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Cigarette smoking, illicit drug use, and routes of administration among heroin and cocaine users

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Abstract

Cigarette smoking is ubiquitous among illicit drug users. Some have speculated that this may be partially due to similarities in the route of administration. However, research examining the relationship between cigarette smoking and routes of administration of illicit drugs is limited. To address this gap, we investigated sociodemographic and drug use factors associated with cigarette smoking among cocaine and heroin users in the Baltimore, Maryland community (N=576). Regular and heavy cigarette smokers were more likely to be White, have a history of a prior marriage, and have a lower education level. Regular smoking of marijuana and crack was associated with cigarette smoking, but not heavy cigarette smoking. Injection use was more common among heavy cigarette smokers. In particular, regular cigarette smokers were more likely to have a lifetime history of regularly injecting heroin. Optimal prevention and treatment outcomes can only occur through a comprehensive understanding of the interrelations between different substances of abuse.

Keywords

polydrug; tobacco; epidemiology; routes of administration; cocaine; heroin

1. Introduction

Tobacco use is associated with increased mortality among heroin and cocaine users (Hser, et al., 1994; Hurt, et al., 1996). Many substance abuse clinicians resist addressing tobacco use, claiming that substance users are uninterested in such treatment, and that it would hinder treatment for illicit substances (Guydish, Passalacqua, Tajima, & Manser, 2007; Weinberger & Sofuoglu, 2009). However, most opioid-dependent patients are interested in quitting smoking (Clarke, Stein, McGarry, & Gogineni, 2001; Clemmey, Brooner, Chutuape, Kidorf, & Stitzer, 1997), quitting smoking is associated with less use of other substances (Kohn, Tsoh, & Weisner, 2003; Satre, Kohn, & Weisner, 2007), and cigarette smoking is a predictor

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of worse illicit treatment outcomes (Frosch, et al., 2000; Frosch, et al., 2002; Harrell, Montoya, Preston, Juliano, & Gorelick, 2011). Further, smoking cessation treatment is effective for smokers dependent on illicit substances (Burling, Burling, & Latini, 2001) and inconsequential to substance abuse treatment outcome (Gariti, et al., 2002), although the ideal timing for such treatment is controversial (Joseph, Willenbring, Nugent, & Nelson, 2004; but see Baca & Yahne, 2009; Fu, et al., 2008).

Cigarette consumption may have a different relationship with opioid use than with cocaine use. Cigarette smoking predicts poorer cocaine treatment outcomes, but has an ambiguous relationship with opioid treatment outcomes (Harrell et al, 2011); likewise, the relationship between craving or use of cigarettes and cocaine may be stronger than the same relationship between cigarettes and heroin (Epstein, Marrone, Heishman, Schmittner, & Preston, 2010). Stimulus generalization may explain this disparity. In the US, crack cocaine smoking is more common than heroin smoking (SAMHSA, 2009). Cues for drug intake are associated with increased craving among substance users (Carter & Tiffany, 1999) and stimulus generalization predisposes individuals to relapse (Siegel & Ramos, 2002). Thus, lighters, smoke, and other stimuli that occur with both cigarette and crack smoking may interfere with abstinence attempts. If stimulus generalization does occur, it would provide further evidence that – particularly for those who smoke other substances, such as marijuana or crack – tobacco dependence can hinder sustained recovery and should be addressed with substance abuse treatment.

The goal of this study is to examine epidemiological evidence for stimulus generalization. One type of evidence that may support stimulus generalization would be if cigarette smoking is associated with increased smoking of other substances. Research examining the relationship between the route of administration (ROA) of cocaine/heroin and cigarette smoking is limited. Cigarette smoking is nearly ubiquitous among cocaine and heroin users (Clemmey et al., 1997; Patkar et al., 2002), so examining the extremely rare non-smokers is unlikely to provide useful information. Comparing heavy cigarette smokers with lighter smokers may be a more productive approach. Twenty or more cigarettes per day (CPD) may be a convenient and appropriate cut-off to describe heavier smokers relative to lighter smokers. Self-reports of CPD typically cluster around a pack (20) a day, a phenomenon called “digit bias” (Klesges, Debon, & Ray, 1995). These biases represent a validity problem, but self-report nonetheless performs similarly to more complicated methods, such as Ecological Momentary Assessment, in discriminating less severe from more severe smokers (Klesges, et al., 1995; Shiffman, 2009). In other words, although it is unlikely that individuals who smoke 19 CPD differ substantially from those who smoke 20 CPD, it is likely that individuals who – due to digit bias – *report* smoking 20+ CPD may differ substantially from those who report smoking less than 20 CPD. The present study examines associations of cigarette smoking with sociodemographic variables and various methods of administering illicit drugs in a sample of recent users in Baltimore, MD. We hypothesize that 1) the most commonly reported CPD will be 20; and 2) higher rates of smoking, particularly smoking 20+ CPD, will be associated with increased smoking of other substances, supporting stimulus generalization.

2. Methods

2.1 Participants

The present study used baseline data from the NEURO-HIV Epidemiologic study (Severtson, Mitchell, Hubert, & Latimer, 2010). The Institutional Review Board at the Johns Hopkins Bloomberg School of Public Health approved and monitored this study. This sample includes 576 participants who reported using cocaine and/or heroin in the past 6 months.

2.2 Measures

HIV-Risk Behavior Interview—Smoking severity was assessed by average number of CPD in the past week. Variables related to cigarette smoking in the general population were included, such as race (Pinsky, 2006; Siahpush, Singh, Jones, & Timsina, 2010), education (Pampel, 2009), marital status (Fleming, White, & Catalano, 2010), homelessness (Lee, et al., 2005), occupational status (Shavers, Lawrence, Fagan, & Gibson, 2005), and parental drug use (Barrett & Turner, 2006). We were particularly interested in the role of income source in cigarette smoking (Farrelly, Bray, Pechacek, & Woollery, 2001; Siahpush, Wakefield, Spittal, Durkin, & Scollo, 2009). “Previously married” included any participants that were divorced, separated, or widowed. “Parental drug use” refers to drug use by a parent during the childhood of the participant. For “Substances ever used”, separate questions are asked based on ROA. Questions regarding heroin injection, for example, are asked separately from questions regarding heroin smoking. Sixty-three substance-ROA pairs are included. We conducted chi-square and logistic regression analyses for any substance use or any regular use of alcohol, marijuana, or any form of cocaine/heroin use endorsed by 5% or more of the sample. Regular substance use was defined as ever using the substance daily or nearly daily for 3 months or more.

2.3 Statistical analysis

Four smoking groups were created: 1) “*non-smokers*” (0 CPD); 2) “*light smokers*” (1–19 CPD); 3) “*regular smokers*” (a pack, or 20 CPD); and 4) “*heavy smokers*” (over 20 CPD). Comparisons between groups were conducted using chi-square (χ^2) tests for urinalysis results, main income source, any lifetime use, and any regular use. Odds Ratios for regular/heavy cigarette smoking, i.e., smoking 20 or more CPD versus smoking less than 20 CPD, were determined by univariate and multivariate logistic regression. Substance-ROA pairs were examined in separate models due to multicollinearity concerns (Morton, 1977). We adjusted for the number of illicit substances ever used and sociodemographic variables to reduce the influence of potential confounders.

3. Results

3.1 Cigarette self-report clustering

The vast majority (91%) reported daily cigarette smoking. Similar to prior literature (Klesges, et al., 1995; Shiffman, 2009), the most frequently reported number of CPD was 20 ($n = 204$; 35%). Few (6%) reported smoking between 11 and 18 CPD and no participant reported smoking 19, or 21–24 CPD, demonstrating the presence of “digit bias”, i.e., a tendency to report smoking exactly 20 CPD (Klesges, et al., 1995; Shiffman, 2009).

3.3 Drug use characteristics

Chi-square revealed significant differences by smoking status for opioid-positive urinalysis ($p < .01$), main source of income ($p < .01$), any lifetime injection of cocaine ($p < .01$), heroin ($p < .01$), or speedball ($p = .03$), and any history of regularly either smoking marijuana ($p = .03$), smoking crack ($p = .047$), or injecting heroin ($p < .01$). Over three-quarters of *heavy smokers* were positive for opioids (83%), compared to slightly over half of *non-smokers* (51%). More *heavy smokers*’ main source of income was a regular job (32%) than *non-smokers* (19%). *Non-smokers*’ main income source differed from *heavy smokers* ($p = .03$), but not *light smokers* ($p = .18$). Large majorities of *heavy smokers* have injected cocaine (58% vs. 43%), heroin (83% vs. 50%), or speedball (60% vs. 41%), compared to no more than half of non-smokers. Most *light smokers* regularly smoked marijuana (57%), compared to less than half of both *heavy smokers* (48%) and *non-smokers* (48%). Similarly, many *light smokers* regularly smoked crack (42%), compared to *heavy smokers* (27%) and *non-smokers* (32%).

The pattern for heroin injection was more linear. Over two-thirds of *heavy smokers* regularly injected heroin (72%), compared to less than half of *non-smokers* (41%). See Figure 1.

3.4 Odds of Regular/Heavy Cigarette Smoking

See Table 1 for odds of regular/heavy cigarette smoking based on sociodemographic and drug use variables. Examination of lifetime regular drug use revealed that in the unadjusted model, lifetime history of regular marijuana smoking, heroin injection, and “speedball” injection were associated with increased risk of regular/heavy cigarette smoking. Only injection of heroin remained significant when controlling for sociodemographic and comorbidity variables.

4. Discussion

The present study identified correlates of regular/heavy cigarette smoking among a large sample of 576 recent cocaine and heroin users. In support of the first hypothesis, the most commonly reported number of CPD was 20, suggesting “digit bias” (Klesges, et al., 1995; Shiffman, 2009). Evidence regarding the second hypothesis – generalization of cue reactivity of smoking from one substance to another – was ambiguous. Although there were differences by smoking status for the regular smoking of marijuana or crack, the differences were in unexpected directions. In both cases, more light smokers used regularly than both heavy smokers and non-smokers. Cocaine patients report that heavy cigarette smoking makes the regular smoking of other substances difficult due to the harshness of the smoke (Sees & Clark, 1993). This may interfere with the ability of stimulus generalization of cue reactivity to increase overall smoking. Further research is needed.

Although the hypothesized relationship was not found, regular/heavy smokers used a greater number of other substances and more heavy smokers have ever injected. Further, regular/heavy cigarette smokers were more likely to have regularly injected heroin. This is consistent with findings that current injection drug users (IDUs) smoke more than prior IDUs (Marshall, et al., 2011). The reason for this relationship is unclear. Heroin injection may be a particularly severe form of drug use that is associated with more severe behavior in general (Chun, et al., 2009; Gossop, Griffiths, Powis, & Strang, 1992). Controlling for various covariates helped to reduce this possibility, but may not have accounted for the true differences driving this relationship. Further research should examine this issue in other subgroups, such as prescription opioid users.

Alternatively, something specific about injection, opioid use, or injection heroin use may be uniquely associated with cigarette smoking. Injection of heroin leads to a larger subjective “high” than nasal heroin (Comer, Collins, MacArthur, & Fischman, 1999), and is more prevalent than smoking of heroin (SAMHSA, 2009). Only one person from the present sample reported ever smoking heroin regularly. Opiates such as heroin tend to increase cigarette smoking by human participants in experimental designs (Chait & Griffiths, 1984; Spiga, Martinetti, Meisch, Cowan, & Hursh, 2005). It is also possible that nicotine is useful in relieving pain associated with injection. Although the relationship between tobacco smoking and pain is complex, nicotine appears to relieve pain in humans (Shi, Weingarten, Mantilla, Hooten, & Warner, 2010). In animals, opioids and nicotine can cause cross-tolerance to pain-relieving effects (Biala & Weglinska, 2006; Pomerleau, 1998). Further research is needed, especially given the intertwined relationships between injection heroin use, HIV/AIDS, cigarette smoking, and increased mortality (Braithwaite, et al., 2005; Burkhalter, Springer, Chhabra, Ostroff, & Rapkin, 2005; Chaturvedi, et al., 2007; Engels, et al., 2006).

The study had some limitations. The data are cross-sectional, so no causal relationships can be established. Longitudinal and experimental research may provide better answers to questions about stimulus generalization. Additionally, further research in other areas is needed to see if our results are generalizable outside of Baltimore, MD. For example, the co-occurrence of heroin injection and cigarette smoking may be a cultural factor specific to Baltimore. Also, data were obtained by self-report, which may be limited by memory biases or trust issues. The urinalysis data, however, is consistent with self-report, and self-report is recognized as relatively reliable and valid (Darke, 1998; Shiffman, 2009).

There are several notable strengths. The inclusion of a large sample of a hard-to-reach group of heroin and/or cocaine users provided for advantages compared to prior literature. It permitted for detailed analysis of sociodemographics and the creation of multivariate models to explore potential confounders. We were able to examine adequate sample sizes of non-smokers, light smokers, regular smokers, and heavy smokers. Finally, this is the only study on illicit drug use and cigarette smoking of which we are aware that provides data on routes of administration for both cocaine and heroin, including heroin and/or cocaine users who have never injected either drug. Optimal prevention and treatment outcomes require a comprehensive understanding of the interrelations between different substances of abuse.

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Highlights

- We examined correlates of cigarette smoking among heroin and cocaine users
- Regular tobacco smokers more likely to be White, previously married, and uneducated
- Marijuana and crack use associated with cigarette smoking, but not heavy smoking
- Injection use was more common among heavy cigarette smokers
- Tobacco smokers more likely to regularly inject heroin, even when covariate adjusted

Figure 1. Percentages of illicit drug users who reported smoking crack, smoking marijuana, or injecting heroin regularly during their lifetime as a function of cigarette smoking status. Regular drug use was defined as using every day or nearly every day for three months or more.

Table 1

Correlates of regular/heavy cigarette smoking (a pack a day or greater) among a sample of 576 recent¹ cocaine and/or heroin users in Baltimore, Maryland.

	Total	OR ²	95% C.I. ³	AOR ⁴	95% C.I. ³
Sociodemographics and Polydrug use					
Age	33.0±7.4	0.95	0.93, 0.97	0.98	0.95, 1.01
Female Gender	235(41%)	0.83	0.60, 1.16	1.11	0.75, 1.63
White Race	276(48%)	4.41	3.11, 6.26	3.02	1.93, 4.73
High School Diploma or GED	248(43%)	0.64	0.46, 0.89	0.64	0.44, 0.95
Previously Married	129 (22%)	1.60	1.08, 2.38	2.00	1.26, 3.18
Recent ¹ Homelessness	117 (20%)	1.28	0.85, 1.93	1.09	0.69, 1.73
Recent ¹ Income from Regular Job	143 (25%)	1.40	1.00, 1.95	1.39	0.94, 2.05
Parental Drug Use During Childhood	253 (47%)	1.04	0.75, 1.44	0.80	0.55, 1.17
Number of Illicit Substances Ever Used	10.7±6.3	1.09	1.05, 1.12	1.05	1.01, 1.08
Lifetime Regular⁵ Drug Use					
Drank Alcohol	336(59%)	1.16	0.83, 1.62	1.08	0.74, 1.57
Smoked Marijuana	331(58%)	1.49	1.07, 2.08	1.13	0.76, 1.69
Snorted Cocaine	109(19%)	1.13	0.75, 1.72	1.21	0.75, 1.94
Smoked Crack	204(35%)	0.84	0.60, 1.18	1.12	0.75, 1.68
Injected Cocaine	113(20%)	1.29	0.85, 1.95	0.94	0.58, 1.53
Snorted Heroin	323(56%)	1.00	0.72, 1.40	1.27	0.87, 1.85
Injected Heroin	332(58%)	2.59	1.84, 3.64	1.58	1.05, 2.39
Snorted Speedball	47(8%)	1.00	0.55, 1.82	1.34	0.69, 2.63
Injected Speedball	123(21%)	1.51	1.01, 2.25	1.52	0.96, 2.40

Statistically significant findings appear in **bold**.

¹ 'Recent' defined as past 6 months

² Odds Ratios

³ Confidence Interval

⁴ Adjusted Odds Ratios, Adjusted for all Sociodemographic and Polydrug use variables

⁵Regular refers to daily or near daily use for 3 months or more