Stimulant Use Trajectories and the Longitudinal Risk of Heavy Drinking: Findings From a Rural Population-Based Study

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Abstract

The extant literature offers little information about the longitudinal course of alcohol use among stimulant users, particularly those in rural areas, but it is plausible that reductions in stimulant use are accompanied by increases in heavy drinking. The objective of this study was to examine the longitudinal relationships between heavy drinking days and latent trajectories of powder cocaine, crack cocaine, and methamphetamine use. Participants ($n = 710$) were identified via Respondent-Driven Sampling in 3 rural communities in each of 3 states, with interviews conducted every 6 months over 3 years. Latent trajectory classes for powder cocaine, crack cocaine, and methamphetamine use were identified by conducting latent class growth analysis (LCGA). Generalized linear models (GLM) were conducted to examine how these latent classes were associated with the number of heavy drinking days in the past 30 days. Heavy drinking days did not significantly change over time when adjusting for covariates. Compared to those with a "fast low" trajectory of crack use, those with "steady high" and "declining" trajectories had more heavy drinking days. Compared to those with a "fast low" trajectory of powder cocaine use, those with a "steady moderate" trajectory had more heavy drinking days. Trajectories of methamphetamine use were not significantly associated with heavy drinking days. In conclusion, heavy alcohol use changes little over time among rural stimulant users. Many rural cocaine users could potentially benefit from interventions aimed at curtailing heavy drinking.

Keywords

alcohol; stimulants; methamphetamine; cocaine; trajectories; latent class growth analysis

1. Introduction

Cross-sectional analyses of population-based surveys indicate that many persons concurrently use alcohol and cocaine (Grant & Harford, 1990). Relative to cocaine, little research has investigated alcohol consumption among methamphetamine (MA) users, although findings from one cross-sectional survey showed that daily alcohol intoxication is positively associated with past year MA use (Furr, Delva, & Anthony, 2000). Although the co-occurrence of alcohol and stimulant use has been established by cross-sectional research, very little is known about their prospective, longitudinal interplay. Even less is known about the longitudinal epidemiology of alcohol and stimulant use among residents of rural areas, despite the fact that approximately 21% of Americans reside in rural communities (U.S. Census Bureau, 2006) and some evidence that alcohol use differs between rural and urban residents (Booth, Curran, & Han, 2004; Borders & Booth, 2007).

The overarching objective of the study was to investigate the longitudinal associations between heavy alcohol consumption and trajectories of powder cocaine, crack cocaine, and MA use among residents of rural areas using one or more of these stimulants at study entry. We describe changes in the number of heavy drinking days over a 3-year period; identify different latent trajectory classes for powder cocaine, crack cocaine, and MA use; and examine how those latent trajectory classes are associated with changes in heavy drinking over time.

2. Method

2.1. Setting

The study is based on data collected as part of the Rural Stimulant Study (RSS), a population-based study of cocaine and methamphetamine users in 3 rural counties in each of 3 states (Ohio, Kentucky, and Arkansas) (Booth, Leukefeld, Falck, Wang, & Carlson, 2006; Borders et al., 2008).

2.2. Subjects

Eligibility criteria were: 1) recent stimulant use, defined as the self-reported use of crack cocaine, powder cocaine, and/or MA by any route of administration within the previous 30 days; 2) age 18 years or older; 3) a verifiable address in one of the targeted counties; and 4) no formal drug abuse treatment in the 30 days prior to the baseline interview.

Participants were recruited using Respondent-Driven Sampling (RDS) (Heckathorn, 1997; Heckathorn, 2002). Initial study seeds completed a baseline interview and were asked to hand out study referral coupons to other persons whom they knew. Seeds received $10 for each referral (up to 3 referrals) who completed an interview. Participants received $50 after completion of each interview.

2.3. Data collection

Between 225 and 250 persons were recruited in each state, for a total sample size of 710 stimulant users at baseline. The 36-month participation rate was 73%. Results from attrition analyses indicate that younger persons, males, and whites were slightly more likely not to complete a follow-up interview. Written informed consent was obtained from all participants and their identity was further protected by a certificate of confidentiality granted by the National Institute on Drug Abuse.

2.4. Measures

The dependent variable is the number of heavy drinking days in the past 30 days, which was assessed at baseline and each follow-up interview by asking, "In the past 30 days, how many heavy drinking days did you have (heavy drinking means 6 drinks or more in one day for men and 4 drinks or more in one day for women)?" Participants were instructed that one drink of alcohol was the equivalent of a 12 oz. beer, a 4 oz. glass of wine, or a 1½ oz. shot of liquor.

At each interview, participants were asked, "On how many days in the past 30 days did you use [drug]?" We created binary variables indicating any past 30-day powder cocaine, crack cocaine, and MA use. As discussed in the analysis section, these binary variables were used to develop latent trajectory classes for powder cocaine, crack cocaine, and MA use.

We included in our analysis potential confounders of the relationship between stimulant and alcohol use. Time invariant covariates included gender, race/ethnicity, and the recruitment site. Time variant covariates included age; educational attainment; marital status; and ASI employment, legal, and psychiatric summary scores (McLellan et al., 1992). We also included a binary variable that was set at 1 at the first follow-up interview for which a participant reported receiving treatment and included binary variables indicating the past 30-day use of drugs that were used by more than 10% of the sample at the baseline interview.

2.5. Statistical analysis

We first conducted latent class growth analysis (LCGA) using the MPlus v. 6.0 software program to identify homogeneous groups of participants with similar powder cocaine, crack cocaine, and MA use trajectories. These latent classes are based on the past 30-day use/non-use of each drug. We determined the appropriate number of classes based on Bayesian information criteria (BIC), Akaike information criteria (AIC), entropy, and the usefulness of the classes in practice, as has been done by other researchers (Muthen & Muthen, 2000). Indicator variables were created for each latent trajectory, with "fast low" use classes serving as reference groups. Next, we calculated the mean number of heavy drinking days over time for each powder cocaine, crack cocaine, and MA use trajectory. We then estimated a generalized linear model (GLM) using SAS version 9.2 PROC GENMOD to examine how the latent trajectory classes of powder cocaine, crack cocaine, and MA use were associated with the number of heaving drinking days in the past 30 days. The model specified repeated measures nested within site and a Poisson distribution for the number of heavy drinking days, which was highly skewed. In addition, we included time and other covariates described earlier and we tested for potential interactions between time and each trajectory class.

3. Results

3.1. Sample statistics

At the baseline interview, the sample was rather young with a mean age of 33.05 years (SD=10.35), approximately evenly distributed across the 3 study sites, predominantly male (61.41%), mostly white (67.88% white, 29.30% black/African American, and 2.82% other races), with low education attainment (41.40% had less than a high school education, 42.68% had a high school degree/equivalency, and 15.92% had more than a high school education), and largely single (84.23%). Illicit drug use, other than cocaine and MA, was common at the baseline interview for marijuana (80.99%), amphetamines (12.39%), non-prescription tranquilizers (26.66%), and non-prescribed pain killers (45.63%). The ASI composite scores were as follows: employment mean=0.569, SD=0.291; legal problems mean=0.104, SD=0.182; and psychiatric problems mean=0.167, SD=0.219.

3.2. Latent class growth analysis

Table 1 describes the number and percentage of observations assigned to each latent trajectory class based on their most likely membership and how the mean number of heavy drinking days changes over time by class. Figures of the trajectories are available from the first author.

For powder cocaine, we selected a model with 4 classes that had the lowest AIC and BIC values. The "steady high" class was characterized by a continued high probability of use over time (0.87 and 0.77 probabilities at the baseline and 36-month interviews, respectively). The "declining" class was characterized by a very dramatic decline in the probability of use from baseline (0.74) to the 36-month interview (0.03). A "steady moderate" class had a moderate probability of use at the baseline interview (0.28) that declined slightly toward the 36-month interview (0.19). The "fast low" class was characterized by a rapid decline in the probability of use between the baseline (0.33) and 6-month follow-up interview (0.01) and a further decline to 0.00 probability over the remaining follow-up period.

For crack cocaine, the AIC and BIC values were lowest for 5 classes, but we selected a 4-class profile because one of the classes in the 5-class model had a low proportion (4.5%) of observations. As was the case for powder cocaine, we found for crack cocaine a "steady high" class in which the probability of use remained high (0.93 and 0.94 probabilities at the baseline and 36-month interviews, respectively) and a "declining" class in which the probability of use declined rather markedly over time (0.81 and 0.11 probabilities at the baseline and 36-month interviews). In contrast to powder cocaine, the crack cocaine trajectories included an "increasing" class that exhibited a heightened probability of use over time (0.22 and 0.37 probabilities at the baseline and 36-month interviews). Finally, like for powder cocaine, there was a "fast low" class characterized by a rapid decline in the probability of use between the baseline (0.38) and 6-month follow-up interviews (0.06) that remained near or at 0.00 over the remaining follow-up.

For MA, the AIC and BIC values were lowest for 4 classes, but we selected a 3-class profile because one of the classes in the 4-class model had a low proportion (3.5%) of observations. All of the MA classes were characterized by declining trajectories, but at different rates. The "moderate to low" class had a 0.75 probability of use at baseline, which declined to less than 0.05 by the final interview. The "high to moderate" class had a less marked decline in the probability of MA use from 0.75 at baseline to 0.52 at 36 months. Finally, as we found for powder and crack cocaine, a "fast low" MA class exhibited a sharp decline in the probability of use between the baseline (0.25) and the 6-month interviews (0.01) and continued to remain near or at 0.00 over the following interviews.

3.3. Regression analysis of heavy drinking days

Table 2 shows results from the generalized linear model of heavy drinking days in the past 30 days. Significant ($P < 0.05$) results are italicized. Persons in the "steady moderate" powder cocaine use class had significantly more heavy drinking days compared to those in the "fast low" powder cocaine class. Persons in the "steady high" and "declining" crack cocaine classes had significantly more heavy drinking days compared to those in the "fast low" crack cocaine class. The MA classes appear to be unrelated to heavy drinking over time. Of the remaining drug use variables, the past 30-day use of marijuana, amphetamines, non-prescription tranquilizers, and non-prescribed painkillers were significantly associated with heavy drinking days. Formal substance abuse treatment was negatively associated with heavy drinking days.

4. Discussion

A small number of prospective studies of alcohol and heroin use have found that many persons remit from using these substances over time without formal substance abuse treatment (Cunningham, 1999; DeWit, Offord, & Wong, 1997; Shah, Galai, Celentano, Vlahov, & Strathdee, 2006; Sobell, Cunningham, & Sobell, 1996), which has frequently been termed "spontaneous recovery." Similarly, in a study related to the data described herein, approximately 1/3 of stimulant users not in-treatment abstained from cocaine and MA after 24 months of follow-up (Borders et al., 2008). Although such recovery is a positive outcome, a key concern is the possibility that persons increase their consumption of alcohol as they reduce their use of cocaine and/or MA. Overall, our findings suggest that continued use of many illicit drugs is associated with more frequent heavy drinking, rather than the inverse.

Our findings also suggest that many rural users of stimulants as well as several other commonly used illicit drugs could potentially benefit from substance abuse treatment, at least with regard to their alcohol use. However, because only about 34% of all participants received some type of formal substance abuse treatment over the course of 3 years, and we found significant differences in treatment rates among the 3 study sites (Carlson et al., 2010), any treatment-based intervention would have a modest impact, especially in communities with limited treatment access.

In conclusion, the current study expands our knowledge of the natural history of alcohol use and stimulant use among stimulant users residing in rural areas of the U.S., where methamphetamine and cocaine use have become major public health concerns, just as they are in many urban communities. The findings from this study suggest persons with certain longitudinal trajectories of crack and powder cocaine use engage in significantly different patterns of heavy drinking, but we found little evidence that cocaine or MA users who decrease their stimulant use also increase their use of alcohol over time.

Acknowledgments

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Research Highlights

On average, heavy drinking does not change over time among rural stimulant users.

Particular trajectories of cocaine use are associated with greater heavy drinking days.

Many rural cocaine users could potentially benefit from interventions aimed at curtailing heavy drinking.

Table 1

Latent Trajectory Class[a] and Mean Heavy Drinking Days by Class Over Time

| Drug | Class Name | N in class | % in class | Mean Heavy Drinking Days, by Interview | | | | | | | |
				Baseline	6-mo	12-mo	18-mo	24-mo	30-mo	36-mo
Powder Cocaine	Steady high	60	8.5	7.22	7.53	7.21	6.78	7.07	6.31	5.88
	Declining[b]	118	16.6	7.79	6.32	6.27	5.37	4.26	4.71	4.78
	Steady moderate[b]	145	20.4	8.59	5.70	6.23	6.40	4.96	5.36	5.22
	Fast low[b]	387	54.5	5.55	3.76	3.97	3.57	4.19	3.71	3.97
Crack Cocaine	Steady high	119	16.7	8.16	6.87	8.76	7.17	7.60	7.55	6.91
	Declining[b]	165	23.2	8.07	6.58	5.89	5.83	4.04	4.45	4.14
	Increasing	81	11.4	6.60	3.52	4.13	3.64	4.90	4.12	4.43
	Fast low[b]	345	48.6	5.53	3.60	3.49	3.61	3.59	3.30	3.37
Meth.	High to moderate	58	8.2	4.86	3.63	2.52	4.35	5.22	3.21	3.57
	Moderate to low	148	20.8	5.82	4.51	4.38	4.48	4.54	4.91	4.05
	Fast low[b]	504	71.0	7.15	5.36	5.88	5.04	4.66	4.60	4.95

[a] Classification of individuals based on their most likely latent class membership.

[b] Time trend in heaving drinking days $P < 0.05$, based on results from generalized linear models for each class with time entered as the only independent variable.

Table 2

Longitudinal Associations Between Heavy Drinking Days and Cocaine and Methamphetamine Latent Trajectory Classes[a]

Variable	Est.	SE	P
Intercept	1.110	0.203	<0.0001
Age (years)	0.006	0.005	0.248
Time (1–7)	0.004	0.013	0.771
Site (v. Ohio)			
Arkansas	0.062	0.127	0.622
Kentucky	*0.537*	*0.141*	*0.0001*
Male (v. female)	0.141	0.078	0.071
Race/ethnicity (v. white)			
Black	0.188	0.124	0.130
Other	−0.226	0.233	0.333
Education (v. < high school)			
High school	*−0.198*	*0.095*	*0.037*
> high school	−0.158	0.135	0.241
Married (v. single)	−0.138	0.085	0.103
Powder cocaine class (v. Fast low)			
Steady high	0.179	0.162	0.270
Declining	0.155	0.122	0.203
Steady moderate	*0.248*	*0.107*	*0.020*
Crack cocaine class (v. Fast low)			
Steady high	*0.359*	*0.131*	*0.006*
Declining	*0.240*	*0.112*	*0.032*
Increasing	0.039	0.147	0.791
Meth. class (v. Fast low)			
High to moderate	−0.141	0.189	0.454
Moderate to low	−0.085	0.121	0.480
Marijuana use past 30 days (v. none)	*0.302*	*0.074*	*<0.0001*
Amphetamine use past 30 days (v. none)	*0.267*	*0.084*	*0.002*
Tranquilizer use past 30 days (v. none)	*0.285*	*0.060*	*<0.0001*
OxyContin	0.003	0.081	0.974
Painkiller use past 30 days (v. none)	*0.267*	*0.060*	*<0.0001*
ASI employment score (0–1)	−0.013	0.107	0.904
ASI legal problems score (0–1)	0.144	0.132	0.276
ASI psychiatric score (0–1)	−0.154	0.132	0.244
Past 6 month treatment (v. none)	*−0.342*	*0.096*	*0.0004*

[a] From SAS Proc Genmod with Poisson distribution for heavy drinking days.