); Westchester County, New York (n = 360); and San Juan, Puerto Rico (n = 312). The Westchester Study (WS, 1993–1998) was a survey of mental health service need and utilization among youth (ages 9–17), including 173 youth recruited randomly from the community (Kovalenko et al., 2001). Since the same survey instrument was used in both studies, and the New York subsample of the MECA study and the WS community subsample were selected from the same sampling frame, a combined community sample from both studies (MECA n = 1,285; WS n = 173; Total N = 1,458) was used in these analyses. The overall compliance rate of the combined community sample is 85% (MECA Study 84% and Westchester Study community sample 94%).

Procedures

One child (ages 9–17) and one parent/guardian in each household were interviewed regarding childhood psychopathology, mental health service utilization, and a wide array of risk factors (Lahey et al., 1996). Written consent was obtained from both parent/guardian and child prior to the interview. Interview length was approximately 3 hours. Interviewers received 40 hours of training and ongoing monitoring.

Measures of Suicidal Ideation and Attempts

Youth suicidal ideation and attempt data were obtained from parents and the youth themselves during the assessment of depressive disorder. Two questions regarding suicidal behaviors were asked: (1) Had the child thought about suicide or killing him/herself in the past 6 months prior to the interview [suicidal ideation]? (2) Had the child ever tried to kill him/herself [suicide attempt]? A “yes” answer from either of the two informants was treated as positive. A three-category suicidal behavior variable was created with “0” for no suicidal behavior, “1” for suicidal ideation only, and “2” for suicide attempt. In analyses for suicidal ideation in the past 6 months, youth with suicidal ideation only were compared with those without suicidal behaviors. In analyses for suicide attempt, youth who have ever attempted suicide were compared with all others.

Measures of Substance Use, Abuse and Dependence

Use of Alcohol, Cigarettes, and Other Drugs—Information about adolescent age of onset for substance use, use in lifetime, current use, frequency of use, and quantity of use was obtained from parent and youth dyads as part of the NIMH-Diagnostic Interview Schedule for Children (DSM-III-R) or DISC 2.3 (Shaffer, Fisher et al., 1996). If either parent or child reported the child's use of the substance, the child was considered to be a user. Age of onset for each substance was calculated from both the parent and child reports. When the parent and child reported different ages of onset, the younger age was used.

Abuse and Dependence—Youth alcohol abuse and dependence in the 6 months prior to the interview were also assessed by the DISC 2.3 (Shaffer, Fisher et al., 1996). Although the DISC gives diagnoses of alcohol abuse and dependence separately, due to the small number of cases for each disorder, they were combined in the analyses. Information on marijuana abuse and dependence and other drug abuse and dependence was also obtained through the DISC interview. This information was combined into one variable: drug abuse/dependence. Information from both parents and children was combined. The logic applied for the combined diagnoses is that a criterion is considered met if reported by either the parent or the child. Since nicotine dependence was not assessed by the DISC 2.3, a measure of frequent use (i.e., smoking more than one cigarette a day) was used in the analyses.

Patterns of Substance Use/Abuse—A three category scale was created for each type of substance (cigarettes, alcohol, and other drugs) to take into account the severity of substance use. *Cigarettes*: (1) did not smoke in the last 6 months, (2) smoked less than one cigarette a day (infrequent use), and (3) smoked one cigarette or more a day. *Alcohol*: (1) did not drink 6 or more times in the past year, (2) drank alcohol 6 or more times but did not meet criteria for alcohol abuse/dependence, and (3) met criteria for alcohol abuse/dependence. *Drugs*: (1) did not use any illicit drug in the past year, (2) used illicit drugs, but did not meet criteria for abuse or dependence, and (3) met criteria for drug abuse/dependence. In some analyses, groups (2) and (3) for drug use were combined.

Finally, in order to examine the relationships between suicidal behaviors and use of each type of substance, a Guttman scale (Miller, 1991) of substance use was created where youth were grouped in eight ordered categories: (I) no substance use at time of the interview; (II) smoked cigarettes only (infrequent use, less than 1 cigarette a day); (III) drank alcohol only (no abuse or dependence); (IV) use of cigarettes and alcohol only; (V) used any illegal drugs, but no abuse or dependence on any substance; (VI) frequent cigarette use (smoked at least 1 cigarette a day), but no alcohol or drug abuse/dependence; (VII) alcohol abuse/dependence, but no drug abuse/dependence; and (VIII) drug abuse/dependence. This Guttman scale takes into account the fact that most youth start with legal drugs (cigarettes or alcohol) and progress to illegal drugs (Kandel, Yamaguchi, & Chen, 1992), and necessarily start with substance use before progressing to abuse/dependence. Youth at level I did not use any substance, while those at level VIII had the most severe drug abuse/dependent problems.

Measures of Mental Disorders

Youth psychopathology in the 6 months prior to the interview was assessed by the NIMH-Diagnostic Interview Schedule for Children (DSM-III-R) or DISC 2.3. The validity and reliability of the measures have been reported elsewhere (Schwab-Stone et al., 1996; Shaffer, Fisher et al., 1996). A diagnosis was considered to be positive if symptoms reported by either the parent or the child met DSM criteria (Shaffer, Fisher et al., 1996). Depressive disorders assessed include major depression and dysthymia. Anxiety disorders assessed were social phobia, agoraphobia, panic, separation anxiety, overanxious disorder, generalized anxiety, and obsessive compulsive disorder. Disruptive behavior disorders assessed were

attention-deficit hyper-activity disorder, oppositional defiant disorder, and conduct disorder. Age of onset of a diagnosis was calculated from both parent and child reports. When the parent and child reported different ages of onset, the younger age was used.

Family Psychiatric History—Family psychiatric history was assessed by the Family Psychiatric History Screen for Epidemiologic Studies (FHE; Lish, Weissman, Adams, Hoven, & Bird, 1995) administered to the parent respondent. One variable, "Parental psychiatric problems," was used in the analyses. It was coded "yes" if either biological parent "ever had a serious mental illness, emotional problems, or a nervous breakdown."

Sociodemographic Characteristics—Youth demographic data included gender, age, and ethnicity. Youth were divided into four ethnic groups: non-Hispanic White, African American, Hispanic, and Other. Information about mother's education, public assistance, and family structure (living with both biological parents vs. others) was obtained from parent interviews.

Analysis

Bivariate analyses were conducted for the association of suicidal behaviors (3 categories) with the following variables: substance use/abuse, psychiatric disorders, and sociodemographic characteristics. Chi-square test was used for categorical variables and ANOVA was used for continuous variables. When an overall group difference was detected with $p < 0.05$, post hoc two group comparisons were conducted. Bonferoni correction in p values for multiple comparisons was applied so that a difference between two groups was considered significant only if $p < 0.0167$ (=0.05/3).

Logistic regression analyses were conducted to examine the association between two binary outcome variables (suicidal ideation and suicide attempt, each in comparison to the no-suicidal behavior group) and the main predictors (use/abuse of substances), adjusting for sociodemographic and other risk factors. Individual substances with three ordinal categories of use/abuse for each were used as main predictors in separate analysis. The analyses were conducted hierarchically with use/abuse of a type of substance (either cigarettes, alcohol, or drugs) as the main predictor, controlling for other potential confounding variables. In the first set of models, the substance of interest was examined controlling for study site. In the second set of models, sociodemographic factors that were significant in the bivariate analysis were added (age, gender, maternal education, living with biological parents, and public assistance) as additional controls. In the third set of models, psychiatric disorders (depression, anxiety, and disruptive disorders) were further controlled for. In the analyses of suicide attempt, a fourth model was considered with suicidal ideation included as an additional control variable.

It is known that many youth use multiple substances. To further understand what patterns of substance use were related to suicidal behaviors, the Guttman scale of substance use (described earlier) was introduced into the logistical regression analyses. Youths were divided into eight mutually exclusive categories with different patterns of substance use/abuse. The first category, no current use of any substance, served as the reference group. Analyses were also conducted hierarchically controlling for the confounding variables in the manner previously described.

Finally, to better understand the role of substance use in the onset of suicide attempt, we analyzed data of retrospectively reported age of onset of both suicide attempt and substance use with Cox proportional hazards models, adjusting for potential confounding factors such as sociodemographics, onset of depression, and onset of use of other substances. The age at first suicide attempt was the time variable of interest and was censored by age at interview if

a child did not report any suicide attempt. The onset of use of a specific substance was treated as a time-varying predictor that was coded as 1 if the onset of using the substance preceded the first suicide attempt and as 0 otherwise.

Results

Bivariate Analyses

Among the 1,458 youth in the sample, 49 (3.4%) reported at least one suicide attempt in their life (Table 1). Seventy-four (5.1%) youth reported suicidal ideation in the year prior to the interview but had never attempted suicide. Table 1 shows family and individual characteristics by suicidal behaviors. There were more girls (69.4%) who had attempted suicide than boys (31.6%). Youth with suicide attempt (Mean age = 14.4) were significantly older than those without any suicidal behavior (Mean age = 12.8). Finally, youth with at least one suicide attempt were less likely to live with both biological parents than those without any suicidal behavior.

In terms of substance use and abuse, youth with suicidal behaviors were more likely to use and abuse substances than youth without suicidal behavior. The results also show a relationship between types of suicidal behaviors and substance abuse and dependence. For example, alcohol abuse/dependence among youth with suicidal ideation was four times that of those without suicidal behaviors, whereas alcohol abuse/dependence among suicide attempters was twelve times that of the same reference group. Youth with suicidal behaviors were more likely to have other psychiatric disorders than youth without such behaviors. Separate analyses by gender showed that the bivariate associations between suicidal behaviors and substance use/abuse were very similar between boys and girls (data not shown).

Logistic Regression Analyses

Results of logistic regression analyses for suicidal ideation and suicide attempt are reported in Tables 2 and 3, respectively. Stronger associations were observed for suicide attempt than ideation. For both ideation and attempt, the association between suicidal behaviors and substance use and abuse can be partially explained by family characteristics (Model 2), and by other psychiatric disorders (Model 3), which can be seen by the decrease in the magnitude of Odds Ratios in both models. After family characteristics were controlled for, frequent smoking (AOR = 3.5, $p < .01$) and alcohol abuse/dependence (AOR = 4.5, $p < .05$) were still significant. However, after controlling for psychiatric disorders, none of the substance use variables were significantly associated with suicidal ideation.

Much stronger associations were found for suicide attempt (Table 3). After controlling for all potential confounding factors (including suicidal ideation), alcohol abuse/dependence, drug use, and frequent cigarette smoking were each significantly associated with suicide attempt, with Adjusted Odds Ratios of 9.3 ($p < .01$), 4.6 ($p < .01$), and 3.0 ($p < .05$), respectively.

The analyses for each type of substance (cigarettes, alcohol, and other drugs) were limited because they could not take into account the fact that many youth use multiple substances. To further explore the relationship between type of substance and suicide attempt, a Guttman scale of substance use was used in the logistical regression analyses, ordering levels of substance use from none to drug abuse/dependence. Table 4 shows that after controlling for other potential confounding variables, use of alcohol and/or cigarettes (groups II, III, and IV vs. no use group I) did not predict suicide attempt. The four higher level substance use groups (from level V to level VIII) were significantly associated with suicide attempt, even after controlling for sociodemographic factors (Model 2). After

controlling for other psychiatric disorders and suicidal ideation, alcohol abuse/dependence (level VII) remained a strong predictor of suicide attempt (AOR = 25.2, $p < .001$), followed by frequent smoking (level V, AOR = 5.0, $p < .05$).

Survival Analyses

The results of the Cox proportional hazards regression analysis are reported in Table 5. Models A1–A3 show that, controlling for family sociodemographic factors, the use of each type of substance predicted subsequent onset of suicide attempts. The hazards ratios were 2.1 ($p < .05$) for onset of alcohol use, 3.5 ($p < .001$) for cigarette smoking, and 5.0 ($p < .001$) for use of other drugs, indicating that over any given year drug users were five times as likely to attempt suicide as were those who did not use drugs.

Model B included three time-varying variables for three types of substance use. The onset of depression was an additional control in the model. The results indicate that onset of depression strongly predicted first suicide attempt. After controlling for sociodemographic factors, depression, and use of other substances, smoking (Hazards ratio = 2.4, $p < .05$) and use of other drugs (Hazards ratio = 2.3, $p < .05$) still significantly related to the first suicide attempt. The effect of alcohol was no longer statistically significant independent of the simultaneous effects of smoking, other drugs, and depression.

Discussion

This study examined the association of substance use/abuse/dependence with suicidal ideation and attempt. One strength of the study was the use of data from a representative sample of youth in the community, rather than clinical settings. Another strength was the assessment of the different psychiatric disorders by the DISC, a standardized psychiatric instrument for children. A third strength was the attempt to evaluate the impact of each specific type of substance or pattern of substance use on suicide ideation and attempt.

Many previous studies have examined the impact of one type of substance (e.g., alcohol, nicotine) without controlling for the use of other types of substances, or have simply assessed the impact of substance use as a whole (Henriksson et al., 1993; Levy & Deykin, 1989; Marttunen, Aro, Henriksson, & Lonnquist, 1991; Miller, Hemenway, & Rimm, 2000; Roy & Linnoila, 1986; Windle & Windle, 1997). In this study, efforts were made to evaluate the contribution of each type of substance to suicidal behaviors while controlling for the impact of other substances.

Alcohol abuse and dependence appeared to be strongly associated with suicide attempt. This finding was consistent with some previous studies (Beck & Steer, 1989, Kessler, Borges, & Walters, 1999). The relationship between alcohol and suicidality may involve the disinhibitory effects of acute alcohol intoxication, the increase in vulnerability for depression resulting from chronic alcohol abuse, as well as possible self-medication for depressive symptoms, including suicidal behaviors. Findings from some neurobiological studies suggest that both suicidal behaviors and alcohol abuse are associated with some underlying biological risk factors, such as serotonergic abnormalities. A relationship between low levels of serotonin and suicide attempts was found in biological psychiatry research. Audenaert et al. (2001) found evidence of abnormally low frontal serotonin binding capacity in recent suicide attempters. Experiments with animals (rats) have found that consuming a large dose of ethanol leads, in the short term, to an increase in the serotonin levels of the brain's nucleus accumbens (Yoshimoto, McBride, Lumeng, & Li, 1992). This may explain why people use alcohol to self-medicate their depressive symptoms. However, Weiss and colleagues (1996) found that after continuous administration of ethanol over an extended period (3–5 weeks), if the animals are then

deprived of ethanol for 8 hours, serotonin levels in the same brain region drop very low. When the animals are then given free access to ethanol, the serotonin levels rise again, but remain lower than those attained in nondependent animals. This may indicate a worsening of depressive symptoms as a result of alcohol dependence, which, at least in humans, may lead to a decision to commit suicide.

Drug abuse/dependence was not significantly associated with suicide attempt in our study. However, in a study of youth aged 14 to 24 in Germany, based on multivariate analyses, drug abuse/dependence rather than alcohol abuse/dependence predicted suicide attempt (Wunderlich, Bronisch, & Wittchen, 1998). Age differences may explain this difference between the two studies.

In previous studies, the impact of cigarette smoking was sometimes assessed with-out controlling for the impact of alcohol or other drugs (Miller et al., 2000), or became nonsignificant after controlling for other drugs (Wunderlich et al., 1998). In this study, smoking was found to be significantly associated with suicide attempt, even after controlling for alcohol and drug abuse/dependence. Our findings indicate that tobacco might be used for "self-medication" by some people with depressive symptoms, including suicidal behaviors. Biological studies have shown that nicotine exposure has a short-term effect of raising serotonin levels in the frontal cortex, thus relieving depressive symptoms (Ribeiro, Bettiker, Bogdanov, & Wurtman, 1993). Tobacco smoke may also contain other antidepressant components which encourage depressed individuals to smoke (Balfour & Ridley, 2000). With chronic intake of nicotine, however, receptivity to serotonin in the frontal cortex may decrease (Kenny, File, & Rattray, 2001), leading to more depressive symptoms, which increases the risk of suicide.

Our findings on drug use/abuse/dependence were limited because of the relatively small number of youth in the sample who had used or abused drugs, which made the assessment of the impact of each specific drug impossible. Nevertheless, using the combined measure of substance use (including all the various drugs) in the analyses made the estimates of the unique impact of cigarettes or alcohol much more valid and accurate.

Our findings support the theory that the associations between substance use/abuse and suicidal behaviors are partially explained by some "third variables," which indicate that they might result from common vulnerabilities. For example, after controlling for depression, the associations between substance use/abuse and suicidal behaviors were attenuated.

As in previous studies (Cornelius, Salloum, Day, Thase, & Mann, 1996; Kandel et al., 1991; Kessler et al., 1999), this study found significant associations between use/abuse of some substances (e.g., alcohol, cigarettes) and suicide attempt, but not for suicidal ideation. This might be due to the fact that they represent different levels of suicidal behaviors. It is also possible that the relationship between suicide attempt and substance use/abuse could involve all the following factors: (1) the effects of acute intoxication; (2) self-medication; and (3) shared risk factors; while the relationship between suicidal ideation and substance use/abuse may only involve the latter two factors.

This study was limited by its cross-sectional design with retrospective reports of onset of substance use and suicidal behaviors. No causal relationship could be determined. The study was also limited by the small number of adolescent drug abusers in the community sample, therefore, no specific analyses could be done to examine the impact of each specific illegal drug. However, the findings of the study highlight the role of substance use in adolescent suicidal behaviors. Youth with alcohol abuse/dependence are at the greatest risk of a suicide attempt. Cigarettes, on the other hand, were the primary substance used by adolescents to self-medicate. Their use was associated with both suicidal ideation and attempt. Therefore,

in the prevention of suicide, attention should be paid to youth who are smoking and drinking. On the other hand, in the prevention of smoking or alcohol use, the assessment of suicidal behaviors and other depressive symptoms is also crucial.

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TABLE 1
Family and Individual Characteristics by Suicidal Behaviors

	Suicidal Behaviors			
	None (*n*= 1,335) % or Mean	Ideation Only (*n*= 74) % or Mean	Attempt (*n*= 49) % or Mean	Total (*n*= 1458) % or Mean
Sociodemographics				
Girls (%)[b,c]	47.6	41.9	69.4	48.0
Age (Mean)[b]	12.8	13.6	14.4	12.9
Ethnicity (%)				
White	51.8	54.1	53.1	52.0
African American	15.4	12.2	16.3	15.3
Hispanic	26.9	25.7	20.4	26.6
Other	5.8	8.1	10.2	6.1
Low income (%)	15.2	18.9	18.4	15.5
Mother's education (Mean)	13.6	14.2	12.8	13.6
Public assistance (%)	10.2	13.5	20.4	10.7
Not living with both biological parents (%)[b]	37.6	43.2	61.2	38.7
Parental psychiatric problems	8.2	13.5	8.3	8.4
Substance Use/Abuse/Dependence				
Cigarettes, past 6 months (%)[a,b]				
Smoked, infrequent use	5.8	10.8	10.2	6.2
Smoked at least 1 cigarette a day	3.1	10.8	24.5	4.2
Alcohol, past year (%)[a,b]				
Drank 6 or more times, no abuse/dependence	11.3	20.3	22.5	12.1
Alcohol abuse/dependence	0.9	4.1	12.2	1.4
Drugs, past year (%)[a,b,c]				
Used drugs, no abuse/dependence	3.8	10.8	28.6	5.0
Drug abuse/dependence	1.0	1.4	6.1	1.2
Other Psychiatric Disorders				
Depression (%)[a,b]	5.7	32.4	46.9	8.4
Anxiety (%)[a,b]	24.8	46.0	67.4	27.3
Disruptive disorders (%)[a,b]	11.7	37.8	34.7	13.8

[a] "Ideation Only" Group is statistically different from "None" group, $p < .01$

[b] "Attempt" Group is statistically different from "None" group, $p < .01$

[c] "Attempt" Group is statistically different from "Ideation Only" group, $p < .01$.

TABLE 2

Logistic Regression for Suicidal Ideation from Specific Substance (N = 1,409)

	Model Set 1[a] Controlling for Site		Model Set 2[b] Adding Sociodemographic Factors		Model Set 3[c] Adding Psychiatric Disorders	
	AOR[d]	(% CI[e])	AOR	(% CI)	AOR	(% CI)
Cigarettes[f]						
Infrequent use	2.2*	(1.0, 4.6)	1.9	(0.8, 4.1)	1.4	(0.6, 3.2)
Smoked at least 1 cigarette per day, past 6 months	4.2***	(1.8, 9.0)	3.5**	(1.4, 8.2)	1.8	(0.6, 4.5)
Alcohol[g]						
Drank 6 or more times, past year(no Abuse/Dep.)	2.1*	(1.1, 3.7)	1.6	(0.8, 3.1)	1.3	(0.6, 2.5)
Alcohol Abuse/Dependence	5.4*	(1.2, 17.8)	4.5*	(1.0, 15.6)	1.5	(0.3, 6.3)
Drugs[f]						
Used Drugs, Past Year	2.8**	(1.3, 6.0)	2.2+	(0.9, 4.7)	1.1	(0.5, 2.7)

+ $p < .10$;

* $p < .05$;

** $p < .01$;

*** $p < .001$

[a] Site was controlled for in these analyses.

[b] Site, ethnicity, gender, age, mother's education, living with biological parents, and public assistance were controlled for in these analyses.

[c] Site, ethnicity, gender, age, mother's education, living with biological parents, public assistance, depression, anxiety and disruptive disorders were controlled for in these analyses.

[d] AOR = Adjusted Odds Ratio.

[e] CI = Confidence Interval.

[f] Reference group: No use in the past year.

[g] Reference group: Did not drink 6 or more times in the past year.

TABLE 3

Logistic Regression for Suicide Attempts from Specific Substance (N = 1,458)

	Model Set 1[a] Controlling for Site		Model Set 2[b] Adding Sociodemographic Factors		Model Set 3[c] Adding Psychiatric Disorders		Model Set 4[d] Adding Suicide Ideation	
	AOR[e]	(% CI[f])	AOR	(% CI)	AOR	(% CI)	AOR	(% CI)
Cigarettes[g]								
Infrequent use	2.3^{+}	(0.8, 5.5)	1.8	(0.6, 4.5)	1.2	(0.4, 3.4)	1.0	(0.3, 3.3)
Smoked at least 1 cigarette per day, past 6 months	9.4***	(4.4, 19.1)	5.1***	(2.1, 11.9)	3.8**	(1.4, 9.6)	3.0*	(1.0, 8.7)
Alcohol[h]								
Drank 6 or more times, past year (no Abuse/ Dep.)	2.5**	(1.2, 5.0)	1.8	(0.8, 3.9)	1.5	(0.6, 3.5)	1.5	(0.6, 3.9)
Alcohol Abuse/Dependence	14.5***	(4.9, 38.6)	10.6***	(3.3, 32.0)	7.4**	(2.1, 25.3)	9.3**	(2.0, 41.1)
Drug[g]	9.4***	(4.9, 17.7)	5.8***	(2.8, 12.1)	4.2***	(1.9, 9.3)	4.6**	(1.8, 11.9)
Used Drugs, Past Year								

$^{+}p < .10$,

$^{*}p < .05$;

$^{**}p < .01$;

$^{***}p < .001$

[a] Site was controlled for in these analyses.

[b] Site, ethnicity, gender, age, mother's education, living with biological parents, and public assistance were controlled for in these analyses.

[c] Site, ethnicity, gender, age, mother's education, living with biological parents, public assistance, depression, anxiety and disruptive disorders were controlled for in these analyses.

[d] Site, ethnicity, gender, age, mother's education, living with biological parents, public assistance, depression, anxiety, disruptive disorders and suicidal ideation were controlled for in these analyses.

[e] AOR = Adjusted Odds Ratio.

[f] CI = Confidence Interval.

[g] Reference group: No use in the past year.

[h] Reference group: Did not drink 6 or more times in the past year.

TABLE 4

Logistic Regression for Suicide Attempts from Substance Use, Abuse, and Dependence (Hierarchical)[a] (N = 1, 458)

	Model 1		Model 2		Model 3		Model 4	
	AOR[b]	(% CI[c])	AOR	(% CI)	AOR	(% CI)	AOR	(% CI)
SUBSTANCE USE, ABUSE AND DEPENDENCE STATUS: (reference group = I. No use of any substance, *n* = 1,185)								
II. Cigarettes only, infrequent use (*n* = 39)	2.7	(0.4, 9.5)	2.5	(0.4, 9.5)	1.9	(0.3, 8.1)	2.9	(0.3, 15.8)
III. Alcohol use only (no abuse/dependence, *n* = 90)	1.1	(0.2, 4.0)	1.1	(02, 4.2)	1.2	(0.2, 4.5)	1.4	(0.2, 6.0)
IV. Infrequent cigarette smoking and alcohol use only (*n* = 27)	1.9	(0.1, 9.8)	1.7	(0.1, 9.6)	1.1	(0.1, 7.0)	0.5	(0.1, 4.6)
V. Drug use (no abuse or dependence of any substance, *n* = 43)	6.5***	(2.1, 16.9)	5.5**	(1.7, 15.4)	3.5*	(1.0, 10.7)	2.6	(0.6, 10.1)
VI. Cigarettes, at least 1 cigarette a day (no alcohol or drug abuse/dependence) (*n* = 40)	12.5***	(4.9, 29.1)	8.8***	(2.9, 25.0)	7.9***	(2.5, 24.6)	5.0*	(1.2, 19.4)
VII. Alcohol abuse/dependence (no drug abuse/dependence) (*n* = 17)	20.5***	(6.1, 60.8)	19.0***	(5.0, 66.9)	14.6***	(3.4, 59.3)	25.2***	(4.6, 129.2)
VIII. Drug abuse/dependence (*n* = 17)	10.4***	(2.3, 35.2)	6.3*	(1.2, 25.8)	3.6	(0.6, 17.6)	4.1	(0.6, 24.6)
OTHER PREDICTORS								
Girl	—		2.9**	(1.5, 5.8)	2.3**	(1.1, 4.8)	3.2**	(1.4, 7.5)
Age	——		1.1	(0.3, 1.6)	1.1	(0.9, 1.3)	1.1	(0.9, 1.3)
Mother's Education	—		0.9	(0.9, 1.1)	1.0	(0.9, 1.1)	0.9	(0.8, 1.1)
Public Assistance	—		1.2	(0.8, 1.8)	1.1	(0.7, 1.7)	0.9	(0.5, 1.5)
Not living with both biological parents	—		2.1*	(1.1, 4.2)	2.0*	(1.0, 4.0)	2.6*	(1.2, 5.7)
Depression	—		—		4.1***	(2.0, 8.2)	1.5	(0.6, 3.5)
Any anxiety Disorder	—		—		4.0***	(2.0, 8.1)	2.6*	(1.2, 5.7)
Any Disruptive Disorder	—		—		1.0	(0.5, 2.3)	0.6	(0.1, 1.6)
Suicidal Ideation	—		—		—		33.5***	(15.0, 79.0)

+ $p < .10$,

* $p < .05$;

** $p < .01$;

*** $p < .001$

[a] Site was controlled for in all the models.

[b] AOR = Adjusted Odds Ratio

[c] CI = Confidence Interval

TABLE 5

Association Between Onset of Substance Use and the First Suicide Attempt[a] (N = 1,458)

Model	Variables	Hazards Ratio	(% CI[b])
A1[c]	Cigarette	3.5***	(1.8, 6.6)
A2[c]	Alcohol	2.1*	(1.1, 3.9)
A3[c]	Drugs	5.0***	(2.4, 10.6)
B[d]	Cigarette	2.4*	(1.1, 5.0)
	Alcohol	1.4	(0.7, 2.9)
	Drugs	2.3*	(1.0, 5.3)
	Depression	8.5***	(4.5, 15.9)

* $p < .05$;

** $p < .01$;

*** $p < .001$

[a] Cox Proportional Hazards Model with time-varying variables was used. Site was controlled in all the models.

[b] CI = Confidence Interval

[c] Model A1–A3: gender, mother's education, living with biological parents and public assistance were controlled in the model (coefficients not shown).

[d] Model B: In addition to the sociodemographic variables controlled in Model A, onset of depression and use of other substances were also controlled in this model.