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An exploration of alcohol use severity and route of drug administration among persons that use heroin and cocaine

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Abstract

Background: Alcohol use is prevalent among populations of persons that use illicit drugs. Problematic alcohol use among persons that use heroin and cocaine has been associated with poor treatment adherence, abstinence maintenance, and mental health concerns. Fully exploring how alcohol use severity interacts with route of administration (ROA) may be of notable importance in development of treatment protocols for persons that use heroin and cocaine.

Methods: Data from a neurological and sociobehavioral assessment of risk factors among injection and noninjection drug users known as the NEURO-HIV Epidemiologic Study was used in the analyses. Participants ($N = 551$) included those who reported their level of past-30-day alcohol use and past-6-month heroin and cocaine use.

Results: Multiple logistic regression analyses found that both problematic and moderate alcohol users were significantly less likely than abstainers to report injecting heroin and cocaine. Both problematic and moderate alcohol users were significantly more likely than abstainers to snort substances.

Conclusions: Alcohol use may play a role in promoting or impeding the use of substances through certain ROAs. Treatment protocols that transition persons that use injection heroin and cocaine to noninjection use of these substances may be used in conjunction with treatments that reduce alcohol consumption as a means to reduce noninjection drug use.

Keywords

Alcohol; cocaine; heroin; route of administration

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Author contributions

Michael Scherer conceived the idea for the current study, developed the study design, analyzed the results, and was responsible for a majority of writing and editing on the manuscript. Paul T. Harrell made contributions to the introduction section and analysis of data. Rebecca C. Trenz contributed to the introduction section and prepared and revised the manuscript for the special edition. Sarah Canham provided writing and editing support. William W. Latimer is the principal investigator on this project. Dr. Latimer provided consistent guidance and support on the formulation of the analyses and final version of the manuscript.

Introduction

Alcohol use is prevalent among populations of persons that use illicit drugs; in fact, research has indicated that approximately 91% of persons who use heroin and 77% of persons who use cocaine have reported a history of alcohol use or misuse.^{1,2} In addition, problematic alcohol use among persons who use heroin and cocaine has been associated with poor treatment adherence,³ abstinence maintenance,^{3,4} and increased mental health concerns.^{5,6} When examining heroin or cocaine use, having a thorough understanding of alcohol use among this population and the role it plays in the consequences of route of administration (ROA) can be of vital importance for developing treatment protocols. Fully exploring how alcohol use interacts with ROAs may be particularly important among persons who use heroin and cocaine given the low rates of treatment completion among this group.⁷ Previous research exploring ROAs has typically focused on injection drug use (IDU) for persons who use heroin and noninjection drug use (NIDU) for persons who use cocaine.^{8–10} Despite the prevalence of alcohol use among persons that use illicit drugs, research in this area has generally overlooked the role alcohol may play in ROA.

Different ROAs have varied immediate and long-term outcomes. IDU, for example, is associated with increased risk for vein deterioration, skin and soft tissue abscesses,¹¹ drug dependence,^{12,13} and overdose.^{14,15} Smoking substances has been linked to medical complaints and higher mortality rates.^{13,16–19} Snorting substances has been linked to increased risk of engaging in sex exchange behaviors such as trading sex for drugs.²⁰ Persons who use injection drugs were more likely to meet diagnostic criteria for abuse or dependence, have a greater perceived need for substance abuse treatment, and were more likely to have co-occurring mental and physiological concerns.²¹ Among persons who use heroin, few noteworthy demographic differences have been found between IDU and NIDU as it pertains to alcohol use.

The literature on heroin use has typically considered other forms of heroin use (i.e., snorting, swallowing, smoking) as transitional periods ultimately leading to injection.²² Some literature, however, has indicated that NIDU is gaining popularity among persons that use heroin.²³ Some reasons for switching from IDU to NIDU include social stigma associated with IDU, health concerns, and preferences for other ROAs.²⁴ Although alcohol use is common among persons that use cocaine,^{8,9,25,26} previous research has found that those who snort cocaine tend to use increased amounts of alcohol compared with those who utilized other ROAs. For example, in a study of adults in outpatient treatment for cocaine dependence, those who met diagnostic criteria for alcohol dependence were significantly more likely to snort cocaine when compared with those who did not meet the same diagnostic criteria.²⁷ Similarly, despite the physiological and behavioral concerns associated with the use of the crack cocaine,^{20,28,29} those who used crack tended to drink less alcohol than those who did not.³⁰

Although heroin and cocaine are typically used independently, it is not uncommon for these 2 substances to be combined in what is called *speedball*. The preferred ROA for persons who use speedball is either injection or snorting,³¹ making this population vulnerable to human

immunodeficiency virus (HIV) transmission and other blood-borne diseases. Further, among persons that use opioids, injecting speedballs was linked to using unclean equipment as well as sharing injection equipment.³² Outside of physical dependence and the risk of infectious disease, the use of cocaine and speed-balls has been associated with a host of physical and psychological health problems.^{11,33,34} In addition, overdosing among young users of injection drugs was associated with the use of speedballs, with an average of more than 2 overdose episodes per individual.³⁵ These studies underlie not only the general consequences of speedball use, but also of IDU specifically. Hence, gaining a better understanding of how factors such as alcohol use may impact IDU and allow individuals who use these illicit substances to move away from IDU to NIDU is of vital importance when abstinence from these substances is not possible.

The physical and psychological consequences of both heroin and cocaine use make this a topic of particular importance for scientific study. Furthermore, it is critical to gain a thorough understanding of how the severity of alcohol use and consequences associated with different ROAs intersect. Understanding the role alcohol use plays in ROA may prove a useful tool in allowing interventionists to create protocols that—in lieu of cessation of heroin or cocaine use—may allow persons that use these substances to move from ROAs with high health risks (i.e., IDU) to less risky NIDU ROAs. To this end, the current study examines ROA as it relates to the use of heroin and cocaine and how the use of these substances may be predicted by alcohol consumption above and beyond the moderate or abstinence level.

Methods

Sample

The population in the current study was drawn from baseline data of a parent study designed to investigate neuropsychological and social-behavioral risk factors among drug users in Baltimore known as the NEURO-HIV Epidemiologic Study. This study was monitored and approved throughout its duration by the institutional review board at the Johns Hopkins Bloomberg School of Public Health. The NEURO-HIV Epidemiologic Study is discussed in detail elsewhere^{36,37}; therefore, it will be outlined below only as it is directly relevant to the current study.

Participants of the NEURO-HIV Epidemiologic Study were between the ages of 15 and 50 years and self-reported their use of injection and noninjection drugs in the prior 6 months. The HIV-Risk Behavior Interview is a detailed behavioral assessment of drug use and sexual practices. Questions addressed demographic, educational, medical, and neurodevelopment variables along with a detailed assessment of lifetime and recent (past day, past week, past month, past 6 month, past year) drug use and sexual practices, including a history of sexually transmitted infections (STIs). Participants were recruited through advertisements in local papers, street outreach, and referrals from local service agencies. Participants provided written informed consent, completed a face-to-face HIV-Risk Behavior Interview, and were then reimbursed \$45 in gift cards. The present study used a subset of participants ($N = 551$) who disclosed their level of alcohol use in the prior 30 days and their other drug use for the prior 6 months.

The mean age of the sample was 32.9 years ($SD_{age}=7.4$). The majority of the sample was male (58.6%) and almost evenly split between those who identified as white (50.6%) and those who identified as black (49.4%). See Table 1 for descriptive statistics for the entire study sample.

Measures

General demographics—Participants self-reported demographic information including age, sex, race, highest educational attainment, employment status, incarceration, and homelessness history. Participants were recruited from a sociodemographic region of the United States where the median household income is \$41,385 and 23.8% of persons live below the poverty level.

Alcohol use problem severity—Similar to Scherer et al.,²⁶ alcohol use severity was created following guidelines laid out by the National Institute on Alcohol Abuse and Alcoholism (NIAAA).³⁸ The NIAAA defines excess or problematic alcohol use as an average of 14 standard drinks for men and 7 standard drinks for women per week. In the United States, a standard drink equates to 12 fluid ounces of beer, 8 to 9 fluid ounces of malt liquor, 5 fluid ounces of wine, and 1.5 fluid ounces of 80-proof spirits or hard liquor. Past-30-day alcohol consumption was assessed in the current study, as this is the standard used by Substance Abuse and Mental Health Services Administration (SAMHSA) to classify drinking severity categories. Participants who reported consuming no alcohol in the prior 30 days were placed in the “Abstinent” drinking condition ($n = 222$). In the prior 30 days, if a female participant reported consuming 30 drinks or fewer, or a male participant reported consuming 60 or fewer drinks, they were classified as “Moderate Drinkers” ($n = 212$). If either group consumed more than their respective limits, they were placed in the “Problematic Drinkers” category ($n = 117$).

Substance use—Participants self-reported use of any of the following substances in the 6 months prior to the assessment: injection, snorting, smoking and swallowing of heroin, injection and snorting of cocaine, injection or smoking of crack, and injection or snorting of speedballs. “Yes” responses were coded 1, whereas “no” responses were coded 0 for each substance. Participants also completed single item measures assessing age of first drink, first IDU, and first NIDU (see Table 1 for descriptive data of ROA in the sample).

Statistical analyses

Means and frequencies were used to describe the demographic variables and substance use characteristics of study participants. Chi-square statistics were conducted to determine significant differences in ROA among conditions of drinking severity. Multiple logistic regressions were conducted to determine differences between drinking severity and ROA. Age and sex were included as covariates in all logistic regressions. All statistical analyses used SPSS version 18.0 (SPSS, Chicago, IL).

Results

Chi-square analyses were used to identify differences between levels of drinking severity and ROA for heroin, cocaine, crack, and speed-ball use. Drinking severity groups were found to be significantly different on measures of heroin injection ($\chi^2 = 25.84, P < .001$), snorting ($\chi^2 = 11.01, P = .004$), and smoking ($\chi^2 = 7.40, P = .025$). A majority (67.6%) of those who abstained from alcohol in the past month injected heroin in the past 30 days. The majority (56.1%) of persons identified as problematic drinkers snorted heroin. Injecting and snorting were significant for cocaine use ($\chi^2 = 10.69, P = .005$ and $\chi^2 = 25.06, P < .001$, respectively) and speed-ball use ($\chi^2 = 7.23, P = .027$ and $\chi^2 = 7.48, P = .024$, respectively), whereas smoking was the only ROA significant for crack use ($\chi^2 = 23.16, P < .001$). Over two fifths (41.4%) of persons that abstained from alcohol injected cocaine and over two fifths of persons identified as problematic drinkers snorted cocaine (see Table 2 for a summary of each ROA for each substance by drinking severity group).

Drinking severity condition was a significant predictor of injecting and snorting heroin. Persons identified as problematic drinkers were about one third as likely as abstainers to inject heroin, and about one half as likely as persons identified as moderate alcohol users to inject heroin (adjusted odds ratio [AOR] = 0.35, 95% confidence interval [CI]: 0.12–0.60 and AOR = 0.47, 95% CI: 0.29–0.84, respectively). Persons identified as moderate alcohol users were 1.66 times more likely than abstainers to have snorted/sniffed heroin in the prior 6 months (AOR = 1.66, 95% CI: 1.11–2.47). Similar relationships for smoking and swallowing heroin were not found in the current study (Table 3 displays the associations between drinking severity conditions and past-6-month ROA for each substance).

Persons that were identified as problematic alcohol users were about half as likely as either those that abstained from alcohol use or persons with moderate alcohol use to have injected cocaine in the prior 6 months (AOR = 0.52, 95% CI: 0.31–0.89 and AOR = 0.53, 95% CI: 0.32–0.90, respectively). Those identified as moderate users were 1.72 times more likely than abstainers to snort/sniff cocaine (AOR = 1.72, 95% CI: 1.04–2.85), whereas those with problematic use were almost 4 times more likely than abstainers (AOR = 3.94, 95% CI: 2.29–6.80) and over twice as likely as those identified as moderate users to have snorted/sniffed cocaine in the prior 6 months (AOR = 2.32, 95% CI: 1.41–3.81). Persons with problematic alcohol use were also almost half as likely as those with moderate use to have injected speedball in the prior 6 months (AOR = 0.55, 95% CI: 0.33–0.93), whereas persons with problematic use were about twice as likely as abstainers to have snorted/sniffed speedball (AOR = 2.14, 95% CI: 1.06–4.34). Finally, compared with abstainers, persons with moderate alcohol use were almost twice as likely and persons with problematic alcohol use were almost 3 times as likely to have smoked crack in the prior 6 months (AOR = 1.93, 95% CI: 1.29–2.89 and AOR = 2.88, 95% CI: 1.75–4.77, respectively).

Discussion

The current study has several important findings concerning the role of drinking severity on ROA among persons that use heroin and cocaine. Although previous literature found minimal differences between IDU and NIDU among persons that use heroin,²¹ the inclusion

of the alcohol drinking severity component in the current study demonstrates a noteworthy difference in these conditions. That is, with both heroin and cocaine—and to a lesser degree, speedball—participants who reported problematic use of alcohol were significantly less likely to use injection as a preferred ROA and more likely to snort/sniff a substance. This may indicate that alcohol use somehow interferes with IDU or may make injection less appealing, while simultaneously having the opposite effect on the snorting of drugs. This would not be the first example of moderate alcohol use benefiting the physical or mental health of an individual.³⁹ Perhaps the social nature of alcohol use provides the person who uses these substances with a social support network, which in turn provides some degree of protection against the more deleterious nature of injection. Although this relationship is not clear in the current study, others have theorized that IDU may lose favor as a ROA due to social stigma.²⁴ The idea is that if alcohol is primarily used in social settings, the social network may contribute to a desire to avoid the socially stigmatizing ROA of IDU. The current study, however, did not emphasize the social setting in which the participant generally drank, and as such, further exploration of the relationship between social stigma and ROA must be reserved for future research.

Previous literature has indicated that those who were characterized as having problematic alcohol use were significantly more likely to snort or sniff cocaine powder when compared with those who did not meet this alcoholic criteria.²⁷ This was supported in the current study in that persons identified as having problematic alcohol use were almost 4 times more likely than persons that abstained from alcohol and over 2 times more likely than persons that used alcohol moderately to snort/sniff cocaine. Similarly, persons who used alcohol moderately were almost twice as likely to snort/sniff cocaine, as were those that abstained from alcohol use. This is consistent with research conducted by Gossop et al.,³⁰ who found persons that use alcohol at a problematic level were almost 4 times more likely than those who abstained from alcohol use to snort/sniff cocaine. This may also be explained by the social stigma hypothesis; the social stigma associated with IDU, coupled with a continued desire for substance use, may result in change of ROA from IDU to snorting. It is not clear in the current study, however, the order in which the problematic use of alcohol contributed to illicit drug use.

Interestingly, Gossop et al.³⁰ found that those who smoked crack cocaine were less likely to drink excessive amounts of alcohol. In the current study, compared with abstainers, those who reported the moderate and problematic use of alcohol were respectively almost 2 and 3 times more likely to have smoked crack cocaine in the previous 6 months. This difference may be due to what Gossop et al. refer to as the order of use. The current research examined the ability of alcohol use to predict current ROAs of persons that use heroin and cocaine, whereas Gossop et al.'s research focused primarily on concurrent alcohol use with other substance use. Despite this methodological difference, however, both studies underlie the importance of examining the role of alcohol use on route of illicit drug administration.

A more thorough understanding of the role alcohol use plays in ROA may prove useful in the treatment of other substances. For example, previous literature has discussed the utility of helping those who abuse heroin and cocaine to move to less harmful ROAs.⁴⁰ Although abstinence is clearly the desired outcome for treatment, for those who cannot achieve

abstinence, transition to a less harmful ROA may provide a useful intermediate step during treatment and may at least reduce the risk of blood-borne illnesses. The transition from the use of injection drugs to noninjection drugs can then be used in conjunction with treatment protocols that focus on the reduction of alcohol use as a mechanism to help reduce noninjection drug use. If, as the current research indicates, the moderate or problematic use of alcohol plays a significant role in determining ROA, a more thorough understanding of the mechanisms by which this occurs may allow interventionists to aid in moving illicit drug users to less harmful ROAs.

The current study has several limitations that should be noted here. First, the current study utilizes a cross-sectional design and cannot be used for making causal statements. Further, as this study focuses particularly on persons that use heroin and cocaine, the generalizability of findings to other populations is limited. Ideally, alcohol use time frame and illicit substance use time frame would be identical. However, in dealing with a hard-to-reach population such as persons that use heroin and cocaine, limiting participants to the prior month—as opposed to the prior 6 months—would have dramatically reduced the sample size for the study. Further, prior research has found that individuals who have engaged in heroin use in the prior 6 months were likely to do so again.^{41,42} The current research also utilizes self-report measures to assess substance use behaviors, and participants may over- or underreport their substance use. Despite this, however, self-report measures of substance-related variables provide information over a greater time interval than could be achieved by other methods. Further, Darke⁴³ conducted a review of self-report among IDUs and concluded that using self-report is a reliable and valid method of describing drug use behaviors and history. Given the nature of the research questions, the use of self-report measures appeared both necessary and appropriate.

Due to the limited number of participants who reported a ROA beyond injecting or snorting heroin or cocaine, as well as injection of crack cocaine, interpretation of findings regarding the role of drinking severity on those particular ROAs should be done with caution. Previous research has indicated NIDU to be growing in popularity particularly among persons that use heroin.^{23,24} Beyond snorting heroin, the small number of respondents who reported smoking or swallowing any substances (other than crack cocaine) makes interpretation of these data difficult. However, the data do seem to suggest that some relationship is present, and although this cannot be accurately ascertained in the current research, future research aimed at further exploring this relationship is warranted. Lastly, future research should address the misuse of alcohol among users of heroin and cocaine transitioning from IDU to NIDU and how these individuals may fit into treatment protocols.

Conclusions

The current study provides valuable information in understanding the role of drinking severity on ROA among persons that use heroin and cocaine. Although clearly abstinence from the use of heroin and cocaine would be the preferred result, transitioning to less harmful ROAs may serve as a valuable intermediate step to abstinence. More specifically, treatment protocols that transition persons that use injection heroin and cocaine to noninjection use of these substances can then be used in used in conjunction with treatment

protocols that focus on the reduction of alcohol consumption as a means to reduce noninjection drug use. Future research should seek to explore why the consumption of alcohol by persons who use heroin and cocaine is associated with less detrimental ROAs, specifically IDU, and how interventions may subsequently capitalize on this unique finding.

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Table 1.Descriptive statistics of participants ($N = 551$).

Characteristic	<i>n</i>	%
Sex		
Male	323	58.6
Female	228	41.4
Race		
White	279	50.6
Black	272	49.4
Education		
Less than high school	251	45.6
Finished high school or GED	300	54.4
Drinking severity		
Abstinence	222	40.1
Moderate	212	38.3
Problematic	117	21.2
Route of administration—Heroin		
Injection	316	57.4
Snorting	276	50.1
Smoking	6	1.1
Swallowing	28	5.1
Route of administration—Cocaine		
Injection	201	36.5
Snorting	131	23.8
Swallowing	12	2.2
Route of administration—Speedball		
Injection	199	36.1
Snorting	63	11.4
Crack		
Injection	13	2.4
Smoking	295	53.5

Table 2.

Prevalence of recent heroin and cocaine use route of administration by drinking severity group.

Route of administration	Drinking severity group						χ^2
	Abstinent ^a (n = 222)		Moderate ^a (n = 212)		Problematic ^a (n = 117)		
	n	%	n	%	n	%	
Heroin							
Injection	150	67.6	120	56.6	46	39.3	25.84 ^{***}
Snorting	91	41.0	119	56.1	66	56.4	11.01 ^{**}
Smoking	2	0.1	0	0	4	3.4	7.40 [*]
Swallowing	8	3.6	11	5.2	9	7.7	3.32
Cocaine							
Injection	92	41.4	81	38.2	28	23.9	10.69 ^{**}
Snorting	34	15.3	50	23.6	47	40.2	25.06 ^{***}
Swallowing	5	2.3	2	0.1	5	4.3	1.58
Speedball							
Injection	85	38.9	84	39.6	30	25.6	7.23 [*]
Snorting	17	7.7	25	11.8	21	17.9	7.48 [*]
Crack							
Injection	5	2.3	6	2.8	3	2.6	0.16
Smoking	93	41.9	121	57.1	81	69.2	23.16 ^{***}

^aPrior 30 days.^{*} $P < .05$;^{**} $P < .01$;^{***} $P < .001$.

Summary of logistic regression analysis with drinking severity group as a predictor of past-6-month heroin and cocaine use by route of administration.

Table 3.

Predictor	Injection		Snorting		Smoking		Swallowing	
	AOR ^a	(95% CI)	AOR ^a	(95% CI)	AOR ^a	(95% CI)	AOR ^a	(95% CI)
Predictors of heroin use								
Abstainers vs. moderate users	0.68	0.43–1.08	1.66*	1.11–2.47	—	—	1.25	0.41–3.88
Abstainers vs. problematic users	0.35***	0.21–0.60	1.52	0.95–2.44	5.60	0.34–92.04	3.14	0.84–11.74
Moderate vs. problematic users	0.47**	0.29–0.84	0.95	0.60–1.52	—	—	2.53	0.68–9.41
Predictors of cocaine use								
Abstainers vs. moderate users	1.01	0.66–1.52	1.72*	1.04–2.85	—	—	0.60	0.09–4.18
Abstainers vs. problematic users	0.52*	0.31–0.89	3.94***	2.29–6.80	—	—	2.32	0.44–12.36
Moderate vs. problematic users	0.53*	0.32–0.90	2.32**	1.41–3.81	—	—	3.92	0.41–37.72
Predictors of speedball use								
Abstainers vs. moderate users	1.01	0.72–1.62	1.45	0.74–2.81	—	—	—	—
Abstainers vs. problematic users	0.61	0.36–1.01	2.14*	1.06–4.34	—	—	—	—
Moderate vs. problematic users	0.55*	0.33–0.93	1.57	0.83–2.97	—	—	—	—
Predictors of crack use								
Abstainers vs. moderate users	1.05	0.17–6.56	—	—	1.93***	1.29–2.89	—	—
Abstainers vs. problematic users	0.97	0.10–9.83	—	—	2.88***	1.75–4.77	—	—
Moderate vs. problematic users	0.68	0.07–6.58	—	—	1.55	0.94–2.56	—	—

^a Adjusted odds ratio, adjusted for age and sex. Drinking severity group was created using prior-30-day alcohol use.

* $P < .05$;

** $P < .01$;

*** $P < .001$.