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Transitions in Illicit Drug Use Status over 3 Years: A Prospective Analysis of a General Population Sample

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Abstract

Objective—To examine 3-year transitions among nonuse, asymptomatic use and problem use of illicit drugs for US adults in the general household population.

Method—Data from the nationally representative NESARC study of 34,653 adults interviewed twice, 3 years apart. Three mutually exclusive categories of baseline drug status comprised past year non-users (n=32,675), past-year asymptomatic drug users (n=861), and past-year symptomatic drug users (n=1,117). Symptomatic drug use was defined as presence of one or more symptoms that operationalize DSM-IV drug abuse and dependence criteria. Variables tested for association with 3-year transitions to different status categories included sociodemographic, health, substance use and psychiatric covariates.

Results—Among baseline nonusers, 95.4% continued to be nonusers at follow-up, 2.1% became asymptomatic users, and 2.5% developed drug problems. Among baseline asymptomatic users, 66.6% had stopped using drugs at follow-up, 14.3% continued to be asymptomatic users and 19.1% had developed drug problems. Nearly half (49.0%) of those with drug problems at baseline had stopped using drugs at follow-up, 10.9% had transitioned to asymptomatic use and 40.1% continued to have drug problems. Younger age, male gender, white race, and not being married were associated with progression from non-use to use or problematic use, as were alcohol and tobacco categories, major depression and schizotypal, borderline and narcissistic personality disorders. Panic disorder and avoidant personality disorder were associated with less progression.

Conclusions—Transitions in drug use status are common. The finding that alcohol and tobacco-related variables and co-occurring psychopathology are important correlates of transitions

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suggests the value of addressing all co-occurring disorders and substance use in patient assessments and treatment planning, both for preventing adverse transitions and promoting positive transitions.

INTRODUCTION

Few studies have examined the natural history of illicit drug use and drug use disorders in the US general population, despite their being associated with extensive costs, harms, disability and deaths.^{1–9} Although data on the prevalence of illicit drug use and disorders¹⁰ are critical to the allocation of health resources, cross-sectional prevalence data confound initial drug use with recurrent drug use and confound progression from use to drug problem with chronic problems – leading to divergent characterizations of the course of drug use and drug use disorder.^{10–12} In light of recent evidence that different genetic factors may influence initiation of drug use and progression to dependence,¹³ and in order to determine whether unique public health responses are required to address each of these processes, there is a need to elucidate risk factors specific to each or common across all. Because only a select minority of individuals with drug use disorders obtains drug treatment,^{9,10} it is critical to examine transitions within the general population.

Most epidemiologic studies of substance use initiation have focused on the high-risk period of adolescence.^{14–16} One recent study examining adults, based on the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), found that the odds of initiating illicit drug use over a three-year follow-up interval were significantly increased by childhood abuse, familial substance use problems, mood, personality and alcohol use disorders and nicotine dependence. The odds of initiating use were lower among women, Asians/Pacific Islanders and Hispanics and greater among unmarried individuals.¹⁷

Data from the NESARC also have been used to study transition from first use to dependence for cannabis and cocaine.¹⁸ For both drugs, the odds of progressing from use to dependence decreased with age, income, and education but increased with being unmarried, initiating use before age 14, and having lifetime psychiatric and substance use disorders. For cannabis only, progression to dependence was more likely among men. Similarly, data from the National Comorbidity Survey¹⁹ showed that male cannabis users were more likely than females to develop cannabis dependence shortly after initiation of use, whereas onset of cocaine dependence among cocaine users showed little variation by sex. Two additional NESARC-based studies showed that independent major depression increased the odds of relapse to cocaine dependence²² and that antisocial, borderline and schizotypal personality disorders were positively associated with persistent cannabis abuse and dependence.²³

Data from general population samples have shown varying correlates of drug use cessation and remission from drug use disorder. In a longitudinal community sample of lifetime marijuana users, cessation of use by ages 34–35 was negatively associated with male gender, use of other illicit drugs and delinquency and positively associated with education, age at first use, depressive symptoms, and getting married or becoming a parent for the first time.²⁰ In an analysis of NESARC respondents with lifetime cannabis and cocaine dependence,²¹ the odds of having achieved remission at interview were lower for men and those with other

drug dependence and higher among those 18–29 versus 45+ years of age for both substances. For cannabis only, remission was positively associated with lifetime conduct disorder and negatively associated with personality disorder and alcohol dependence. For cocaine only, remission was positively associated with nicotine dependence and negatively associated with Black race/ethnicity.

Inconsistent findings across past studies reflect not only their focus on different drug transitions, but also the effects of sample composition, study design, follow-up interval, and definition of drug use and problems. Even among studies sharing a common sample,^{17, 18, 21–23} comparisons may be confounded by the focus on different drugs, different potential correlates and prospective versus retrospective study designs. Standardizing these elements would reduce the “noise” confounding comparisons across studies.

Accordingly, this study prospectively examined a range of transitions in past-year drug status across the three-year follow-up interval between two waves of a U.S. general population study, using a consistent set of potential correlates for all transitions and pooling 10 illicit drug categories in order to preclude identification of correlates relevant for only a single drug. Based on growing evidence that drug dependence may reflect an arbitrary cutpoint on an inherently dimensional scale of drug use problems,^{6, 24–26} as well as evidence from natural-history studies of common transitions among use, abuse and dependence,¹¹ we distinguished drug use with problems from asymptomatic use by the presence or absence of symptoms that operationalize the DSM-IV drug abuse and dependence criteria. Finally, this study adopted a statistical modeling approach that evaluated risks for competing drug transitions, simultaneously indentifying predictors of transitions to asymptomatic use and drug problems among nonusers, predictors of progression to problems and cessation of use among asymptomatic users, and predictors of transitions to asymptomatic use and nonuse among those with drug problems at baseline (Figure 1). For all models, the referent group for transitions comprised individuals whose past-year drug status remained the same at Wave 1 and Wave 2.

METHODS

Sample

This study used data from Waves 1 and 2 of the NESARC. Only respondents consenting to participate after receiving written information about the nature of the survey, uses of the survey data, voluntary nature of their participation and legally-mandated confidentiality of identifiable survey information were interviewed. The research protocol received full ethical review and approval from the U.S. Census Bureau and the U.S. Office of Management and Budget. The nationally representative 2001–2002 Wave 1 sample contained 43,093 U.S. adults 18 and older living in households and noninstitutional group quarters. The 2004–2005 Wave 2 follow-up sample contained 34,653 of the original respondents, 86.7% of those eligible for reinterview (cumulative response rate = 70.2%). Information on the sample design, field work and weighting is available elsewhere.^{5, 27, 28} This study is based on three subsamples of respondents: those who did not use any illicit drugs in the year preceding the Wave 1 interview (n=32,675, including 5,740 former drug users), Wave 1 past-year

asymptomatic drug users (n=856), and individuals with Wave 1 past-year drug problems (n=1,122).

Measures

Drug use status and drug use transitions—Past-year drug use was based on ten categories of drugs: sedatives, tranquilizers, opiates and amphetamines (when used without or beyond the limits of a prescription), cannabis, cocaine/crack, hallucinogens, solvents/inhalants, heroin and “other” drugs. Problem use comprised past-year occurrence of any of 40 symptoms (expanded to include 2 additional withdrawal symptoms in Wave 2) operationalizing DSM-IV drug abuse and dependence criteria. Crosstabulating Wave 1 by Wave 2 drug status (nonuse, asymptomatic use, problems) yielded nine transition categories (Figure 1).

Background and health covariates—Standard background characteristics included Wave 1 age, sex, race-ethnicity, marital status, educational attainment, family income, geographic region, urban/rural residence, receipt of public assistance, and health insurance coverage. Psychological and physical functioning were represented by the norm-based mental and physical component scales of the Short Form 12-Item Health Survey,²⁹ rescaled to a U.S. general population mean of 50 and standard deviation of 10. Number of life stressors was derived from a list of 12 past-year events. Familial substance use problems comprised respondent-reported alcohol or drug problems in any 1st or 2nd degree relative. Childhood abuse comprised physical and/or sexual abuse prior to age 18.

Substance use and psychopathologic covariates—Former drug use reflected use prior to, but not during, the year preceding Wave 1 interview. Tobacco use reflected five tobacco types and distinguished use with and without DSM-IV nicotine dependence.³⁰ Past-year alcohol use categories comprised individuals with DSM-IV alcohol abuse or dependence,³¹ risk drinkers who exceeded the NIAAA low-risk drinking guidelines of 14 drinks per week and 4 drinks on any day for men and 7 drinks per week and 3 drinks on any day for women (<http://rethinkingdrinking.niaaa.nih.gov/>), low-risk drinkers who did not exceed these limits, and nondrinkers. Early drug use was defined as first use before age 14.³² Drug use typology distinguished less addictive drugs (sedatives, tranquilizers, hallucinogens, and solvents/inhalants), more addictive drugs (marijuana and opiates) and highly addictive drugs (amphetamines, cocaine/crack, and heroin), based on the proportion of past year users with drug dependence.³³ Past-year mood, anxiety and personality disorders were measured in accordance with DSM-IV criteria. Their derivation, reliability and validity are available elsewhere (kappa = .40–.74 for Axis I disorders, .40–.71 for Axis II disorders).^{34–36}

Analysis

Chi-square tests and analysis of variance assessed bivariate associations. Multivariate multinomial regression models yielded adjusted associations of the covariates with transition status. Separate analyses were conducted among Wave 1 categories of nonuse (contrasting Wave 2 asymptomatic use and problems with continued nonuse), asymptomatic use (contrasting Wave 2 nonuse and problems with continued asymptomatic use), and problems

(contrasting Wave 2 nonuse and asymptomatic use with continued problems). Covariates were entered in four blocks (sociodemographics, health measures, substance use, and psychiatric disorders), each partially reduced before adding the next block. The models were ultimately reduced to retain only covariates with p-values $<.05$ for at least one of the two competing transition outcomes or whose presence was necessary to retain the proper referent category for multi-categorical variables. Because of small cell sizes, we combined bipolar I and II disorders, panic with and without agoraphobia, and all nonwhite race-ethnic groups. In the models based on Wave 1 asymptomatic use, we additionally combined all mood disorders, all anxiety disorders, and all cluster C personality disorders. SUDAAN software³⁷ was used to obtain variance estimates that account for complex, multi-stage sample designs.

RESULTS

In the year preceding the Wave 1 baseline interview, 93.9% of U.S. adults (≈ 195.0 million individuals) did not use illicit drugs (17.1% former drug users and 76.8% lifetime non drug users), 2.6% (≈ 5.4 million) were asymptomatic users and 3.5% (≈ 7.5 million) had drug problems (Table 1). Among baseline nonusers, 95.4% were continued nonusers at Wave 2, 2.1% became asymptomatic users and 2.5% developed drug problems. Among baseline asymptomatic users, 66.6% stopped using drugs at Wave 2, 14.3% continued to be asymptomatic users and 19.1% developed drug problems. Nearly half (49.0%) of those with baseline drug problems had stopped using drugs at Wave 2, 10.9% were asymptomatic users and 40.1% continued to have drug problems.

Among baseline non drug users (Table 2, left panel), age, psychological functioning and percentage married/cohabiting decreased steadily across Wave 2 nonuse, asymptomatic use and problems, whereas the proportion of males and prevalence of familial substance-use problems, number of life stressors, and childhood abuse increased. Individuals attending/completing college were overrepresented among Wave 2 asymptomatic users, whereas individuals who received public assistance payments or had no health care coverage were overrepresented in the problems category. Transitions to asymptomatic use and problems were strongly associated with other substance use and psychopathology. Severity of drug involvement was positively related to severity of tobacco and alcohol use, and prevalence of most mood and personality disorders increased steadily across Wave 2 nonuse, asymptomatic use, and problems.

Among individuals with baseline asymptomatic use and problems (Table 2, middle and right panels), age and childhood abuse demonstrated the same patterns as they did among nonusers. Mean psychological functioning was highest and public assistance and public health insurance coverage least prevalent among those who remained asymptomatic users at Wave 2. Transitions from asymptomatic use and problems were less strongly associated with other substance use and psychopathology than were transitions from nonuse, but they were strongly associated with Wave 1 drug use characteristics. Individuals who developed/continued to have drug problems were the most likely and those who ceased drug use the least likely to have initiated drug use before age 14 and used highly addictive drugs. Schizotypal, borderline, narcissistic and antisocial personality disorders were overrepresented among individuals who continued to have drug problems; borderline and

antisocial also were overrepresented among those transitioning from asymptomatic use to problems.

Most bivariate correlates remained statistically significant when adjusted for other covariates (Table 3). Transitions from nonuse to asymptomatic use were negatively related to age, nonwhite race-ethnicity, marriage/cohabitation and panic disorder but increased by living in West and urban locations, childhood abuse, smoking and drinking (especially with disordered use), major depressive disorder and narcissistic personality disorder. Transitions from nonuse to problems were negatively related to age, nonwhite race-ethnicity, marriage/cohabitation, income, psychological and physical functioning and avoidant personality disorder and positively associated with male sex, no health insurance, familial substance-use problems, childhood abuse, smoking and drinking, major depressive disorder and schizotypal, borderline and narcissistic personality disorders. When a dummy variable for former drug use was added to the analytic model, none of the other odds ratios significantly changed in magnitude (data not shown); however, a few parameters of marginal statistical significance fell short of the $p < .05$ level of significance. Former drug use itself doubled the odds of transitions to both asymptomatic use and problems.

Among baseline asymptomatic users, transitions to Wave 2 nonuse were negatively associated with male sex, no health insurance, psychological functioning, nondependent smoking, use of more versus less addictive drugs and antisocial personality disorder and positively associated with nonwhite race-ethnicity. Transitions from asymptomatic use to problems were negatively related to psychological functioning, nondependent smoking and Cluster C personality disorder and positively associated with public assistance and borderline personality disorder.

The transition from baseline problems to nonuse was increased among nonwhites and reduced by childhood abuse, initiating drug use before age 14, using more or highly versus less addictive drugs, and schizotypal and narcissistic personality disorders. The only significant correlate of transitioning from problems to asymptomatic use was positive for nondependent smoking.

DISCUSSION

Transitions in drug status over a three-year interval were influenced by a wide range of factors, including sociodemographic and health characteristics, familial substance problems, childhood abuse, tobacco and alcohol use, and psychopathology. For most of these, their associations with progression from nonuse to asymptomatic use mirrored their associations with progression from nonuse to drug problems. Mood and anxiety disorders were associated with progression from nonuse to use (including problematic use), whereas factors related to poverty, health, family history and personality disorder were significant only for transitions to and from drug problems, i.e., appeared more strongly linked with persistent than casual, experimental use. Correlates of transitions to drug use were similar to those previously reported for first initiation of drug use;¹⁷ however, the present study uniquely identified the specific mood, anxiety and personality disorders underlying the broad

associations previously reported and demonstrated the prognostic importance of alcohol and tobacco use even in the absence of alcohol and nicotine disorders.

Our findings regarding transitions *from* asymptomatic use and drug problems are difficult to compare with prior NESARC-based studies^{18, 21} because of differences in study design. Earlier studies used survival analyses of retrospective data to examine transitions over the life course, whereas we prospectively examined transitions over a three-year follow-up. Whereas previously-identified correlates may reflect transitions occurring during adolescence, individuals in current study were 18 and older at the baseline. Moreover, the previously-identified protective effects of greater education and being married (for the risk of developing cannabis dependence) may reflect consequences of not developing dependence rather than direct preventive effects.

In the present study, the intensity of alcohol use had a linear association with transitions to drug use (including problem use) but no association with progression from use to problems. Thus, the relationship with use may more strongly reflect common contextual correlates than common genetic liability. Similarly, nicotine dependence was associated with initiating drug use but neither development of nor remission from drug problems. However, asymptomatic users who were nondependent smokers were less likely than nonsmokers to stop using drugs and less likely to or develop drug problems. Given problems, they were at increased risk of reverting to asymptomatic use. Taken together, these results suggest the existence of a common resistance to nicotine dependence and drug problems, possibly reflecting similar delivery mechanisms for tobacco and cannabis, shared genetic liability or the lack thereof, or common effects on reward systems cross-sensitization.³⁸

Extending prior studies of associations between any personality disorder and drug transitions, we found that these associations were driven by a handful of specific disorders. Consistent with two recent NESARC-based studies that examined the persistence of drug use disorder,^{22,23} we found that schizotypal and narcissistic personality disorders were negatively associated with drug use cessation among problem users; however, we did not replicate a similar effect of antisocial personality disorder that was reported in those studies. This discrepancy may reflect our adjustment for early drug use initiation, which may have mediated the effect of antisocial personality disorder. The negative associations of avoidant and any Cluster C personality disorder with transitioning from asymptomatic to problem use suggest that fear and anxiety characteristic of this cluster may temper the intensity of drug use.

The positive association between major depressive disorder and initiation of use may reflect a form of self-medication, as suggested in a study of individuals with psychosis and substance use disorders,³⁹ whereas the negative association of panic disorder with initiation of use (significant only for panic with agoraphobia) could reflect discomfort with procuring illicit drugs.

This study did not replicate earlier findings of excess drug use disorder among individuals with early-onset use,^{32,40} probably because individuals in this study were at least 18 years of age at baseline, by which time most disorders attributable to early use would already have

occurred. However, the negative association between early-onset use and transitioning from problems to nonuse suggests that the excess prevalence of drug use disorder among early drug users reflects both increased onset and chronicity. Thus, these results support the importance of preventing early recreational drug use. Our finding of positive associations between social disadvantage and transition to drug problems may reflect poverty-related exposure to illegal drug markets or lack of constraints that usually keep drug use within reasonable limits (e.g., job responsibilities) and are consistent with previously-reported negative associations between income and the likelihood of developing cannabis and cocaine dependence.¹⁸

This study had a number of limitations that affect interpretation of its findings. By combining lifetime non drug users with former users, we may have failed to identify factors that differentially affect initiation and recurrence. However, controlling for former use had no meaningful impact on the other correlates of transitions from nonuse, and tests for effect modification revealed only a single, marginally significant ($p=.035$) interaction of former drug use with other correlates, no more than would be expected by chance given the 34 correlates tested. Further, by combining all illicit drugs, this study was unable to address variation by drug type, as has been suggested in past studies.^{18,21} Because cannabis was the drug most often used in this sample, correlates may apply to cannabis more than other drug-use transitions. Finally, this study focused on drug transitions during a relatively brief period, corresponding to ages well beyond peak drug use and drug use disorder for many respondents. Accordingly, the results of this study should be viewed as a complement to existing studies that have investigated transitions over the life course.

This study had a number of unique strengths. Its prospective design reduced the likelihood of false inferences regarding causality and ensured that associations with psychiatric disorders reflected those present at baseline and not those that may have developed after initiation of drug use or even after remission of drug problems. Relative to survival models, which provide no information on individuals withdrawn from the risk of developing drug problems (censored) because of drug use cessation, the models used in this study yielded correlates of drug use cessation that can inform efforts to prevent drug use and treat drug problems. In addition, this study contrasted transitions to asymptomatic use and nonuse. Studies of remission from alcohol dependence⁴¹ have revealed distinct factors predicting abstinent and nonabstinent remission, a finding replicated in this study. Future studies might specifically address the impact of major life events, e.g., marrying and becoming a parent, which were significant predictors of nonabstinent remission from alcohol problems⁴² and marijuana use cessation.²⁰ In contrast to the similar rates of abstinent and nonabstinent remission reported for alcohol dependence,⁴¹ this study found that problem users were more than four times as likely to transition to nonuse as to asymptomatic use. This finding, as well as the high ratio of problems to asymptomatic use at baseline, could reflect the low threshold of any drug problems used in this study, or it may indicate that drugs are more susceptible to problems than alcohol for reasons related either to their illegality or unique physiological effects.

For clinicians, the importance of personality disorder in drug use transitions is clear, perhaps especially for borderline personality disorder, which was associated with the development of

drug problems. The demonstrated overlap of alcohol and tobacco with illicit drugs underscores the value of addressing all substances in patient assessments and treatment planning. Overall, these results support a view of illicit drug use trajectories as varied^{10,11} rather than demonstrating a strict linear progression from nonuse to use to problems requiring formal drug treatment. Among baseline asymptomatic users, two thirds had ceased use in the year preceding the Wave 2 follow-up interview, and only one fifth had progressed to problems. However, among baseline nonusers, more than half of those who had initiated use during the 3-year follow-up interval had already experienced problems. These findings speak to both the importance and potential of early intervention (e.g., in routine medical and emergency care settings) for forestalling the development of drug use disorders in the general population.

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Figure 1.

Significant (p < .05) baseline predictors of transitions in drug use status from baseline to 3-year follow up (details in Table 3).

Wave 2 past-year drug status as a function of Wave 1 past-year drug status: U.S. adults 18 years of age and older at Wave 1

Table 1

Wave 1 drug status	N	Estimated baseline population size (000s)	Wave 1 prevalence		% Distribution by Wave 2 drug status					
					Nonuse		Asymptomatic use		Problems	
			%	SE	%	SE	%	SE	%	SE
Nonuse	32,675	194,986	93.9	0.2	95.4	0.2	2.1	0.1	2.5	0.1
Asymptomatic use	861	5,432	2.6	0.1	66.6	1.8	14.3	1.4	19.1	1.6
Problems	1,117	7,462	3.5	0.1	49.0	2.2	10.9	1.0	40.1	2.0

Wave 1 background, health, substance-related and psychiatric characteristics for individuals with Wave 1 – Wave 2 transitions in drug status

Table 2

Mean values of selected Wave 1 characteristics	Wave 1 Nonuse						Wave 1 Asymptomatic Use						Wave 1 Problems									
	Wave 2 Nonuse n=31,264		Wave 2 Asymp. Use n=638		Wave 2 Problems n=773		Wave 2 Nonuse n=567		Wave 2 Asymp. Use n=121		Wave 2 Problems n=173		Wave 2 Nonuse n=560		Wave 2 Asymp. Use n=122		Wave 2 Problems n=435					
	μ	SE	μ	SE	M	SE	μ	SE	μ	SE	μ	SE	μ	SE	μ	SE	μ	SE				
	p						p						p									
Age	46.3	0.2	38.4	0.7	33.2	0.6	.000	38.3	0.8	36.7	1.3	34.5	1.1	.023	31.5	0.7	28.6	1.1	29.0	0.6	.014	
Psychological funct. score	52.9	0.1	51.6	0.4	50.0	0.4	.000	50.0	0.4	53.2	0.9	48.1	0.9	.001	47.8	0.6	49.0	1.2	47.6	0.7	.602	
Physical functioning score	50.8	0.1	52.9	0.4	51.4	0.4	.000	51.3	0.6	52.7	0.8	52.3	0.9	.333	51.7	0.5	52.2	1.2	52.3	0.6	.680	
Number of life stressors	1.5	0.0	2.0	0.1	2.4	0.1	.000	2.5	0.1	2.2	0.2	3.0	0.2	.077	3.2	0.1	3.4	0.2	3.7	0.1	.031	
% Prevalence of selected Wave 1 characteristics	Wave 1 Nonuse						Wave 1 Asymptomatic Use						Wave 1 Problems									
	Wave 2 Nonuse n=31,264		Wave 2 Asymp. Use n=638		Wave 2 Problems n=773		Wave 2 Nonuse n=567		Wave 2 Asymp. Use n=121		Wave 2 Problems n=173		Wave 2 Nonuse n=560		Wave 2 Asymp. Use n=122		Wave 2 Problems n=435					
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE				
	46.6	0.4	52.8	2.4	62.6	2.2	.000	49.9	2.6	70.7	4.4	63.0	4.3	.000	57.6	2.5	71.5	4.2	67.7	2.6	.006	
	29.4	1.6	20.3	2.1	30.7	2.3	.000	23.6	2.3	15.3	3.6	20.2	3.7	.142	34.1	2.7	23.8	4.4	28.6	2.7	.064	
	65.5	0.5	53.1	2.3	41.7	2.2	.000	49.8	2.5	43.7	5.2	39.3	4.8	.127	35.1	2.5	32.3	5.0	32.8	2.6	.772	
	56.3	0.6	61.1	2.4	53.9	2.3	.063	59.6	2.6	72.7	4.6	67.5	3.7	.049	53.8	2.8	51.1	5.5	45.8	3.1	.143	
	25.6	0.7	28.9	2.3	16.8	1.7	.000	21.3	2.2	28.8	5.6	21.3	3.8	.477	14.5	1.8	20.4	4.7	14.2	2.7	.368	
	6.2	0.2	7.0	1.2	9.6	1.2	.016	7.9	1.2	1.8	1.0	11.3	2.8	.001	8.9	1.2	10.8	2.9	13.0	1.9	.197	
							.000							.016							.350	
	Private	70.8	0.8	70.3	2.3	57.9	2.2		70.6	2.4	61.0	5.6	57.3	4.5		55.9	2.8	56.5	5.3	50.4	3.6	
	Public	12.4	0.4	8.1	1.2	12.4	1.5		9.3	1.4	5.2	2.0	10.2	2.6		14.1	1.9	8.9	2.7	11.9	1.8	
	None	16.8	0.6	21.5	2.1	29.7	2.0		20.0	2.2	33.8	5.1	32.5	4.2		30.0	2.5	34.6	5.0	37.6	3.5	
	Region:						.025							.220							.387	
	Northeast	19.8	3.3	20.1	3.7	18.3	3.5		18.8	3.6	19.0	6.0	14.2	4.4		15.2	3.1	17.9	5.1	21.5	4.5	
	Midwest	23.3	3.1	20.0	3.4	21.5	4.3		24.7	3.6	24.2	4.9	20.5	4.6		22.4	3.5	25.4	5.3	22.6	4.5	
South	35.7	3.2	32.0	3.8	36.9	4.3		30.8	3.7	24.6	5.6	25.5	4.8		30.8	3.7	23.4	5.3	28.4	4.0		
West	21.3	3.3	27.9	4.0	23.2	3.8		25.7	4.0	32.3	6.1	39.9	6.5		31.6	4.3	33.4	6.4	27.4	5.2		

Urban residence	79.2	1.7	84.3	2.2	82.4	2.5	.006	81.5	2.3	81.8	4.5	88.2	3.3	.166	81.1	2.4	80.5	4.9	81.7	3.1	.965
Family history of alcohol or drug problems	56.0	0.8	64.2	2.5	69.1	2.3	.000	74.3	2.0	72.2	4.8	77.9	3.4	.556	80.1	2.2	79.9	4.7	80.9	2.3	.956
Childhood abuse	42.8	0.5	58.7	2.6	65.4	2.4	.000	51.8	2.5	59.4	5.4	69.6	3.9	.003	48.9	2.8	62.4	5.1	69.2	2.7	.000
Tobacco status:							.000							.276						.004	
Nonsmoker	76.0	0.5	63.0	2.4	52.1	2.3		46.7	2.8	39.3	4.9	43.6	4.2		41.2	2.7	23.6	3.9	30.6	2.7	
Nondependent smoker	13.8	0.3	19.4	2.0	24.1	1.6		21.3	2.2	34.4	5.2	22.4	3.8		16.0	2.0	31.0	4.7	18.7	2.1	
Nicotine dependence	10.1	0.3	17.7	1.8	23.8	2.1		32.0	2.5	26.3	4.6	34.0	4.7		42.8	2.7	45.4	4.7	50.6	2.7	
Alcohol status:							.000							.092						.131	
Nondrinker	36.0	0.7	15.9	1.7	20.3	1.8		12.8	1.7	4.8	2.4	9.4	2.7		11.8	1.7	7.1	2.6	7.4	1.4	
Low-risk drinker	38.8	0.5	35.8	2.3	30.8	2.0		27.9	2.5	20.4	4.2	21.8	3.7		16.9	2.0	15.0	3.6	12.7	1.8	
Risk drinker	19.5	0.4	32.9	2.1	30.4	2.0		30.3	2.3	38.9	5.5	38.0	4.8		30.4	2.4	34.9	5.1	28.3	2.9	
Alcohol use disorder	5.7	0.2	15.4	1.7	18.5	1.6		29.1	2.2	35.8	5.2	30.8	4.6		40.8	2.9	43.0	5.3	51.7	3.4	
Initiated drug use <age 14	NA	NA	NA	NA	NA	NA		9.1	1.4	11.6	3.3	19.6	3.2	.023	12.5	1.6	16.2	3.5	23.4	2.5	.002
Type of drugs used:														.000						.005	
Less addictive	NA	NA	NA	NA	NA	NA		27.2	2.4	12.1	3.0	9.3	2.7		13.4	1.7	5.5	2.5	5.2	1.2	
More addictive	NA	NA	NA	NA	NA	NA		67.6	2.5	82.3	3.6	77.9	3.8		68.5	2.4	73.7	4.5	72.6	2.7	
Highly addictive	NA	NA	NA	NA	NA	NA		5.3	1.0	5.6	2.4	12.8	2.9		18.2	2.2	20.8	4.1	22.2	2.6	
Affective disorders:																					
Major depressive disorder	4.6	0.2	8.8	1.3	11.2	1.6	.000	9.3	1.5	4.6	2.0	9.6	2.5	.176	11.6	1.5	11.3	3.4	12.4	1.8	.927
Bipolar I	1.6	0.1	2.6	0.8	3.6	0.7	.008	3.5	1.0	4.5	2.2	5.2	1.7	.679	8.9	1.4	13.3	4.2	11.8	2.0	.307
Bipolar II	0.7	0.1	1.5	0.5	1.9	0.6	.056	2.2	0.7	1.5	1.5	2.9	2.0	.856	2.6	0.7	2.1	1.1	4.3	1.1	.410
Dysthymia	1.1	0.1	2.4	0.7	2.4	0.6	.033	1.9	0.7	0.3	0.3	1.2	0.6	.125	3.1	0.8	1.2	0.8	4.3	1.1	.067
Hypomania	0.5	0.1	0.4	0.2	1.2	0.5	.288	0.6	0.3	0.0	0.0	0.8	0.8	.118	2.7	0.8	0.5	0.4	1.7	0.7	.023
Panic w/ agoraphobia	1.4	0.1	1.1	0.4	2.9	0.7	.093	3.4	1.2	1.4	1.3	4.0	2.1	.458	2.8	0.6	3.3	1.6	4.7	1.1	.326
Panic w/ agoraphobia	0.5	0.0	0.1	0.1	1.0	0.3	.000	0.7	0.4	0.7	0.6	1.1	0.9	.927	2.0	0.7	2.8	1.8	3.9	1.3	.422
Social phobia	2.6	0.1	3.7	0.8	3.9	0.9	.127	4.4	1.1	1.6	1.1	4.1	1.5	.140	7.5	1.3	4.5	2.1	8.8	1.7	.264
Specific phobia	6.7	0.3	7.2	1.3	8.5	1.5	.420	11.8	1.6	6.6	2.3	11.6	3.3	.201	12.3	1.7	10.2	3.5	19.6	2.6	.054
Generalized anxiety	1.8	0.1	2.1	0.6	2.2	0.7	.715	3.9	0.8	5.9	2.6	5.0	1.7	.699	6.4	1.2	7.1	2.6	9.3	1.7	.392
Personality disorders:																					
Avoidant	2.0	0.1	3.5	0.9	3.4	0.7	.021	3.4	0.8	3.0	1.8	1.6	0.8	.288	7.2	1.3	5.8	2.3	11.1	2.1	.154

Dependent	0.3	0.0	0.2	0.2	0.7	0.3	.426	0.4	0.2	0.0	0.0	1.3	1.0	.166	1.7	0.6	1.2	1.2	5.5	1.6	.093
Obsessive-compulsive	7.5	0.2	10.1	1.4	12.0	1.4	.007	10.6	1.7	11.9	3.4	9.5	2.5	.836	15.8	2.0	10.9	3.1	19.6	2.3	.128
Paranoid	3.6	0.2	5.2	1.1	7.5	1.2	.004	9.2	1.6	4.4	2.1	5.5	1.7	.116	15.0	2.0	13.3	3.8	19.9	2.3	.167
Schizoid	2.7	0.1	3.4	0.9	5.3	1.1	.039	3.8	0.9	4.7	2.1	4.8	1.7	.849	7.6	1.3	8.5	3.4	12.1	1.9	.146
Histrionic	1.3	0.1	2.6	0.6	3.4	0.7	.003	3.6	0.8	3.5	2.0	9.6	2.8	.146	8.1	1.4	11.7	3.5	12.3	2.1	.251
Borderline	4.6	0.2	7.3	1.2	24.8	2.1	.000	10.9	1.6	7.8	2.7	22.3	3.4	.005	13.7	1.8	14.0	3.4	28.1	2.8	.000
Schizotypal	3.2	0.1	5.0	0.9	17.6	1.7	.000	5.7	1.2	5.7	2.6	9.4	2.8	.446	5.7	1.0	9.4	3.5	19.3	2.2	.000
Narcissistic	5.1	0.2	9.8	1.4	20.7	1.8	.000	10.7	1.5	8.5	3.0	15.0	3.5	.377	11.7	1.8	12.0	3.3	24.8	2.4	.001
Antisocial	2.7	0.1	5.7	1.1	9.9	1.3	.000	6.8	1.1	13.8	3.7	23.3	3.9	.001	18.7	2.2	20.8	4.6	29.6	2.6	.015

Table 3

Odds ratios and 95% confidence intervals for correlates of Wave 1 – Wave 2 transitions in drug status, based on reduced^a multinomial regression models

	Wave 1 Nonuse					Wave 1 Asymptomatic Use					Wave 1 Problems				
	Wave 2 Nonuse n=31,264	Wave 2 Asymp. Use n=638		Wave 2 Problems n=773		Wave 2 Nonuse n=567		Wave 2 Asymp. Use n=121	Wave 2 Problems n=173		Wave 2 Nonuse n=560		Wave 2 Asymp. Use n=122	Wave 2 Problems n=435	
	(Ref.)	Odds ratio	95% conf. interval	Odds ratio	95% conf. interval	Odds ratio	95% conf. interval	(Ref.)	Odds ratio	95% conf. interval	Odds ratio	95% conf. interval	Odds ratio	95% conf. interval	(Ref.)
Age	Ref.	0.98 [*]	(0.97–0.98)	0.95 [*]	(0.94–0.96)	---	---	---	---	---	---	---	---	---	---
Male	Ref.	NS	NS	1.78 [*]	(1.46–2.17)	0.54	(0.32–0.92)	Ref.	NS	NS	---	---	---	---	---
Nonwhite	Ref.	0.54 [*]	(0.42–0.69)	0.77	(0.60–1.00)	2.14 [§]	(1.21–3.76)	Ref.	NS	NS	1.60	(1.10–2.35)	NS	NS	Ref.
Married	Ref.	0.68 [*]	(0.56–0.83)	0.65 [*]	(0.53–0.79)	---	---	---	---	---	---	---	---	---	---
Family income \$70,000	Ref.	NS	NS	0.76	(0.60–0.97)	---	---	---	---	---	---	---	---	---	---
Received public assistance	---	---	---	---	---	NS	NS	Ref.	4.51	(1.09–18.59)	---	---	---	---	---
Public health insurance ^b	Ref.	NS	NS	NS	NS	NS	NS	Ref.	NS	NS	---	---	---	---	---
No health insurance ^b	Ref.	NS	NS	1.33	(1.06–1.66)	0.43 [§]	(0.24–0.77)	Ref.	NS	NS	---	---	---	---	---
West	Ref.	1.50 [*]	(1.25–1.81)	NS	NS	---	---	---	---	---	---	---	---	---	---
Urban residence	Ref.	1.40	(1.07–1.83)	NS	NS	---	---	---	---	---	---	---	---	---	---
Psychological funct. Score	Ref.	NS	NS	0.99	(0.98–1.00)	0.95 [*]	(0.92–0.99)	Ref.	0.94	(0.90–0.97);	---	---	---	---	---
Physical functioning score	Ref.	NS	NS	0.98 [*]	(0.98–0.99)	---	---	---	---	---	---	---	---	---	---
Family history of alcohol or drug problems	Ref.	NS	NS	1.35 [*]	(1.10–1.65)	---	---	---	---	---	---	---	---	---	---
Any childhood abuse	Ref.	1.71 [*]	(1.38–2.11)	1.88 [*]	(1.52–2.33)	---	---	---	---	---	0.52 [*]	(0.36–0.75)	NS	NS	Ref.
Nondependent smoker ^c	Ref.	1.34	(1.01–1.77)	1.78 [*]	(1.45–2.19)	0.53	(0.29–0.96)	Ref.	0.42	(0.20–0.85)	NS	NS	2.28	(1.17–4.46)	Ref.
Nicotine dependence ^c	Ref.	1.42	(1.08–1.85)	1.73 [*]	(1.32–2.25)	NS	---	Ref.	NS	---	NS	NS	NS	NS	Ref.
Low-risk drinker ^d	Ref.	1.78 [*]	(1.31–2.42)	1.40	(1.05–1.86)	---	---	---	---	---	---	---	---	---	---
Risk drinker ^d	Ref.	2.55 [*]	(1.87–3.47)	1.82 [*]	(1.34–2.46)	---	---	---	---	---	---	---	---	---	---
Alcohol use disorder ^d	Ref.	3.40 [*]	(2.29–5.04)	2.59 [*]	(1.84–3.64)	---	---	---	---	---	---	---	---	---	---

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	Wave 1 Nonuse						Wave 1 Asymptomatic Use						Wave 1 Problems					
	Wave 2 Nonuse n=31,264 (Ref.)	Wave 2 Asymp. Use n=638		Wave 2 Problems n=773		Wave 2 Nonuse n=567	Wave 2 Asymp. Use n=121 (Ref.)	Wave 2 Problems n=173		Wave 2 Nonuse n=560	Wave 2 Asymp. Use n=122	Wave 2 Problems n=335 (Ref.)						
		Odds ratio	95% conf. interval	Odds ratio	95% conf. interval			Odds ratio	95% conf. interval				Odds ratio	95% conf. interval				
Initiated drug use at ages <14	---	---	---	---	---	---	---	---	---	0.54*	(0.36–0.81)							
Used more addictive drugs ^e	---	---	---	---	0.37*	(0.19–0.71)	Ref.	NS	NS	0.39*	(0.22–0.71)	NS	NS	Ref.				
Used highly addictive drugs ^e	---	---	---	---	NS	NS	Ref.	NS	NS	0.39	(0.19–0.81)	NS	NS	Ref.				
Major depressive disorder	Ref.	1.49	(1.04–2.15)	1.58	(1.10–2.27)	---	---	---	---	---	---	---	---	---				
Panic disorder	Ref.	0.38§	(0.19–0.79)	NS	NS	---	---	---	---	---	---	---	---	---				
Any Cluster C pers. disorder	---	---	---	---	NS	NS	Ref.	0.30	(0.11–0.80)	---	---	---	---	---				
Avoidant pers. Disorder	Ref.	NS	NS	0.49§	(0.29–0.84)	---	---	---	---	---	---	---	---	---				
Schizotypal pers. Disorder	Ref.	NS	NS	2.16*	(1.52–3.06)	---	---	---	---	0.38*	(0.23–0.65)	NS	NS	Ref.				
Borderline pers. Disorder	Ref.	NS	NS	2.25*	(1.60–3.17)	NS	NS	Ref.	(1.20–7.96)	---	---	---	---	---				
Narcissistic pers. disorder	Ref.	1.56	(1.11–2.18)	1.66*	(1.24–2.21)	---	---	---	---	0.53§	(0.33–0.85)	NS	NS	Ref.				
Antisocial pers. Disorder	---	---	---	---	0.35§	(0.16–0.74)	Ref.	NS	NS	---	---	---	---	Ref.				

Note: "NS" denotes variables with p-values of .05 that were included in the reduced model because they were significant for at least one of the two outcomes or to maintain the appropriate referent category for multi-categorical variables; "----" denotes variables that were not included in the reduced model.

^a Models containing only variables significant at p<.05 level or whose inclusion was necessary to maintain the proper referent for categorical variables Referents for categorical variables:

^b Private health insurance;

^c Nonsmoker;

^d Nondrinker;

^e Used less addictive drugs

§ p<.01;

* p<.005