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Probability and Predictors of Transition from Abuse to Dependence on Alcohol, Cannabis, and Cocaine: Results from the National Epidemiologic Survey on Alcohol and Related Conditions

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Abstract

Background: Little is known about the transition from substance abuse to substance dependence. **Objectives:** This study aims to estimate the cumulative probability of developing dependence and to identify predictors of transition to dependence among individuals with lifetime alcohol, cannabis, or cocaine abuse.

Methods: Analyses were done for the subsample of individuals with lifetime alcohol abuse ($n = 7802$), cannabis abuse ($n = 2832$), or cocaine abuse ($n = 815$) of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC). Estimated projections of the cumulative probability of transitioning from abuse to dependence were obtained by the standard actuarial method. Discrete-time survival analyses with time-varying covariates were implemented to identify predictors of transition to dependence.

Results: Lifetime cumulative probability estimates indicated that 26.6% of individuals with alcohol abuse, 9.4% of individuals with cannabis abuse, and 15.6% of individuals with cocaine abuse transition from abuse to dependence at some point in their lives. Half of the transitions of alcohol, cannabis, and cocaine dependence occurred approximately 3.16, 1.83, and 1.42 years after abuse onset, respectively. Several sociodemographic, psychopathological, and substance use-related variables predicted transition from abuse to dependence for all of the substances assessed.

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Declaration of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

Conclusion: The majority of individuals with abuse do not transition to dependence. Lifetime cumulative probability of transition from abuse to dependence was highest for alcohol, followed by cocaine and lastly cannabis. Time from onset of abuse to dependence was shorter for cocaine, followed by cannabis and alcohol. Although some predictors of transition were common across substances, other predictors were specific for certain substances.

Keywords

transition; abuse; dependence; cannabis; alcohol; cocaine

INTRODUCTION

Substance dependence is associated with a broad range of negative consequences and represents a tremendous burden to individuals and society (1-3). About 2.0% of adults living in the United States (US) had a DSM-IV drug use disorder in the prior 12 months (1.4% abuse, 0.6% dependence), and 10.3% reported a drug use disorder at any point in their lifetime (7.7% abuse, 2.6% dependence) (4). While several sociodemographic correlates were associated with greater risk of both drug abuse and dependence, other correlates were specific only for abuse or only for dependence (4). Furthermore, recent research showed that alcohol abuse/drug abuse and alcohol dependence/drug dependence populations are not homogeneous and require elucidation of the subgroups to identify etiologies (5,6). These findings highlight the importance of disaggregating different levels of severity among the same spectrum (7).

Factor analytic studies indicate that although the diagnostic criteria for DSM-IV abuse and dependence diagnosis load on different factors (8-11), these factors are highly correlated (12,13), supporting the unification of these two conditions in one disorder of variable severity for DSM-5 (14). Furthermore, although abuse and dependence vary in terms of severity (15,16), several studies have indicated that abuse tends to represent DSM-5 mild/moderate substance use disorder, while dependence is similar to DSM-5 severe substance use disorder (17,18). Therefore, examining transitions from abuse to dependence could be understood as examining transitions between different levels of severity (19,20). That would be in line with previous studies reporting a lower quality of life and psychological functioning of patients with dependence compared with those with abuse (19,20). Several studies have examined predictors of transition to substance dependence, but most of these studies have focused on the transition from use to dependence (19,21-26). Much less is known about the transition from abuse to dependence. For those reasons, identifying risk factors for the transition from a milder substance use disorder, represented in abuse, to dependence is a crucial step in understanding the etiology of substance use disorders, identifying individuals vulnerable to more severe levels of addiction and developing effective treatment and preventive interventions.

Moreover, studying the probability and length of time of transition from abuse to dependence is a useful alternative to estimating the addictive liability of substances, because it examines individuals that have already faced problems due to their use of substances (27). Despite these facts, little is known about the transition from abuse to dependence because most studies examining predictors of transition to substance dependence or estimating the addictive potential of different substances have focused exclusively on the transition from use to dependence (19,21-25).

Existing research suggests that early age of onset of substance use, low educational attainment, urban residency, and being previously married increase the risk of transition from abuse to dependence (28-30). Findings about race are mixed. One study suggested that

white race (29) increased the risk of transition but another study failed to replicate that finding (28). Prior research also suggests that the length of time and rate of transition from onset of abuse to dependence varies greatly across drugs (27,31,32).

Important questions remain regarding predictors of transition from abuse to dependence. Some studies examined all substances together (29,30) or focused on a single substance (28), precluding formal examination of similarities and differences of predictors across substances. Other studies used high-risk or clinical populations (27,29,31), focused on certain geographical regions (27,29,31), or examined a limited number of sociodemographic variables (28). No published study has examined psychiatric comorbidity as a possible predictor of transition, despite the high prevalence of psychiatric disorders among individuals with substance use disorders.

We sought to build on prior work by drawing on data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), a large nationally representative study of the US adult population (33). The main goals of this study were to (1) estimate the cumulative probability of developing dependence among individuals with lifetime alcohol, cannabis, or cocaine abuse (the drugs with the highest levels of abuse or dependence in the United States) (2); (2) estimate the rate of transition from substance abuse to dependence for the three substances; and (3) assess the association between several sociodemographic characteristics, psychiatric comorbidity, and drug use-related variables for the risk of transition to dependence among individuals with abuse.

METHODS

Sample

The NESARC target population at Wave 1 was the civilian noninstitutionalized population 18 years and older residing in households and group quarters. The final sample included 43,093 respondents. Blacks, Hispanics, and adults 18–24 were oversampled, with data adjusted for oversampling and household- and person-level nonresponse. The overall survey response rate was 81%. Data were adjusted using the 2000 decennial census, to be representative of the US civilian population for a variety of sociodemographic variables. Interviews were conducted by experienced lay interviewers with extensive training and supervision (34,35). All procedures, including informed consent, received full human subjects review and approval from the US Census Bureau and US Office of Management and Budget. This study examined the data of the subsample of individuals with lifetime alcohol abuse ($n = 7802$), cannabis abuse ($n = 2832$), or cocaine abuse ($n = 815$) at Wave 1 interview who did not develop dependence prior to abuse on that substance.

Data were collected using the Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV (AUDADIS-IV) (36). The AUDADIS-IV is a structured diagnostic interview, developed to advance measurement of substance use and mental disorders in large-scale surveys (37). Computer algorithms produced DSM-IV diagnoses based on AUDADIS-IV data.

Measures

Extensive AUDADIS-IV questions covered DSM-IV criteria for alcohol, cannabis, and cocaine. Age of substance use onset, substance abuse, and substance dependence were assessed via extensive items covering the DSM-IV criteria (38). Age of substance use onset was determined by asking respondents about the age at which they first “had at least 1 drink of any kind of alcohol (not counting small tastes or sips)” (alcohol use), used cannabis (cannabis use), or used cocaine or crack (cocaine use). Drug-specific dependence criteria were aggregated to yield diagnoses of drug dependence for each substance. The good to

excellent test-retest reliability and validity of AUDADIS-IV substance use disorder (SUD) diagnoses is well documented in clinical and general population samples (36,39).

A previous diagnosis of a SUD (abuse or dependence) to any substance other than the one under examination was also included as a covariate in the analysis of transition.

Mood disorders included DSM-IV primary major depressive disorder, dysthymia, and bipolar I and II disorders. Anxiety disorders included DSM-IV panic disorder, social anxiety disorder, specific phobia, and generalized anxiety disorder. AUDADIS-IV methods to diagnose these disorders are described in detail elsewhere (35,40-42).

Avoidant, dependent, obsessive-compulsive, paranoid, schizoid, histrionic, and antisocial personality disorders were assessed on a lifetime basis at Wave 1 and described in detail elsewhere (35,35). Personality disorders' diagnosis required long-term patterns of social and occupational impairment (37).

Test-retest reliabilities for AUDADIS-IV mood, anxiety, and personality disorders' diagnoses in the general population and clinical settings were fair to good ($\kappa = .40$ to $.77$) (36,39,43). Convergent validity was good to excellent for all affective, anxiety, and personality disorders diagnoses (35,40), and selected diagnoses showed good agreement ($\kappa = .64$ to $.68$) with psychiatrist reappraisals (43).

Self-reported race/ethnicity was recorded into five groups: Whites, Blacks, Hispanics, Asians, and Native Americans. Other sociodemographic characteristics included gender, age, urbanicity (urban vs. rural), nativity (US-born vs. foreign-born), educational attainment, individual and family income, marital status, and employment status. Early substance use onset, defined as before age 14 (44), and family history of SUD (any alcohol or drug use disorder among first-degree relatives) were also included as substance use-related covariates.

Analyses

Weighted frequencies and their respective 95% confidence intervals (95% CI) were computed to characterize the sample. Estimated projections of the cumulative probability of transitioning from abuse to dependence in the general population were obtained by the standard actuarial method (45) as implemented in PROC LIFETEST in SAS version 9.1.3 (SAS Institute, Cary, NC). Separate curves were generated for each substance. We present estimates of the probability of transition to dependence during the first year and first decade after substance abuse onset, as well as the cumulative probability of lifetime transition. Individuals with onset of dependence before abuse were not included in the analyses, representing 16.3% of individuals with lifetime alcohol abuse, 3.6% of those with lifetime cannabis dependence, and 15.1% of those with lifetime cocaine dependence. Including respondents with onset of substance dependence before onset of abuse resulted in similar findings to when they were excluded. For that reason those results are not presented, but are available on request.

Univariate and multivariable survival analyses with time-varying covariates (with person-year as the unit of analysis) (46) were implemented using SUDAAN version 9.1 (Research Triangle Institute, Research Triangle Park). These unadjusted and adjusted models aimed at assessing the association between sociodemographic, psychiatric comorbidity, and substance use-related covariates and the hazards of transition to substance dependence. The person-year variable was defined as the number of years from substance abuse onset to age of dependence onset or age at Wave 1 interview (for censored cases). Education, marital status, and presence of DSM-IV mood, anxiety, and SUD other than the one under examination

were included as time-dependent covariates. Stepwise model selection procedures were used to identify independent correlates based on likelihood-ratio tests. Taylor series linearization methods implemented in SUDAAN were used to estimate standard errors and test for significance, taking into account the complex survey design.

To evaluate the presence of a forward telescoping bias (47) and recall bias among individuals who transitioned from abuse to dependence, we examined the correlation between the years from abuse to the NESARC interview and the years from abuse to dependence.

RESULTS

Sociodemographic Characteristics

Sociodemographic characteristics of the study sample are presented in Table 1. The highest proportion of individuals with alcohol abuse was among persons 45 years of age or older, whereas the highest proportion of individuals with cannabis and cocaine abuse was among persons 30–44 years of age. For all three types of substances, the majority of respondents with substance abuse were male, white, US-born, and living in urban areas, had at least some college education, and had an individual income of less than 20,000 dollars per year at the time of the interview. Also, for all three substances, the largest group was married or living with someone and was currently employed or had a history of past employment.

Psychiatric and Substance Use Comorbid Disorders

Psychiatric comorbid disorders and other substance use-related characteristics of the study sample are presented in Table 1. Almost one quarter of individuals with alcohol abuse and about one-third of those with cannabis and cocaine abuse had a personality or mood disorder. About one quarter of individuals with abuse on any of the substances assessed had an anxiety disorder. The majority of respondents initiated the use of the substance under consideration after age 14. Almost 50% of individuals with cannabis or cocaine abuse had a lifetime history of nicotine or alcohol dependence in the year prior to Wave 1. Also, 20.73% of individuals with a lifetime history of alcohol abuse, 7.42% of those with a history of cannabis abuse, and 14.78% of those with a history of cocaine abuse reported dependence to the same substance in the year prior to the interview. The majority of those with cannabis or cocaine abuse had a family history of SUD.

Probability of Transitioning to Substance Dependence among Individuals with Substance Abuse

During the first year after the diagnoses of substance abuse were met, the probability of transition to dependence was 4.5% for alcohol, 2.8% for cannabis, and 5.5% for cocaine. The estimated cumulative probabilities of transition to dependence a decade after the onset of abuse were 16.7% for alcohol, 8% for cannabis, and 13.2% for cocaine. Lifetime cumulative probability estimates indicated that 26.6% of individuals with alcohol abuse, 9.4% of individuals with cannabis abuse, and 15.6% of individuals with cocaine abuse would become dependent on those substances at some time in their lives. Half of the cases of alcohol, cannabis, and cocaine dependence were observed approximately 3.16, 1.83, and 1.42 years after abuse onset, respectively (Figure 1). The correlation between the years from abuse onset to NESARC interview and years from abuse onset to onset of dependence was $r = .42$, $p < .0001$ for alcohol; $r = .35$, $p = .01$ for cannabis; and $r = .2$, $p = .09$ for cocaine.

Sociodemographic Predictors of Transition from Substance Abuse to Dependence

After controlling for the effect of socioeconomic characteristic, psychiatric comorbidity, and drug use covariates, older age predicted lower risk of transition to alcohol and cannabis

dependence (Table 3). Males were more likely than women to progress from alcohol abuse to dependence. Compared to whites, Asians were more likely to transition from cocaine abuse to dependence. Respondents living in urban areas were more likely to transit to cannabis dependence. Being married decreased the risk of transition to alcohol and cocaine dependence.

Psychiatric and Substance Use-Related Predictors of Transition from Substance Abuse to Dependence

After controlling for the effect of other covariates, a history of personality or mood disorders predicted the transition from abuse to alcohol and cannabis dependence (Table 3).

Individuals with alcohol or cocaine abuse and a history of any psychotic disorder had an increased risk of becoming dependent on these substances. Compared to respondents with onset of use after age 14 years, respondents with earlier onset of use were more likely to transit to alcohol dependence. A history of nicotine dependence increased the risk of transition from alcohol and cannabis abuse to dependence. Individuals with alcohol dependence were at higher risk for cannabis dependence. A history of cannabis or cocaine dependence increased the risk of transition for the other substances assessed. A family history of SUD predicted the transition to dependence among individuals with alcohol abuse.

DISCUSSION

In a large, nationally representative sample of US adults, the lifetime cumulative probability of transition from substance abuse to dependence was the highest for alcohol (26.6%), followed by cocaine (15.6%) and lastly cannabis (9.4%), that is, the majority of individuals with abuse did not transition to dependence. However, the time from onset of abuse to dependence was shorter for cocaine, followed by cannabis and alcohol. Although some predictors of transition were common across substances, other predictors were specific for certain substances.

Several factors, including legal status, higher social acceptability, and more availability of alcohol compared to other substances could explain its higher rates of transition (48-50). Higher availability and mean consumption of alcoholic beverages are related to a higher prevalence of alcohol use disorders (48,51). The legal status and social acceptability of alcohol may also lead individuals to consume over longer periods of their lives, extending the period during which biological mechanisms related to addiction can be affected and increasing the time at risk of transition.

A previous study found that individuals with alcohol use were more likely to transition to dependence followed by cocaine and then cannabis (52). The current study extends those findings by indicating that the probabilities of transition from abuse to dependence follow the same pattern, but the rates of transition are considerably higher. Our results, in line with previous findings (28-30,53), suggest that although abuse of one substance increases the risk of transition to dependence, the majority of individuals with abuse do not transition to dependence. The interplay of individual vulnerability, environment, and exposure to risk factors may determine the differences in trajectories among individuals with substances use disorders.

In accord with previous research (27,31,32,54), time to transition was shorter for cocaine, followed by cannabis and alcohol. These patterns of transition are also consistent with findings of a faster transition from use to dependence on cocaine than from use to dependence on cannabis and alcohol (52). A shorter lag period from abuse to dependence on

cocaine could be indicative of greater addictive liability and may be related to its pharmacokinetic properties (27,55). We did not find a negative correlation between years from onset of abuse to time of NESARC interview and years elapsed from onset of abuse to onset of dependence, indicating that forward telescoping and recall biases, if present, are unlikely to be large. Rather, we found a nonsignificant correlation in the case of cocaine and significant positive correlations in the case of alcohol and cannabis. The reasons for these positive correlations are unknown. In the case of alcohol, they may be related to increases in the volume of drinking, frequency of intoxication, and reduction in utilization of treatment services by more recent cohorts (56-58) along with increasingly more tolerant societal norms and attitudes toward alcohol consumption (59). Increases in the potency of cannabis could contribute to explaining the faster transition from abuse to dependence of respondents with an abuse onset closer to NESARC interview (60,61).

Individuals with alcohol or cannabis abuse and a history of any mood or personality disorder, and individuals with alcohol or cocaine abuse and a history of psychotic disorders showed increased risk of becoming dependent. Previous studies have shown that mental disorders increase the risk of substance dependence (4,62-65), as well as the risk of transition from use to dependence (52). Our findings document that mental disorders also increase the risk of transition to dependence among individuals with abuse. The association between mental disorders and substance use has been extensively documented (4,66-68). Several mechanisms may contribute to these associations, including shared genetic predisposition, correlated liabilities, environmental factors, and unidirectional relationships, in which one condition influences the other, or even bidirectional relationships (65-70). Early treatment or prevention of these comorbid disorders could contribute to reducing the risk of transition (65).

A history of alcohol, cannabis, cocaine, or nicotine dependence predisposed individuals with substance abuse to the development of dependence on the other substances. Many drugs of abuse share common mechanisms of action (71). Consumption of more than one drug may lead to faster neuroadaptations (72,73). Also, drug interactions resulting in decreased adverse effects and synergism of drug effect may favor use of different substances at the same time (72,74,75). Higher genetic liability has been associated with polysubstance use, and allelic variations in several genes have been associated with predisposition to polysubstance use disorders (73,76,77). Polysubstance use behaviors may also be strengthened by environmental influences that allow an easier access to several drugs (78,79).

Males were more likely than women to progress from alcohol abuse to dependence, consistent with prior analyses indicating that, in the general population, the progression from alcohol use to dependence is more common in men than in women (80,81). Men have higher enzymatic activity of alcohol dehydrogenase and aldehyde dehydrogenase, leading to higher consumption of alcohol and less adverse effects facilitating tolerance (82,83). Previous studies have associated tolerance with a higher transition to alcohol dependence from abuse (84). Other factors like peer behavior and socialization into traditional gender roles could explain part of the difference (30,85).

In the univariate analyses, we found that Blacks and Asians were more likely to transition to cocaine dependence, while Hispanics and Asians were more likely to alcohol dependence. Racial differences in substance use disorders may be partly due to differences in patterns of use that can be influenced by social and cultural factors and may be related to diverse sociocultural contexts of the individuals (86,87). The effect of racial disparities in healthcare access and services may also have contributed to differences in the rates of transition (88-92).

Several sociodemographic, psychopathologic, and substance use-related predictors of transition from abuse to dependence differed from those of transition from use to dependence (52). For example, a history of psychotic disorder increased the risk of transition from alcohol or cocaine abuse to dependence, but not from alcohol or cocaine use to dependence. Respondents with early onset of alcohol use were more likely to transition from alcohol abuse to dependence, but not from alcohol use to dependence. At the same time, although some previously identified risk factors of transition from use to dependence also predicted transition from abuse to dependence (e.g., dependence on another substance, mood or personality disorders), other risk factors of transition did not predict abuse to dependence, such as male gender for cannabis, black race for cocaine, or anxiety disorder for alcohol and cannabis (52). Our findings suggest that risk factors for dependence vary across the different stages of progression from use to dependence. Although treatment interventions that target the main psychopathological risk factors for dependence should be effective regardless of whether individuals are only using or have already progressed to abuse, certain risk factors may offer opportunities for stage-specific interventions.

Our study has limitations common to most large-scale surveys. First, information on substance use and SUD was based on self-report and not confirmed by objective methods. Second, diagnoses may be subject to recall bias and to cognitive impairment associated with the use of drugs. However, those biases, if present, are unlikely to be large, as indicated by absence of negative correlations between years from abuse to NESARC interview and years from abuse onset to onset of dependence. Third, the NESARC excludes institutionalized populations, who have an increased probability of having a diagnosis of substance dependence. It has also some important strengths, including its large sample size, generalizability, careful methodology, and the inclusion of individuals who abused only one substance as well as those who abused multiple substances, allowing the use of those substances as predictors in multivariable models.

Despite the limitations, our study indicates that although the speed of transition from abuse to dependence is fastest from cocaine, followed by cannabis and alcohol, the cumulative probability of transition is highest for alcohol, followed by cocaine and cannabis. A history of mood, anxiety, personality, or substance use disorders strongly predisposed individuals to transition. Identifying and targeting risk factors for substance abuse and developing effective interventions for its treatment may be an important avenue to decrease the prevalence of substance dependence.

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FIGURE 1.
Cumulative probability of transitioning to dependence on alcohol, cannabis, and cocaine among individuals with abuse of these substances.

TABLE 1

Sociodemographic, psychopathologic, and substance abuse-related characteristics of individuals with lifetime history of alcohol, cannabis, or cocaine abuse by type of substance at NESARC Wave 1.

Characteristic	Alcohol abuse (n = 7802)		Cannabis abuse (n = 2832)		Cocaine abuse (n = 815)	
	%	95% CI	%	95% CI	%	95% CI
Age group						
18–29	19.07	(18.03–20.14)	30.02	(27.69–32.45)	18.62	(15.06–22.78)
30–44	37.53	(36.31–38.75)	42.72	(40.30–45.18)	54.09	(49.50–58.62)
>45	43.41	(42.03–44.80)	27.26	(25.16–29.47)	27.29	(23.47–31.47)
Gender						
Male	67.45	(66.11–68.77)	67.48	(65.34–69.55)	69.31	(65.71–72.68)
Female	32.55	(31.23–33.89)	32.52	(30.45–34.66)	30.69	(27.32–34.29)
Race/ethnicity						
Whites	80.69	(78.39–82.80)	78.12	(75.64–80.42)	75.99	(71.82–79.71)
Blacks	7.17	(6.27–8.19)	9.24	(7.90–10.80)	8.56	(6.77–10.77)
Hispanics	7.76	(6.14–9.77)	7.31	(5.91–9.00)	9.40	(7.01–12.51)
Asians	1.46	(1.01–2.11)	1.47	(.96–2.23)	1.23	(.62–2.45)
Native Americans	2.92	(2.40–3.55)	3.86	(2.93–5.07)	4.82	(2.91–7.86)
US-born						
Yes	94.33	(92.91–95.49)	96.01	(94.70–97.01)	96.09	(93.92–97.51)
No	5.67	(4.51–7.09)	3.99	(2.99–5.30)	3.91	(2.49–6.08)
Urbanicity						
Rural	21.46	(18.30–24.99)	19.89	(16.46–23.82)	16.16	(11.87–21.63)
Urban	78.54	(75.01–81.70)	80.11	(76.18–83.54)	83.84	(78.37–88.13)
Education						
<High school	11.79	(10.69–12.97)	12.17	(10.68–13.84)	12.88	(10.03–16.39)
High school	26.51	(25.05–28.03)	27.99	(25.80–30.29)	31.85	(27.95–36.01)
College	61.70	(59.89–63.49)	59.84	(57.39–62.25)	55.28	(51.27–59.22)
Individual income						
0–\$19,999	34.47	(32.95–36.01)	41.53	(38.95–44.15)	38.10	(33.62–42.79)
\$20,000–\$34,999	24.24	(22.93–25.61)	24.28	(22.22–26.46)	23.23	(19.92–26.91)
\$35,000–\$69,999	28.57	(27.34–29.83)	24.33	(22.24–26.56)	29.17	(25.47–33.16)
\$70,000	12.72	(11.33–14.26)	9.86	(8.26–11.73)	9.50	(7.11–12.58)
Family income						
0–\$19,999	16.98	(15.82–18.22)	21.04	(19.28–22.93)	19.61	(16.64–22.96)
\$20,000–\$34,999	19.03	(17.90–20.21)	19.55	(17.91–21.30)	19.90	(16.99–23.18)
\$35,000–\$69,999	34.00	(32.55–35.47)	32.38	(30.30–34.53)	37.67	(33.49–42.05)
\$70,000	30.00	(27.94–32.14)	27.03	(24.44–29.79)	22.81	(18.73–27.48)
Marital status						
Married	64.49	(63.12–65.84)	55.30	(53.17–57.41)	55.17	(51.13–59.14)
Divorced/separated	14.11	(13.20–15.07)	14.75	(13.26–16.37)	20.04	(17.12–23.31)
Widowed	2.56	(2.24–2.93)	1.02	(0.63–1.66)	.78	(.37–1.64)

Characteristic	Alcohol abuse (<i>n</i> = 7802)		Cannabis abuse (<i>n</i> = 2832)		Cocaine abuse (<i>n</i> = 815)	
	%	95% CI	%	95% CI	%	95% CI
Never married	18.84	(17.73–20.00)	28.93	(27.08–30.84)	24.01	(20.51–27.90)
Employment status						
Ever employed	89.78	(88.92–90.57)	94.50	(93.48–95.37)	92.07	(89.84–93.84)
Never employed	10.22	(9.43–11.08)	5.50	(4.63–6.52)	7.93	(6.16–10.16)
Psychopathology						
Any personality disorder	22.46	(21.21–23.75)	32.80	(30.48–35.22)	37.48	(33.37–41.77)
Any mood disorder	24.15	(22.96–25.39)	34.51	(32.27–36.83)	34.69	(30.49–39.14)
Any anxiety disorder	22.37	(21.17–23.63)	28.22	(25.99–30.57)	26.08	(22.34–30.20)
Any conduct disorder	1.67	(1.37–2.03)	2.14	(1.57–2.91)	2.11	(1.17–3.77)
Any psychotic disorder	1.00	(.79–1.27)	2.43	(1.74–3.38)	2.48	(1.52–4.00)
Substance abuse-related characteristics						
Early onset ^I (before age 14)	12.47	(11.63–13.37)	21.78	(19.84–23.85)	3.52	(2.31–5.34)
Late onset ^I	87.53	(86.63–88.37)	78.22	(76.15–80.16)	96.48	(94.66–97.69)
Nicotine dependence	32.35	(30.96–33.77)	49.35	(46.87–51.83)	49.79	(45.50–54.08)
Alcohol dependence	20.73	(19.50–22.01)	46.13	(43.91–48.37)	55.80	(51.60–59.93)
Cannabis dependence	2.78	(2.39–3.23)	7.42	(6.24–8.80)	11.40	(8.89–14.50)
Cocaine dependence	2.24	(1.87–2.68)	6.05	(5.06–7.23)	14.78	(12.04–18.01)
Family history of SUD	50.51	(49.08–51.94)	59.70	(57.44–61.92)	72.25	(68.48–75.72)

Note:

^I Use onset for the substance of interest described in the column (i.e., alcohol, cannabis, or cocaine).

TABLE 2

Predictors of transition from abuse to dependence on alcohol, cannabis, and cocaine among individuals with specific substance abuse. Univariate results of survival analyses.

Characteristics	<u>Alcohol dependence</u>		<u>Cannabis dependence</u>		<u>Cocaine dependence</u>	
	HR	95% CI	HR	95% CI	HR	95% CI
Age group						
18–29	5.02	(4.15–6.08)	3.29	(1.96–5.52)	.93	(.41–2.13)
30–44	1.79	(1.53–2.09)	1.40	(.83–2.35)	.58	(.30–1.14)
>45	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Gender						
Male	1.04	(.92–1.18)	1.18	(.86–1.63)	.81	(.50–1.30)
Female ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Race/ethnicity						
Whites ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Blacks	1.07	(.87–1.32)	1.21	(.78–1.87)	2.27	(1.17–4.38)
Hispanics	1.38	(1.10–1.72)	1.05	(.60–1.83)	1.07	(.57–2.01)
Asians	1.61	(1.11–2.34)	2.54	(.93–6.90)	4.64	(1.25–17.30)
Native Americans	1.14	(.78–1.66)	1.92	(.98–3.74)	.86	(.23–3.24)
US-born						
Yes	.92	(.69–1.23)	.40	(.17–.96)	.52	(.20–1.37)
No ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Urbanicity						
Rural ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Urban	1.06	(.90–1.24)	2.18	(1.31–3.61)	1.07	(.48–2.38)
Education (years)	.98	(.95–1.00)	1.00	(.91–1.09)	.97	(.87–1.07)
Individual income						
0–\$19,999	2.16	(1.68–2.77)	1.92	(1.00–3.70)	3.32	(.99–11.15)
\$20,000–\$34,999	2.02	(1.57–2.60)	1.45	(.76–2.75)	2.60	(.78–8.70)
\$35,000–\$69,999	1.40	(1.10–1.80)	.97	(.47–2.03)	2.25	(.64–7.87)
70,000 ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Family income						
0–\$19,999	2.11	(1.73–2.58)	2.41	(1.46–3.99)	1.89	(.94–3.82)
\$20,000–\$34,999	1.68	(1.38–2.04)	1.41	(.80–2.46)	1.35	(.67–2.72)
\$35,000–\$69,999	1.31	(1.09–1.57)	1.51	(.90–2.52)	1.29	(.66–2.52)
70,000 ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Marital status						
Married ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)
Never married	2.00	(1.65–2.42)	2.15	(1.22–3.80)	.86	(.45–1.62)
Divorced/separated/widowed	2.48	(2.03–3.04)	2.20	(1.01–4.80)	2.58	(1.36–4.88)
Employment status						
Ever employed ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	1.00	(1.00–1.00)

Characteristics	Alcohol dependence			Cannabis dependence			Cocaine dependence		
	HR	95% CI		HR	95% CI		HR	95% CI	
Never employed	.59	(.48–.74)		.49	(.23–1.05)		.54	(.20–1.49)	
Any personality disorder									
Yes	2.25	(1.98–2.55)		3.36	(2.44–4.62)		1.43	(.91–2.27)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Any mood disorder									
Yes	3.61	(2.92–4.47)		3.58	(2.26–5.67)		1.71	(.72–4.03)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Any anxiety disorder									
Yes	1.86	(1.41–2.47)		2.38	(1.23–4.61)		1.18	(.36–3.89)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Any conduct disorder									
Yes	.87	(.56–1.34)		1.55	(.56–4.27)		<.01	(<.01–<.01)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Any psychotic disorder									
Yes	2.90	(2.08–4.05)		2.13	(.94–4.83)		3.79	(1.31–10.94)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Specific substance use onset									
Early (before age 14)	1.77	(1.51–2.07)		1.67	(1.17–2.38)		.85	(.30–2.42)	
Late [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Nicotine dependence									
Yes	4.36	(3.72–5.13)		2.83	(1.88–4.26)		1.95	(.99–3.83)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Alcohol dependence									
Yes	NA	NA	NA	2.95	(2.09–4.16)		1.59	(.95–2.66)	
No [/]	NA	NA	NA	1.00	(1.00–1.00)		1.00	(1.00–1.00)	
Cannabis dependence									
Yes	8.58	(6.22–11.83)		NA	NA	NA	3.17	(1.34–7.49)	
No [/]	1.00	(1.00–1.00)		NA	NA	NA	1.00	(1.00–1.00)	
Cocaine dependence									
Yes	8.27	(5.26–13.00)		14.22	(8.28–24.42)		NA	NA	NA
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		NA	NA	NA
Family history of SUD									
Yes	1.55	(1.36–1.76)		1.25	(.88–1.77)		1.58	(.91–2.75)	
No [/]	1.00	(1.00–1.00)		1.00	(1.00–1.00)		1.00	(1.00–1.00)	

Note:

[/] Reference category. Significant results ($p < .05$) are in bold.

TABLE 3

Predictors of progression from abuse to dependence on alcohol, cannabis, and cocaine among individuals with specific substance abuse. Multivariable results of survival analyses.

Characteristics	<u>Alcohol dependence</u>		<u>Cannabis dependence</u>		<u>Cocaine dependence</u>	
	HR	95% CI	HR	95% CI	HR	95% CI
Age group						
18–29	4.08	(3.34–5.00)	2.59	(1.48–4.56)		
30–44	1.69	(1.43–2.00)	1.14	(.66–1.98)		
>45 ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)		
Gender						
Male	1.28	(1.11–1.47)				
Female ^I	1.00	(1.00–1.00)				
Race/ethnicity						
Whites ^I			1.00	(1.00–1.00)	1.00	(1.00–1.00)
Blacks			1.10	(.70–1.72)	1.93	(.94–3.98)
Hispanics			.55	(.28–1.09)	1.12	(.61–2.06)
Asians			1.16	(.35–3.91)	5.04	(1.43–17.83)
Native Americans			1.72	(.90–3.26)	.89	(.26–3.07)
US-born						
Yes			.40	(.15–1.06)		
No ^I			1.00	(1.00–1.00)		
Urbanicity						
Rural ^I			1.00	(1.00–1.00)		
Urban			2.28	(1.38–3.76)		
Marital status						
Married ^I	1.00	(1.00–1.00)			1.00	(1.00–1.00)
Never married	1.78	(1.46–2.17)			.77	(.40–1.47)
Divorced/separated/widowed	2.19	(1.79–2.69)			2.44	(1.29–4.62)
Any personality disorder						
Yes	1.54	(1.34–1.77)	2.48	(1.80–3.43)		
No ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)		
Any mood disorder						
Yes	2.11	(1.64–2.72)	2.09	(1.27–3.43)		
No ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)		
Any psychotic disorder						
Yes	1.98	(1.35–2.91)			3.53	(1.35–9.23)
No ^I	1.00	(1.00–1.00)			1.00	(1.00–1.00)
Specific substance use onset						
Early (before age 14)	1.25	(1.06–1.46)				
Late ^I	1.00	(1.00–1.00)				
Nicotine dependence						

Characteristics	<u>Alcohol dependence</u>		<u>Cannabis dependence</u>		<u>Cocaine dependence</u>	
	HR	95% CI	HR	95% CI	HR	95% CI
Yes	2.92	(2.46–3.46)	1.64	(1.07–2.53)		
No ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)		
Alcohol dependence						
Yes	NA	NA	1.98	(1.43–2.75)		
No ^I	NA	NA	1.00	(1.00–1.00)		
Cannabis dependence						
Yes	3.15	(2.09–4.74)	NA	NA	3.17	(1.28–7.90)
No ^I	1.00	(1.00–1.00)	NA	NA	1.00	(1.00–1.00)
Cocaine dependence						
Yes	2.99	(1.71–5.22)	10.23	(5.93–17.66)	NA	NA
No ^I	1.00	(1.00–1.00)	1.00	(1.00–1.00)	NA	NA
Family history of SUD						
Yes	1.38	(1.21–1.57)				
No ^I	1.00	(1.00–1.00)				

Note:

^IReference category. Significant results ($p < .05$) are in bold.