

Associations of Substance Use, Abuse, and Dependence with Subsequent Suicidal Behavior

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General population survey data are used to disaggregate the associations of substance use disorders with suicide attempts in order to evaluate a number of hypotheses about the processes leading to these associations. Data are from the US National Comorbidity Survey (1990–1992). Discrete-time survival analysis is used to study the effects of retrospectively reported temporally prior substance use, abuse, and dependence in predicting first onset of suicidal behavior. Alcohol and drug use predict subsequent suicide attempts after controlling for sociodemographics and comorbid mental disorders. Previous use is not a significant predictor among current nonusers. Abuse and dependence are significant predictors among users for three of the 10 substances considered (alcohol, inhalants, and heroin). The number of substances used is more important than the types of substances used in predicting suicidal behavior. Disaggregation shows that the effects of use are largely on suicidal ideation and nonplanned attempts among ideators. In comparison, the effects of use on suicide plans and planned attempts among ideators are not significant. Clinicians need to be aware that current substance use, even in the absence of abuse or dependence, is a significant risk factor for unplanned suicide attempts among ideators. *Am J Epidemiol* 2000;151:781–9.

alcohol drinking; comorbidity; mental health; substance-related disorders; suicide; suicide, attempted

Although previous research in both community samples (1–3) and clinical samples (4–6) documents that high proportions of suicide attempters have alcohol and drug abuse or dependence, several issues concerning this association remain uncertain. First, with the exception of alcohol, little is known about the types of substances most strongly related to suicide attempts. Whether depressants are stronger predictors of suicide attempts than are stimulants or hallucinogens is of particular interest (1, 7, 8). Second, it is not known whether substance abuse and dependence are the primary predictors of suicide attempts or whether substance users without abuse or dependence also have elevated risk (9). Third, it is unclear whether suicide attempts are associated with a past history of substance disorder or only with having an active disorder (10). Fourth, little is known as to whether substance disor-

ders predict suicidal ideation, plans among ideators, attempts among ideators either with or without a plan, or some combination of these transitions (11, 12). Finally, the extent to which comorbid mental disorders explain the associations between substance disorders and suicidal behaviors is unknown (13, 14).

All these issues are addressed in the current report, which is based on analysis of data obtained in the National Comorbidity Survey (NCS) (15). The NCS is a nationally representative survey of the US household population that includes retrospective reports about the ages at onset and lifetime occurrences of suicidal ideation, plans, and attempts along with information about the occurrences of mental disorders, substance use, substance abuse, and substance dependence.

MATERIALS AND METHODS

Sample

The NCS was carried out between 1990 and 1992 in a nationally representative household sample of 8,098 persons aged 15–54 years. Informed consent was obtained from all respondents and from the parents of respondents who were minors aged 15–17 years. The response rate was 82.4 percent. Two-part interviews were carried out face-to-face in the homes of respondents. The part I interview, which was administered to all 8,098 respondents, assessed the lifetime and recent

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Abbreviations: CIDI, Composite International Diagnostic Interview; DSM-III-R, *Diagnostic and Statistical Manual of Mental Disorders*, 3rd ed., rev.; NCS, National Comorbidity Survey; OR, odds ratio.

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prevalences of *Diagnostic and Statistical Manual of Mental Disorders*, 3rd ed., rev. (DSM-III-R) (16) psychiatric disorders. The part II interview, which was administered to a total of 5,877 respondents consisting of all those who screened positive for any psychiatric disorder in part I and a probability subsample of all remaining respondents, collected data on correlates of psychiatric disorders. The part II data are the basis for the current report, as questions about suicidal behaviors were included in the part II interview. These data were weighted to correct for differential probabilities of selection in part II as well as for differential probabilities of within-household selection and nonresponse. Comparisons of the part II NCS demographic distributions with census data show that the sample is representative of the US population on a wide range of sociodemographic variables (17). More details about the NCS design and data collection methods are reported elsewhere (15, 18).

Measures

Diagnoses were based on the definitions and criteria of the American Psychiatric Association's DSM-III-R, operationalized with a modified version of the World Health Organization's Composite International Diagnostic Interview (CIDI) (19). The CIDI is a fully structured interview designed for use by trained interviewers who are not clinicians. The diagnoses of central interest are abuse of and dependence on alcohol and drugs. The substances considered here include alcohol, four types of prescription medication (analgesics, sedatives, tranquilizers, and stimulants), and five types of illicit drugs (marijuana and hashish, cocaine, inhalants, hallucinogens, and heroin). Retrospective reports were obtained for each substance on age at first use, age at onset of abuse, and age at onset of dependence. Abuse was defined as the persistent (at least 1 month) or repeated occurrence of either 1) continued use despite knowledge of having a social, occupational, psychological, or physical problem caused or exacerbated by use of the substance or 2) recurrent use in situations in which use is physically hazardous. Dependence was defined as the persistent or repeated occurrence of at least three of nine DSM-III-R symptoms, such as unsuccessful attempts to control use, tolerance, and withdrawal. Abuse and dependence are defined as mutually exclusive so that a respondent who meets criteria for both abuse and dependence is classified as having dependence but not abuse.

Controls were also included for a number of other DSM-III-R disorders that include mood disorders (major depression, mania, and dysthymia), anxiety disorders (panic disorder, generalized anxiety disorder,

phobias, and post-traumatic stress disorder), conduct disorder, antisocial personality disorder, and nonaffective psychosis. The assessments of all these disorders, with the exceptions of conduct disorder and antisocial personality disorder, were based on the CIDI. Conduct disorder and antisocial personality disorder were assessed with the Diagnostic Interview Schedule (20) because the CIDI does not include these diagnoses. World Health Organization CIDI field trials (21) and NCS clinical reappraisal studies (22) both document good reliability and the validity of most of the CIDI diagnoses considered here with two important exceptions. The first involves mania. Only the euphoric-grandiose subtype of mania is validly assessed with the CIDI (23). As a result, only this subtype is included in the definition of mania used in this report. The second involves nonaffective psychosis, which is substantially overdiagnosed with the CIDI (22). As a result, the CIDI was used as a first-stage screen for nonaffective psychosis. All NCS respondents who screened positive had clinical reinterviews prior to a final diagnosis of nonaffective psychosis (24).

The NCS questions about suicidality asked about the lifetime occurrence; age at onset; and recency of suicidal ideation ("Have you ever seriously thought about committing suicide?"), suicide plans ("Have you ever made a plan for committing suicide?"), and suicide attempts ("Have you ever attempted suicide?"). The outcome of primary interest in this report is the first lifetime occurrence of a suicide attempt, although we also examine intervening effects of significant predictors on first onset of suicidal ideation, developing a plan among ideators, making a first attempt among people with a plan, and making a first attempt among ideators without a plan.

The sociodemographic variables included in the analyses as covariates are sex, marital status, cohort, educational attainment, race-ethnicity, urbanicity, and age of youngest child. Marital status was coded to differentiate the currently married, previously married (separated, divorced, widowed), and never married. Cohort was coded to differentiate respondents born in the decades 1966–1975, 1956–1965, 1946–1955, and 1936–1945. Educational attainment was coded to differentiate current students from those who already completed their schooling and, within each of these two categories, to differentiate those who had completed less than high school (0–11 years), high school (12 years), some college (13–15 years), and college or more (≥ 16 years). Race-ethnicity was coded to differentiate among non-Hispanic White, non-Hispanic Black, Hispanic, and other (Native American, Asian, Pacific Islander, and respondents who self-defined themselves as "other"). Urbanicity was coded into

three categories to differentiate among respondents living in census-defined major metropolitan areas, census-defined urban areas, and census-defined non-urban areas. Finally, age of youngest child was coded into four categories consisting of respondents who had no living child and those whose youngest child was 1 year or less old, between 2 and 10 years inclusive, and more than 10 years of age.

Analysis procedures

Discrete-time survival analyses with time-varying covariates (25) were used to estimate the effects of substance use, abuse, and dependence on predicting the subsequent first occurrence of a suicide attempt. A discrete-time approach was used instead of the more traditional continuous-time approach because the NCS recorded the time to event at yearly intervals rather than on a continuous time scale and because the discrete-time approach facilitates the use of the many different time-dependent covariates included in our analyses (26). The use of survival analyses relied on retrospective age-at-onset reports to establish a temporal order between the predictors and the outcomes (27). This was done by treating the person-year as the unit of analysis and creating separate observational records for each year of a person's life up to and including the year at first onset of the outcome. A dichotomous variable was created to distinguish the year of the outcome (coded 1) from years prior to the outcome (coded 0). These data files were analyzed using logistic regression models that included a dummy variable control for each person-year.

Because of the complex sample design and weighting of the NCS, standard errors of the survival coefficients were estimated using the method of jackknife repeated replications (28). These estimates adjust for the clustering and weighting of cases in the household sample. The survival coefficients were exponentiated and are reported in the form of odds ratios. The 95 percent confidence intervals of these coefficients also are reported and have been adjusted for design effects. Multivariate tests were based on Wald chi-squares computed from coefficient variance-covariance matrices that were adjusted for design effects. Results referred to as statistically significant are those that are significant based on two-sided design-based tests evaluated at the 0.05 level of significance.

RESULTS

Aggregate associations

The lifetime prevalence of suicide attempts in the NCS is 4.6 percent. Cross-sectional bivariate associa-

tions between sociodemographics and lifetime history of making an attempt are shown in table 1. Significantly elevated prevalences are found among women, the previously married, respondents in the youngest cohort, and those with comparatively low levels of education. It is also shown that respondents with alcohol and drug dependence have elevated prevalences of suicide attempts.

Table 2 shows the results of survival analyses in which the time-lagged effects of alcohol and drug use, abuse, and dependence on predicting first suicide attempt are assessed with multivariate controls for sociodemographic variables. As shown in model 1, the odds ratios associated with history of substance use and substance disorders (with nonusers being the contrast category) in separate multivariate equations for alcohol and drugs range between 2.8 (alcohol use) and 17.6 (alcohol dependence). There is a dramatic gradient in these odds ratios, with the lowest associated with use and the highest associated with dependence.

The results in model 2 show how these odds ratios change when we introduce controls for comorbid lifetime mental disorders with ages at onset prior to the age at first suicide attempt. The odds ratios, although all still significant, are considerably smaller than in model 1, suggesting that a substantial part of the gross associations are due to comorbidities with these mental disorders. In addition, the clear differences in the magnitudes of odds ratios associated with histories of use, abuse, and dependence seen in model 1 are substantially attenuated in model 2. Finally, the results in model 3 show how the odds ratios change when measures of alcohol and drug use, abuse, and dependence are included in a single prediction equation. The odds ratios associated with abuse and dependence decrease noticeably compared with their values in model 2. Nonetheless, separate tests (with results not shown in table 2) that reparameterized the model using contrast coding of the substance exposures found that the odds ratios of abuse and dependence are significantly different from those of use for both alcohol ($\chi^2_2 = 6.6, p = 0.037$) and drugs ($\chi^2_2 = 12.6, p = 0.002$) in model 3.

Substance-specific associations

The joint effects of use, abuse, and dependence are further explored in table 3 by focusing separately on each of the 10 substances assessed in the NCS. Each row of the table is based on a separate survival equation that includes dichotomous measures of dependence, abuse without dependence, and use without abuse or dependence on one particular substance along with controls for sociodemographics and comorbid lifetime mental disorders with ages at onset prior to the age at first suicide attempt. The substance use

TABLE 1. Selected characteristics† of respondents with and without a lifetime suicide attempt, US Part II National Comorbidity Survey, 1990–1992

	Suicide attempt						χ^2 ‡	df	P value
	Yes			No					
	%	SE§	No.	%	SE	No.			
Sex							28.1	1	<0.001
Male	32.7	3.1	89	51.1	1.2	2,865			
Female	67.3	3.1	183	48.9	1.2	2,740			
Marital status							27.5	2	<0.001
Currently married	51.1	3.3	139	60.6	1.0	3,399			
Previously married	21.7	2.6	59	10.7	0.6	598			
Never married	27.2	2.6	74	28.7	0.9	1,608			
Cohort (year of birth)							7.8	3	0.050
1966–1975	32.7	3.2	89	24.4	0.9	1,368			
1956–1965	27.9	2.9	76	30.7	0.8	1,721			
1946–1955	25.0	3.1	68	27.7	0.9	1,554			
1936–1945	14.3	2.1	39	17.2	0.9	962			
Educational attainment (years)							35.3	3	<0.001
≤11	34.2	3.2	93	21.0	0.9	1,175			
12	38.2	2.4	104	34.9	1.1	1,955			
13–15	21.0	2.6	57	23.3	1.1	1,304			
≥16	6.6	1.7	18	20.9	1.1	1,169			
Race-ethnicity							3.7	3	0.290
Non-Hispanic White	75.0	4.4	204	75.6	2.2	4,237			
Non-Hispanic Black	8.5	2.0	23	11.8	1.1	661			
Hispanic	12.5	3.8	34	9.2	1.6	517			
Other	4.0	1.4	11	3.4	0.6	190			
Urbanicity							0.9	2	0.905
Major metropolitan	44.9	4.8	122	46.4	3.5	2,599			
Urban	33.5	6.2	91	32.4	4.1	1,815			
Nonurban	21.7	4.9	59	21.2	3.1	1,191			
Alcohol							118.0	3	<0.001
Dependence	37.6	3.1	102	13.1	0.6	734			
Abuse without dependence	9.0	1.4	24	9.4	0.5	525			
Use without abuse or dependence	50.9	3.1	139	69.7	0.9	3,898			
Nonuse	2.5	0.9	7	7.8	0.5	439			
Drug							169.0	3	<0.001
Dependence	29.5	3.4	80	6.4	0.3	358			
Abuse without dependence	5.7	1.0	16	4.4	0.3	244			
Use without abuse or dependence	45.3	3.3	123	39.3	0.9	2,197			
Nonuse	19.5	2.4	53	49.9	1.0	2,794			

† These are characteristics of respondents at the time of interview rather than at the time of making their first suicide attempt. As described in the text, time-varying predictors were coded at their values prior to the first attempt when they were used in survival analyses.

‡ Wald chi-square (χ^2) tests examine whether distributions of demographic variables differ between lifetime suicide attempters and nonattempts.

§ SE, standard error.

coefficients are statistically significant in all 10 equations, indicating that users are at significantly higher risk of subsequent first occurrences of suicide attempts than are nonusers. Odds ratios range from a low of 1.7 for use of cocaine to a high of 3.6 for use of sedatives.

Most of the dependence and abuse coefficients are also significant. Furthermore, most of the odds ratios associated with dependence or abuse are larger than the use odds ratios, indicating a generally positive trend. However, analyses of the significance of differ-

TABLE 2. Time-lagged associations of lifetime alcohol and drug use, abuse, and dependence with subsequent first suicide attempt (n = 272), US Part II National Comorbidity Survey, 1990–1992†

	Model 1		Model 2		Model 3	
	OR‡	95% CI‡	OR	95% CI	OR	95% CI
Alcohol						
Use without abuse or dependence	2.8*	1.8, 4.5	2.2*	1.4, 3.5	1.8*	1.1, 3.0
Abuse without dependence	6.1*	3.0, 12.4	3.3*	1.6, 6.9	2.1*	1.0, 4.7
Dependence	17.6*	10.0, 31.0	5.9*	3.4, 10.2	3.3*	1.7, 6.6
Nonuse	1.0		1.0		1.0	
Drug						
Use without abuse or dependence	3.3*	2.3, 4.7	2.3*	1.6, 3.3	2.0*	1.3, 2.8
Abuse without dependence	7.8*	5.4, 11.4	3.8*	2.5, 5.8	2.7*	1.6, 4.6
Dependence	12.7*	8.7, 18.6	5.3*	3.5, 8.0	3.5*	2.0, 6.0
Nonuse	1.0		1.0		1.0	

* Significant at the 0.05 level, two-sided test.

† Odds ratios and 95% confidence intervals were obtained from discrete-time survival analyses using design-based methods (see Analysis procedures subsection) to obtain standard errors. The coefficients in model 1 come from two separate equations, one for alcohol and the other for drugs, with controls for sociodemographic variables. Model 2 also includes controls for comorbid lifetime mental disorders with ages at onset prior to the age at first suicide attempt. Model 3 combines all the substance predictors into a single equation. The reference category is nonuse.

‡ OR, odds ratio; CI, confidence interval.

ences in the odds ratios within substances found that the dependence and abuse odds ratios are significantly different from the odds ratios associated with use for only three of the 10 substances: alcohol ($\chi^2_2 = 31.9$, $p < 0.001$), inhalants ($\chi^2_2 = 10.0$, $p = 0.007$), and heroin ($\chi^2_2 = 45.3$, $p < 0.001$).

Associations with current versus previous lifetime use

The results in table 4 focus on the effects of use (with or without abuse or dependence) and distinguish

between person-years associated with current and previous use. Coefficients are based on 10 separate equations, one for each substance. All 10 of the current use odds ratios are statistically significant predictors of first suicide attempt, controlling for sociodemographics and comorbid lifetime mental disorders. Odds ratios range between 2.0 for current cocaine use and 6.1 for current heroin use. In comparison, only two of the previous use odds ratios are statistically significant: those for marijuana (odds ratio (OR) = 1.5) and heroin (OR = 2.4). The other odds ratios for previous use are in the range 0.8–1.8 and are mostly greater than

TABLE 3. Substance-specific time-lagged associations of use, abuse, and dependence with subsequent first suicide attempt (n = 272), US Part II National Comorbidity Survey, 1990–1992†

	Dependence			Abuse without dependence			Use without abuse or dependence			χ^2_{\ddagger}	p value
	%	OR§	95% CI§	%	OR	95% CI	%	OR	95% CI		
Alcohol	25.0	5.9*	3.4, 10.2	9.2	3.3*	1.6, 6.9	48.3	2.2*	1.4, 3.5	31.9	<0.001
Analgesics	1.2	1.2	0.1, 13.2	2.2	3.7*	1.3, 10.3	13.2	2.0*	1.3, 2.9	2.1	0.353
Sedatives	1.7	3.4*	1.3, 9.0	2.5	3.7*	1.4, 10.1	16.2	3.6*	2.5, 5.3	0.0	0.985
Tranquillizers	1.8	3.0	0.9, 10.0	1.4	4.1*	1.7, 10.3	14.2	2.3*	1.5, 3.5	1.2	0.543
Stimulants	7.3	4.0*	2.2, 7.3	2.4	2.3	0.8, 6.4	18.2	2.4*	1.6, 3.6	5.5	0.064
Marijuana	7.8	2.7*	1.3, 5.5	8.1	2.8*	1.7, 4.8	34.7	2.0*	1.5, 2.6	2.2	0.328
Cocaine	4.1	1.8	0.9, 3.4	2.4	2.6*	1.2, 5.9	11.1	1.7*	1.1, 3.0	0.9	0.647
Inhalants	1.4	6.8*	2.4, 18.8	1.6	10.0*	2.8, 35.0	10.4	1.9*	1.0, 3.5	10.0	0.007
Hallucinogens	1.2	1.7	0.5, 5.2	3.8	3.3*	1.5, 7.3	13.2	1.9*	1.0, 3.7	1.7	0.436
Heroin	0.2	0.7	0.3, 1.4	1.7	34.0*	15.1, 77.0	3.5	3.5*	1.3, 9.6	45.3	<0.001

* Significant at the 0.05 level, two-sided test.

† Odds ratios and 95% confidence intervals were obtained from discrete-time survival analyses using design-based methods (see Analysis procedures subsection) to obtain standard errors. This table represents the results of 10 equations, one for each row. Each model controls for sociodemographics and comorbid lifetime mental disorders with ages at onset prior to the age at first suicide attempt. The reference category is nonuse. Percentages refer to substance exposure prior to suicide attempt.

‡ Wald chi-square (χ^2) tests, based on reparameterization of the model using contrast coding of substance exposures, examine whether abuse and dependence odds ratios are significantly different from use odds ratios.

§ OR, odds ratio; CI, confidence interval.

TABLE 4. Substance-specific time-lagged associations of current versus previous lifetime use with subsequent first suicide attempt ($n = 272$), US Part II National Comorbidity Survey, 1990–1992†

	Current drug use with or without abuse or dependence			Previous drug use with or without abuse or dependence		
	%	OR‡	95% CI‡	%	OR	95% CI
Alcohol	80.9	2.5*	1.6, 3.8	1.6	1.5	0.7, 3.3
Analgesics	14.3	2.4*	1.6, 3.6	2.6	1.0	0.5, 2.0
Sedatives	17.3	5.3*	3.6, 7.8	3.1	1.2	0.5, 2.7
Tranquilizers	14.6	3.5*	2.2, 5.5	2.6	0.8	0.3, 2.0
Stimulants	19.9	3.2*	2.1, 4.7	6.8	1.8	0.9, 3.6
Marijuana	37.7	2.4*	1.6, 3.4	12.5	1.5*	1.2, 1.9
Cocaine	11.3	2.0*	1.3, 3.1	5.7	1.5	0.9, 2.6
Inhalants	6.7	4.9*	2.6, 9.1	6.7	1.5	0.7, 3.1
Hallucinogens	9.9	2.7*	1.3, 5.6	6.9	1.5	0.8, 2.8
Heroin	3.8	6.1*	2.2, 16.8	1.7	2.4*	1.1, 5.5

* Significant at the 0.05 level, two-sided test.

† Odds ratios and 95% confidence intervals were obtained from discrete-time survival analyses using design-based methods (see Analysis procedures subsection) to obtain standard errors. This table represents the results of 10 equations, one for each row. Each model controls for sociodemographics and comorbid lifetime mental disorders with ages at onset prior to the age at first suicide attempt. The reference category is never use. Percentages refer to substance exposure prior to suicide attempt.

‡ OR, odds ratio; CI, confidence interval.

1.0. This indicates the existence of a positive trend association with attempted suicide. However, this set of odds ratios is not significant globally ($\chi^2_8 = 8.3$, $p = 0.405$). Furthermore, no significant effects could be found in post hoc analyses of a global dummy variable for any previous drug use ($\chi^2_1 = 0.4$, $p = 0.527$) or a continuous variable for number of drugs previously used ($\chi^2_1 = 0.3$, $p = 0.584$).

A survival model was estimated that included separate dummy variables for current use (with or without abuse or dependence) of each substance along with controls for sociodemographics and comorbid lifetime mental disorders. As a set, the 10 coefficients for current use were found to be powerful predictors of first suicide attempt ($\chi^2_{10} = 162.9$, $p < 0.001$). Seven of the 10 substances had odds ratios greater than 1.0: alcohol, sedatives, tranquilizers, stimulants, marijuana, inhalants, and heroin. The other three substances (analgesics, cocaine, and hallucinogens) had insignificant odds ratios less than 1.0. The seven positive odds ratios did not differ significantly from each other. This means that the number of substances used is more important than the types of substances used ($\chi^2_7 = 5.7$, $p = 0.647$).

Decomposition of associations through ideation and plans

We combined this result with information about the number of substances currently used into a single count ranging between 0 and 7. As shown in table 5, there is a significant monotonic relation between this count and the subsequent occurrence of a first suicide attempt ($\chi^2_6 = 88.5$, $p < 0.001$). The range of odds

ratios is dramatic, from a low of 2.6 associated with use of only one substance (compared with respondents who currently used none) to a high of 27.4 associated with use of six or seven substances.

Table 5 also presents the results of survival equations that disaggregate this overall relation into components from suicidal ideation to planned suicide attempt. The first of these equations considers the effects of use on first onset of suicidal ideation. The six odds ratios are statistically significant as a set ($\chi^2_6 = 199.4$, $p < 0.001$), and there is a consistent monotonic relation across the set from a low of 1.6 associated with use of one substance to a high of 13.2 associated with use of six or seven substances. However, none of the odds ratios is as large as the parallel coefficients in the equation to predict suicide attempt.

The next equation considers the effects of use on subsequent first onset of a suicide plan in the subsample of ideators. The six odds ratios are not statistically significant as a set ($\chi^2_6 = 10.4$, $p = 0.107$), although all the odds ratios are greater than 1.0, and there is a significant odds ratio associated with using six or seven substances (OR = 2.9). None of the odds ratios in this equation is nearly as large as the parallel coefficients in the equations to predict ideation or attempt. A separate analysis, not reported in the table, shows that a single dummy variable for any use is also not significant in predicting onset of a plan.

The last two equations consider the effects of use on first suicide attempt in either the absence or the presence of a plan. The odds ratios in the equation for unplanned attempt are statistically significant as a set ($\chi^2_6 = 21.6$, $p < 0.001$), and each of the individual

TABLE 5. Time-lagged associations of number of substances currently used and subsequent suicide attempt, first onset of suicidal ideation, plan among ideators, impulsive (unplanned) attempt among ideators, and planned attempt, US Part II National Comorbidity Survey, 1990–1992†

No. of substances currently used	Attempt (n = 272)			Ideation (n = 795)			Plan (n = 230)			Unplanned attempt (n = 145) among ideators without a plan			Planned attempt (n = 127) among ideators with a plan		
	In the total sample			in the total sample			among ideators								
	%	OR‡	95% CI‡	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI	%	OR	95% CI
0	14.2	1.0		13.0	1.0		8.2	1.0		13.4	1.0		14.9	1.0	
1	41.3	2.6*	1.4, 5.0	38.4	1.6*	1.3, 2.1	52.2	1.2	0.6, 2.7	45.3	2.8*	1.6, 4.8	36.5	1.5	0.5, 4.3
2	19.6	4.2*	2.0, 8.5	21.4	3.0*	2.2, 4.0	19.5	1.9	0.9, 4.2	17.8	2.7*	1.5, 4.9	21.8	0.9	0.3, 2.9
3	10.6	6.4*	3.3, 12.3	9.7	4.6*	3.2, 6.7	12.0	1.3	0.5, 3.3	11.3	4.2*	2.2, 8.3	9.9	1.4	0.5, 4.0
4	6.4	11.3*	5.0, 25.7	7.1	7.8*	5.2, 11.7	3.5	1.6	0.7, 3.9	5.1	3.4*	1.9, 5.9	8.0	1.8	0.4, 7.7
5	5.1	14.6*	6.9, 31.0	8.2	6.6*	3.9, 11.2	3.6	1.5	0.5, 4.7	4.7	3.8*	1.9, 7.6	5.5	2.5	0.4, 14.4
6 or 7	2.8	27.4*	6.5, 116.3	2.2	13.2*	7.5, 23.2	1.0	2.9*	1.2, 6.9	2.4	9.6*	3.7, 25.1	3.4	1.4	0.2, 9.9
χ^2_6 (p)	88.5 (<0.001)			199.4 (<0.001)			10.4 (0.107)			21.6 (<0.001)			3.6 (0.732)		

* Significant at the 0.05 level, two-sided test.

† Odds ratios and 95% confidence intervals were obtained from discrete-time survival analyses using design-based methods (see Analysis procedures subsection) to obtain standard errors. This table represents the results of a single model (applied to the five outcomes) that controls for sociodemographics and comorbid lifetime mental disorders with ages at onset prior to the age at first suicide attempt. The reference category is zero substances currently used. Percentages refer to substance exposure prior to suicide attempt.

‡ OR, odds ratio; CI, confidence interval.

odds ratios also is statistically significant. There is no meaningful dose-response relation among the coefficients. In comparison, the odds ratios in the equation for planned attempt are not significant either as a set ($\chi^2_6 = 3.6, p = 0.732$) or individually, although all but one of the odds ratios are greater than 1.0. A separate analysis, again not reported in the table, shows that a single dummy variable for any use is also not significant in predicting onset of a planned attempt.

Finally, we evaluated specifications of the results in table 5 as a function of the sociodemographic variables (sex, marital status, cohort, educational attainment, race-ethnicity, urbanicity, and age of youngest child). Global interaction tests of the number of drugs (modeled as a continuous variable) with sociodemographic variables were performed based on backwards elimination from a saturated two-way interaction equation. This was done for each of the four nested outcomes (ideation, plan among ideators, unplanned attempt, and planned attempt). We found no more significant interactions than one would expect by chance (two of 28).

DISCUSSION

The results reported here are limited by the fact that the NCS is a cross-sectional survey in which information about the occurrences and ages at onset of lifetime substance use and suicidal behaviors is based on retrospective reports. Unwillingness to report or failure to recall accurately the age at onset could introduce errors into the results. Within the context of these limitations, the association between substance disorders and suicide attempts that has been found repeatedly in both clinical samples (5, 29–32) and community samples (1, 3, 33, 34) was replicated. Consistent with previous

research (35–37), our results show significantly higher lifetime prevalences of attempted suicide among women and the previously married, along with a significant inverse association with education (38).

As noted in the Introduction, little attention has been given in previous research to the specifications considered in the current report. The first issue considered was that it might not be substance disorders themselves, but rather comorbid lifetime mental disorders that predict suicide attempts (13, 14). Our results were partially consistent with this hypothesis in showing that statistical controls for comorbid mental disorders lead to a substantial reduction in the odds ratios associated with substance use disorders. However, the residual odds ratios remain statistically significant even after controls for mental disorders, strongly suggesting that the effects of substance use disorders on suicide attempts are not entirely due to the effects of comorbid mental disorders.

The second issue considered was whether there is a significant difference in the odds ratios associated with use in the absence of abuse or dependence and the odds ratios associated with abuse or dependence. Use was found to be a consistent significant predictor across all substances, while we found significant incremental effects of abuse or dependence for only three substances (alcohol, inhalants, and heroin).

The third issue considered was whether the association between use and suicide attempt is found across a wide array of drugs or is limited only to substances with certain pharmacologic properties. Our results are quite clear in showing that, after controlling for the confounding effects of sociodemographics and mental disorders, the strength of the association is very similar for all the types of drugs studied. The

number of substances is clearly more important than the type of substance in predicting first suicide attempt. This finding contradicts the hypothesis that depressants (e.g., alcohol and tranquilizers) are stronger predictors of suicide attempts than are other substances (7, 8).

The fourth issue considered was whether it is current use or a history of use that more strongly predicts suicide attempts. The former was found to be the case, although there are two significant odds ratios for previous use (of marijuana and heroin). With these exceptions, we found that the major risk of suicidal behaviors is linked to current use rather than to past use, suggesting that the causal pathways involved in this association are ones that are activated by use or its proximate correlates.

Although there has not been a great deal of research on the disaggregation of substance effects on suicide attempts through ideation and plans, what little is known about this matter suggests that substance disorders are associated weakly with suicide ideation, but more strongly with plans among ideators (11, 12, 39, 40). We found exactly the opposite. It is not clear why this discrepancy exists, but it is worth noting that the previous studies that examined this specification did not attempt to use age-at-onset reports to sort out temporal priorities and disaggregate nested effects in the way we did in the current report. It is conceivable that this difference in refinement of measures and analysis methods explains the discrepancies.

Another interesting and related specification is our failure to find a dose-response relation between the number of substances used and the risk of unplanned suicide. Assuming that use of multiple drugs does not lead to any greater disinhibition than does use of only one drug, this finding is consistent with the disinhibition hypothesis, which specifies that intoxication can increase risk of suicide attempts among ideators by reducing inhibitions to make an impulsive attempt (41, 42).

Importantly, the association between the number of substances used and the onset of suicidal ideation does exhibit a dose-response relation. The fact that this is not true of the association between the number of substances used and the unplanned attempts among ideators implies that the processes involved in the association between use and ideation are different from those involved in the association between use and progression from ideation to an unplanned attempt. We have no way of knowing what these processes might be, but it is noteworthy that they involve determinants of current rather than of lifetime use. This suggests that the most fruitful areas for further investigation are likely to involve active influences on use or short-term

adverse consequences that no longer exist once use has ended.

Finally, the results reported here suggest that clinicians should recognize that substance users with suicidal ideation have an elevated risk of first suicide attempts even in the absence of a plan. This is an important result in light of the fact that the presence of a plan is typically used as the key indicator of suicide risk among ideators and the fact that little is known about the predictors of attempted suicide among ideators without a plan. The failure to find a dose-response relation in predicting unplanned attempts among ideators indirectly suggests that disinhibition is somehow involved in the effects of substance use. It would be useful for future research to investigate this suggestion more directly by developing measures of individual differences in disinhibition while under the influence as well as by investigating the mediating and modifying effects of personality characteristics associated with lack of planning.

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