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Understanding Subtypes of Inner-City Drug Users with a Latent Class Approach

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Abstract

Aims—We empirically identified subtypes of inner-city users of heroin and cocaine based on type of drug used and route of administration.

Method—The sample was recruited from the communities in Baltimore, MD (SHIELD study) and consisted of 1,061 participants who used heroin and or cocaine in the past 6 months on a weekly basis or more. Latent class analysis (LCA) was used to identify subtypes of drug users based on type of drug and route of administration. Logistic regression was used to compare the subtypes on depressive symptoms, injection risk and drug network compositions.

Findings—Inner-city drug users were classified into five subtypes: three subtypes of injection drug users (IDUs) [heroin injecting (n=134; 13%), polydrug and polyroute (n=88, 8%), and heroin and cocaine injecting (n=404, 38%)], and two subtypes with low proportions of IDUs (LIDUs) [heroin snorting (n=275, 26%) and crack smoking (n=160; 14%)]. The polydrug and polyroute subtype had the highest depressive symptoms risk among all subtypes. Injection risk was lowest in the heroin injecting subtype and significantly differed from heroin and cocaine injecting subtype. The IDU subtypes also varied in the drug network compositions. The LIDU subtypes had similar depressive symptoms risk but vastly differed in the drug network compositions.

Conclusions—Subgroups of inner-city cocaine and heroin users based on type and route of administration differed in their depressive symptoms, injection risk and drug network

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Contributors

Janet Kuramoto designed the research question, undertook the statistical analyses and wrote the first draft of the manuscript. Amy Bohnert advised on statistical analysis. All authors contributed to designing of the study and interpretation of the findings. Carl Latkin provided the data. All authors revised the manuscript drafts. All authors contributed to and have approved the final manuscript.

Conflict of Interest

None of the authors report any conflict of interests.

compositions. Future studies should longitudinally examine factors associated with transitioning across these subtypes to better inform prevention and treatment efforts.

Keywords

latent class analysis; heroin; cocaine; polydrug use; injection

1. Introduction

1.1. Drug abuse in inner-city communities

Drug abuse among individuals residing in inner-city communities has been a long-term public health concern and contributes to significant health consequences (Cornish and O'Brien, 1996; Johnson et al., 1990). Research suggests that polydrug use is also relatively common among those who abuse drugs (Gossop et al., 2002; Latkin et al., 1996b; Leri et al., 2003), and understanding variations in co-use of drugs has important public health implications among inner-city drug users as well. Co-use of heroin and cocaine has been associated with poorer heroin treatment outcomes (Williamson et al., 2006), and individuals who use both may benefit from different therapies (Dobler-Mikola et al., 2005). Additionally, individuals with polydrug use histories and disorders have been shown to be at high risk for a number of outcomes, including psychopathology (Kandel et al., 2001), HIV risk behaviors (Klee et al., 1990) and drug overdose (Darke and Hall, 2003).

1.2. Heterogeneity of drug users in inner-city communities

Previous studies have examined variations in drug users residing in these inner-city communities by either type of drug used or route of drug administration. Both environmental context (Caprioli et al., 2009) and individual characteristics (Hopwood et al., 2008) may drive what type of drug an individual uses. Understanding differences between individuals who use heroin, cocaine, or both is important, given the differing pharmacological actions of these two substances, their associated risks and the specialized treatments that have been developed for each. The route of administration is also relevant to those who use heroin or cocaine. Injecting differs from snorting or smoking in the risk for HIV transmission. Use of multiple routes may also indicate an increased risk; for example, crack smokers who also inject have been noted to engage in greater HIV risk than those who inject but do not smoke crack (Booth et al., 1993). Studies that compared injectors (IDUs) to non-injectors (NIDUs) also suggested differences between these groups on factors such as age, drug use frequency and social networks (Carpenter et al., 1998; Des Jarlais et al., 2007; Neaigus et al., 2006). Previous studies have noted the importance of social networks on drug initiation, persistence and cessation (Galea et al., 2004; Schroeder et al., 2001), as well as for injection risk behavior (De et al., 2007). Drug use and social networks can also be bidirectional (Bohnert et al., 2009), for individuals can shape their drug social network, such as by reducing drug-using social networks (Buchanan and Latkin, 2008) and affiliating with those who use similar types of drugs (Latkin et al., 2001). As drug use is a social behavior, examination of drug network composition as related to drug use pattern would further sharpen our understanding of the context surrounding polydrug use.

1.3. Using latent class analysis to understand pattern of drug use

Latent class analysis (LCA) has been a particularly helpful strategy for empirically identifying subtypes and distinct patterns based on a set of characteristics (McCutcheon, 1987). This technique has been used to examine drug use patterns in national epidemiologic samples of drug users (Agrawal et al., 2007; Carlson et al., 2005; Lynskey et al., 2006). Although these studies have the ability to generalize to a broader population of drug users, they have had a limited ability to identify and describe types of heroin and cocaine users

(aside from an omnibus category of heroin and/or cocaine users), largely because the sampling of users of these substances was low. Additionally, these studies identified patterns of polydrug use based solely on type of drug used or dependence on these drugs.

To date, at least one study has used LCA to distinguish subtypes of drug users beyond pharmacological properties, based on the route and type of drugs. This study was conducted in Canada and found three classes: one class that consisted of high use of Tylenol 3 and benzodiazepine with a high rate of depression and pain, a second included non-injectors and crack smokers, and a third consisted of injection drug users (IDUs) with a high rate of HIV and Hepatitis C (Monga et al., 2007). An extension of this study using a more recent sample found eight classes (Patra et al., 2009). However, both studies were restricted to opioid users, which may only capture a portion of inner-city drug users. Although use of cocaine is relatively common among opioid users (Leri et al., 2003), sampling of opioid users alone may miss a subset of crack cocaine users who do not use opioids (Latkin et al., 2001). The current study attempts to refine our understanding of drug users in an inner-city setting by examining heterogeneity of heroin and/or cocaine drug users, and polydrug users in particular, who used any of these drugs on a weekly basis in the prior six months. We further examined if these resulting subtypes differed in depressive symptoms, injection risk and drug network compositions.

2. Methods

2.1 Study Description

The present study used data from the baseline assessment of the Self-Help In Eliminating Life-threatening Diseases (SHIELD) study, a network-based HIV prevention intervention study conducted in Baltimore, MD (Latkin et al., 2003b). Participants were recruited from communities with high rates of drug use by trained recruiters from 1997 to 1999 for the baseline assessment. Participants were eligible for the SHIELD study if they had at least weekly contact with drug users, were 18 years of age or older, were willing to become peer educators to educate their network members on HIV risk reduction techniques, were willing to bring in a risk network member for assessment, and were not recently enrolled in other HIV behavioral interventions. Among the 1,637 participants who completed the baseline visit, 1,183 individuals reported using illegal drugs in the past 6 months. This study further focused on a final sample of 1,061 individuals who used heroin and/or cocaine once a week or more in the past six months and had complete data on the sociodemographic covariates considered in this study. Study procedures were reviewed and approved by the Committee on Human Research at the Johns Hopkins School of Public Health. All participants provided an informed consent and were paid $15 at the completion of the interview.

2.2 Measures

2.2.1 Alcohol and Drug use—Interviewers asked how often the participants used the following drugs in the past 6 months: drank alcohol, smoked marijuana, took stimulants (other than cocaine), took sedatives, used poppers, injected heroin, snorted heroin, injected speedball (cocaine mixed with heroin), injected methadone, snorted cocaine, injected cocaine, or smoked crack. The available responses ranged from ‘none in the past 6 months’, ‘less than once a week’, ‘1–2 times a week’, ‘3–4 times a week’, ‘almost everyday’, ‘everyday’, ‘2–5 times a day’ and ‘more than 5 times a day’.

2.2.2 Sociodemographic—Participants were asked a series of demographic questions. The demographic characteristics considered in this study were gender, race, education, age, unemployment, homelessness, self-reported HIV status, and ever been in a drug treatment or detoxification program.

2.2.3 Depressive Symptoms—Depressive symptoms were assessed using the Center for Epidemiologic Studies for Depression scale (CES-D) (Radloff, 1977). This scale has been shown to have high reliability and validity among non-clinical drug users (Golub et al., 2004). Participants were asked 20 items regarding their psychological well-being in the past two weeks. The possible answers of 'none', 'some of the time', 'most of the time' or 'all the time,' were given the score of 0, 1, 2, or 3, respectively. These 20 items were summed, with a total possible score of 60. The cutoff point of ≥ 16 was used to define moderate depressive symptoms (Mandell et al., 1999) and ≥ 23 to denote severe depressive symptoms (Husaini et al., 1980).

2.2.4. HIV Injection Risk—Two questions were used to assess if the respondent had engaged in injection risk. Injection risk was defined as using unclean needles or cookers in the past 30 days.

2.2.4. Drug Network Composition—The composition of drug-using networks was examined using the Personal Network Inventory, which is a modified version of the Arizona Social Support Inventory (Barrera and Gottlieb, 1981). This inventory has been shown to have good concurrent and predictive validity and internal consistency (Latkin et al., 1996a). This inventory delineated up to twenty individuals (network members) who comprised the respondent's support and risk network. This inventory also asked participants to list the type of drugs that the participant's network members used. A drug network member was defined as a network member who used drugs, such as heroin, crack or cocaine in the past 6 months. Since many of these variables were not normally distributed, drug network compositions were explored by examining the presence of network members who have used each of the following drugs: injected heroin, injected cocaine, injected speedball, snorted heroin, snorted cocaine or smoked crack.

2.3. Statistical Analyses

2.3.1 Latent class analysis—Latent class analysis (LCA) (McCutcheon, 1987) was used to empirically define and describe subtypes of the drug users in terms of the types of drugs used and route of administration in the past 6 months. The following eight items were used to define the subtypes: 1) drank alcohol, 2) smoked marijuana 3) injected heroin, 4) injected speedball, 5) injected cocaine, 6) snorted heroin, 7) snorted cocaine, and 8) smoked crack. The use of drugs such as sedative, stimulants, poppers and methadone was rare in this sample (weekly use of sedative <5%, <2% for stimulants and <1% for poppers and methadone) and was not considered in the LCA. The frequencies of drug use were not normally distributed; therefore, eight items were dichotomized as 'using on a weekly basis or more' versus 'less than once a week or never.' A dichotomous response was preferred over the categorical frequency responses to better meet the assumption of conditional independence required for LCA.

The LCA was conducted using MPlus version 5.0 (Muthén and Muthén, 1998–2007). Missing data on these items were minimal; twenty-one individuals were missing on one drug item, one individual was missing responses on two drug items and another individual was missing responses on three drug items, but were still considered in the LCA. The two parameters of interest, a conditional probability of endorsing the item given the latent class and a latent class prevalence, were obtained from the model.

We first performed the analysis iteratively for two- through seven-class models without adjusting for demographic covariates and compared the models using several fit indices (Akaike's Information Criteria (AIC), Bayesian Information Criteria (BIC), Entropy, Lo-Mendel Rubin Test (LMRT) and Bootstrap Likelihood Tests (BLT)) and the interpretability

of the results. We then selected a model with the best fit indices and re-ran the latent class analysis adjusting for sociodemographic covariates in Table 3 (gender, age, race, education, unemployment in the past 6 months, homelessness in the past 6 months, HIV self-report positive and ever been in drug treatment), as recommended by Muthen et al. (2004) to better classify individuals into their respective class membership (Muthén, 2004).

2.3.2 Comparison across the subtypes—To examine the differences across these classes on the outcomes of interest, we then used the most likely class membership obtained from the adjusted LCA to classify individuals into a mutually exclusive subtype. These subtypes were then compared across sociodemographics, depressive symptoms, injection risk and drug network composition using the Chi-square tests for categorical variables and Kruskal-Wallis test for continuous variable (age). Sub-comparisons among the injecting (IDU) classes and low proportion of injecting (LIDU) classes were also conducted. We also ran unadjusted and adjusted logistic regressions to examine the association between these subtypes on depressive symptoms, injection risk and drug network compositions. These analyses were conducted using Stata version 10 (StataCorp, 2007).

3. Results

3.1. Description of the sample

The study included 1,061 respondents of active drug users who reported using heroin or cocaine on a weekly basis or more in the past 6 months. Thirty-seven percent of the sample were female (n=397) and predominantly African-American (94%). The mean age of the respondents was 39 (SD=7.0). Weekly use of drugs was high, except for cocaine injecting and marijuana use, which was reported in 12% and 20% of the entire sample. Table 2 and Table 3 further describe the sample.

3.2. Number of classes

The fit statistics of the models for 2 through 7 classes are described in Table 1. The five-class model was selected based on the lowest BIC and highest entropy. The average probability of most likely class membership ranged from 86% to 94%, with most ambiguity to differentiate between Class 4 (heroin snorting subtype) and Class 5 (crack smoking subtype).

3.2 Characteristics of the Five-Class Model

Table 2 shows the conditional probability of endorsing each item (route and type of drugs) among participants classified into their most likely class membership for the five-class model. Three classes emerged as the injecting subtypes (referred to as IDUs subtypes; Classes 1, 2, and 3) and two classes as the minimally injecting subtypes (referred to as Low proportion of IDUs (LIDUs) subtypes; Classes 4 and 5). Thirteen percent of the drug users (n=134) was classified as heroin injecting subtype (Class 1). Ninety-six percent of individuals assigned to this subtype had injected heroin, and the majority used one drug that was not marijuana or alcohol. Class 2 was labeled as polydrug and polyroute subtype (n=88; 8%). All individuals estimated to be in this class used injecting and non-injecting drugs (which included crack). Class 3 was referred to as the heroin and cocaine injecting subtype, since majority of respondents classified into this subtype used multiple injecting drugs. Twenty-six percent of the overall sample was classified into Class 4 (heroin snorting subtype). All individuals assigned to this class snorted heroin, and forty-three percent of these individuals also smoked crack. Fourteen percent (n=160) were classified into Class 5 (crack smoking subtype); 94% of these individuals were crack smokers.

3.4. Comparison of Sociodemographics across Subtypes

There were statistically significant differences across these subtypes on all sociodemographic characteristics examined (Table 3). The majority of these differences were driven by differences between IDU and LIDU subtypes. In general, individuals classified into IDU subtypes were more likely to have a history of drug treatment and be HIV-positive than those classified into LIDU subtypes.

To further examine the sources of these differences, sub-comparisons were made within the IDU subtypes and within the LIDU subtypes. Only 26% classified into the heroin and cocaine injecting subtype was female, whereas this was over 40% for the other two IDU subtypes. A greater proportion of individuals classified into heroin and cocaine injecting subtype had HIV-positive status and history of drug treatment. Among the three IDU subtypes, the proportion of homelessness was lowest in the heroin injecting subtype. Among the LIDU subtypes, the heroin snorting subtype had a greater proportion of females and history of drug treatment but lower proportion of homeless and HIV-positive individuals than the crack smoking subtype.

3.5. Comparison of Subtypes on Depressive Symptoms, Injection Risk and Drug Network Compositions

Table 4 examines the association between these subtypes with depressive symptoms, injection risk and drug network compositions, after adjusting for sociodemographic characteristics examined in Table 3. The LIDU subtypes were less likely to have severe depressive symptoms than the IDU subtypes [AOR=0.74 95%CI=0.56–1.00]. Among the IDU subtypes, the polydrug and polyroute subtype had the highest risk for both moderate and severe depressive symptoms, as compared to the heroin and cocaine injecting subtype [AOR=3.50; 95%CI=1.80–6.80 and AOR=2.63; 95%CI=1.40–4.94, respectively], and as compared to the heroin injecting subtype [AOR=3.32; 95%CI=1.79–6.48 and AOR=2.92; 95%CI=1.55–5.53, respectively]. No differences in depressive symptoms between the two LIDU subtypes were noted.

Individuals classified into heroin injecting subtype were less likely to share needles or cookers in the past 30 days than individuals classified into heroin and cocaine injecting subtype [AOR=0.54; 95%CI=0.35–0.83]. However, injection risk was not significantly different between the polydrug and polyroute subtype from the other two IDU subtypes.

Table 4 also demonstrates significant differences in the composition of drug network members across these subtypes. The LIDU subtypes were less likely to have any injecting networks and were more likely to have snorting and crack smoking networks, as compared to the IDU subtypes. When the heroin injecting subtype was compared to the heroin and cocaine injecting subtype, significant differences were noted in the presence of networks who inject heroin [AOR=1.86; 95%CI=1.22–2.85] or speedball [AOR=0.50; 95%CI=0.33–0.77], but these subtypes did not differ in the presence of non-injecting networks. The presence of injecting networks was similar between the polydrug and polyroute subtype and the heroin and cocaine injecting subtype. However, the two groups differed in the presence of a heroin snorting network [AOR=2.41; 95%CI=1.43–4.06] and crack smoking network [AOR=2.52; 95%CI=1.48–4.29]. The polydrug and polyroute subtype was also significantly different from the heroin injecting subtype in the presence of a heroin injecting network [AOR=0.51; 95%CI=0.29–0.91] and crack smoking network [AOR=2.72; 95%CI=1.46–5.04]. The crack smoking subtype differed from the heroin snorting subtype in the presence of both injecting and non-injecting networks. The crack smoking subtype was less likely to have a heroin injecting network and was more likely to have a cocaine injecting network, as compared to the heroin snorting subtype [AOR=0.53, 95%CI=0.31–0.91 and AOR=3.38;

95%CI=1.42–8.03, respectively]. These subtypes also differed in the presence of a heroin snorting network and presence of a crack smoking network [AOR=0.32; 95%CI=0.21–0.48 and AOR=5.18; 95%CI=3.24–8.29, respectively].

4. Discussion

This study empirically supported the heterogeneity of inner-city drug users recruited from community settings in Baltimore, MD. The LCA identified five classes of inner-city drug users among individuals who used heroin or cocaine on a weekly basis or more in the past 6 months; these classes were distinguished by both route and type of drugs. The five subtypes found in this study were broadly categorized as IDU subtypes and LIDU subtypes. This study further found heterogeneity within the IDU and LIDU subtypes. Within the IDU subtypes, the polydrug and polyroute subtype used both non-injecting and injecting drugs, whereas the other two IDU subtypes were more likely to be injecting alone (heroin injecting and heroin and cocaine injecting subtypes). These subtypes differed in depressive symptoms, injection risk and drug network compositions. The polydrug and polyroute subtype was particularly distinct in drug network compositions compared to the other IDU subtypes. The two LIDU subtypes (crack smoking and heroin snorting) were indistinguishable in depressive symptoms but varied in their drug network compositions.

Consistent with previous studies that used LCA (Monga et al., 2007; Patra et al., 2009), we found a considerable heterogeneity among inner-city drug users. However, we found more discrete classes of drug users than Monga and colleagues (2007) and fewer than Patra and colleagues (2009). The differences may be attributable to the distinction between crack cocaine and powder cocaine use, more sampling of heroin users than prescription opioid users in our study, and more broadly, to regional variations in drug use preferences and drug availability. This study also partially supported Latkin and colleagues' (2001) study, which used a non-LCA approach to examine differences in five predominant groups of past year drug users. Four of these five classes were replicated in our study using LCA; instead of the heroin injecting subtype, their study found individuals who snorted heroin and smoked crack as another predominant group. Differences may be due to the different statistical approach taken to classify drug users, as well as our focus on more active drug users who used drugs on a weekly basis or more in the past six months.

Despite some differences across studies, this study empirically solidified the existing literature on heterogenic drug use patterns of inner-city drug users, which has implications for understanding health risk transmission and developing tailored interventions. IDUs are generally considered to be at a more severe end of the spectrum of drug use, with more dependence (Gossop et al., 1992; Gossop et al., 1994; Strang et al., 1998), higher rates of HIV infection and greater history of treatment (Carpenter et al., 1998; Strang et al., 1992). This study motivates further understanding of polydrug and polyroute subtype in particular, as this subtype had more depressive symptoms and was more enmeshed in polydrug networks. The high prevalence of depressive symptoms across all subtypes was concerning and suggests the need for more attention to mental health. Depressive symptoms have been found to complicate treatment outcomes among drug dependent individuals (Compton III et al., 2003). A high risk of depressive symptoms also increases concern for suicide-related risks, as polydrug use has been associated with subsequent suicide attempt (Darke et al., 2007).

The heroin injecting subtype had the lowest injection risk and differed significantly from the heroin and cocaine injecting subtype. Interestingly, the polydrug and polyroute subtype did not have the highest injection risk among the IDU subtypes, despite the high depressive symptoms and use of multiple drugs, which are both noted as risk factors for injection risks

(Lloyd-Smith et al., 2009; Mandell et al., 1999; Tyndall et al., 2003). The heroin injecting subtype also had a much lower proportion of homelessness; such factor could reflect more resources in individuals classified into this subtype, as compared to the other IDUs, which could potentially serve as a protective factor against sharing injection risk (Galea and Vlahov, 2002).

This study also strongly supported differential association by type and route of drugs, which suggests that drug users affiliate with individuals who use similar drugs (Oetting and Donnermeyer, 1998; Tittle et al., 1986). The polydrug and polyroute subtype was also more likely to have crack smokers in their networks than the other IDU subtypes, suggesting that this subgroup is potentially an important bridge between the IDU and LIDUs subtypes. Although depressive symptoms were similar among the LIDU subtypes, differences in their drug network composition, in both injecting and non-injecting networks, suggest that these two LIDU subtypes may be relatively distinct. The differences in these drug network compositions also suggest potential differences in social norms regarding HIV risk behavior (Latkin et al., 2003a; Latkin et al., 2010), which may also help further understand the variations in injection risk across the IDU subtypes and sexual HIV transmission across the LIDU subtypes.

This is one of the few studies to empirically identify subtypes of inner-city drug users drawn from a community setting using the empirical latent class approach. This study included a large sample of hard to reach inner-city drug users from Baltimore, MD. Exploration of the drug network compositions further solidified the validity of these subtypes. However, several limitations should be noted. The study findings may not be generalizable to drug users in other settings with different types of drug availability, especially with regards to club drugs, nonmedical use of prescription drugs and marijuana users. This study was also cross-sectional and conducted between 1997 and 1999; drug use pattern may have changed since then. We did not have information on timing of drug use among participants who reported polydrug use, although individuals who use multiple drugs concurrently may be different from those who use each drug at different occasion but within a certain time period (Leri et al., 2003). Using the most-likely class membership assignments in the analysis of socio-demographic correlates introduces the possibility of misclassification. However, the average probability for the most likely class ranged between 86% and 94%, indicating that the probability of misclassification was low for most participants.

A sample of inner-city drug users from a community setting can be further distinguished by type of drug used and route of its administration. Many IDUs used multiple drugs; in particular, this study noted that individuals classified into a polydrug and polyroute subtype is potentially highly addicted and may be in a great need for multiple modalities of treatment. Recognizing variations of drug users further provides motivation to better understand the drug use pattern of hard to reach drug users and develop tailored HIV prevention and drug treatment programs. Additional research that examines HIV risk consequences and treatment outcomes associated with these subtypes will also be informative for HIV and drug treatment studies. Further research should also examine these subtypes in a longitudinal setting to sharpen the knowledge on factors that may facilitate transitioning into the lower risk subtypes.

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Table 1

Fit Statistics of the LCA Models, SHIELD study (n=1,061)

	Likelihood	AIC	BIC	Entropy	LMT p-value	Bootstrap LRT p-value
2 class	−4430.649	8895.298	8979.737	0.875	<0.001	<0.001
3 class	−4348.077	8748.155	8877.296	0.830	<0.001	<0.001
4 class	−4291.037	8652.073	8825.917	0.827	<0.001	<0.001
5 class	−4233.989	8555.978	**8774.525**	**0.857**	0.001	<0.001
6 class	−4216.909	8539.817	8803.067	0.827	0.0509	<0.001
7 class	−4197.690	8519.380	8827.332	0.905	0.0078	<0.001

Table 2

Conditional Probability and Drug Use Characteristics from the Five-Class Most Likely Class Membership, SHIELD study (n=1,061)

	Overall	Class 1: Heroin injecting	Class2: Polydrug and polyroute	Class 3: Heroin and cocaine injecting	Class 4: Heroin snorting	Class 5: Crack smoking
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Class Probabilities		134 (13)	88 (8)	404 (38)	275 (26)	160 (14)
Item Probabilities (weekly vs. less than weekly)						
Alcohol use	566 (53)	46 (34)	59 (67)	200 (50)	139 (51)	122 (77)
Marijuana use	210 (20)	15 (11)	38 (43)	48 (12)	57 (21)	52 (33)
Heroin injecting	620 (59)	129 (96)	81 (95)	370 (92)	40 (15)	0 (0)
Heroin snorting	398 (38)	11 (8)	73 (84)	10 (2)	275 (100)	29 (18)
Speedball injecting	495 (47)	48 (36)	77 (88)	370 (92)	0 (0)	0 (0)
Cocaine injecting	127 (12)	0 (0)	76 (87)	381 (95)	0 (0)	18 (11)
Cocaine snorting	475 (45)	3 (2)	40 (46)	5 (1)	38 (14)	41 (26)
Crack smoking	378 (36)	18 (13)	49 (56)	42 (10)	119 (43)	150 (94)
Routes of Drug Administration						
Snorting alone	377 (36)	0 (0)	0 (0)	0 (0)	235 (85)	142 (89)
Injecting alone	450 (42)	103 (77)	0 (0)	347 (86)	0 (0)	0 (0)
Both injecting and snorting	234 (22)	31 (23)	88 (100)	57 (14)	40 (15)	18 (11)
Number of single-drug users[1]	309 (29)	72 (54)	0 (0)	18 (4)	116 (42)	103 (64)

[1] Does not include marijuana or alcohol use

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Table 3

Comparison of Sociodemographic, Depression Symptoms and Drug Network Characteristics within the 5-Class Model, SHIELD study (n=1,061)

		Injection Drug users (IDUs)			Low proportion of IDUs (LIDUs)		Comparisons across subtypes		
	Overall	**Class 1:Heroin injecting**	**Class2: Polydrug and polyroute injecting**	**Class 3: Heroin and cocaine injecting**	**Class 4: Heroin snorting**	**Class 5:Crack smoking**	**Overall**	**Among IDUs**	**Among LIDUs**
Sociodemographic Characteristics	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**p-value**	**p-value**	**p-value**
Female gender	397 (37)	57 (43)	41 (47)	103 (26)	140 (51)	56 (35)	**<0.001**	**<0.001**	**0.001**
African-American	997 (94)	118 (88)	86 (98)	368 (91)	271 (99)	154 (96)	**<0.001**	**0.04**	0.12
At least HS/GED education	547 (52)	64 (48)	51 (58)	186 (46)	146 (53)	100 (63)	**0.005**	0.13	0.06
Age (Mean±SD)	39±7.0	38±6.8	36±5.5	42±6.5	36±7.1	38±6.5	**<0.001**	**<0.001**	**0.004**
Unemployed in the past 6 months	925 (87)	114 (85)	81 (92)	367 (91)	235 (85)	128 (80)	**0.004**	0.12	0.14
Homeless in the past 6 months	265 (25)	12 (9)	32 (36)	113 (28)	49 (18)	59 (37)	**<0.001**	**<0.001**	**<0.001**
HIV self-report positive	163 (15)	15 (11)	15 (17)	103 (26)	12 (4)	18 (11)	**<0.001**	**0.001**	**0.006**
Ever been in drug treatment	727 (69)	94 (70)	59 (67)	320 (79)	172 (63)	82 (51)	**<0.001**	**0.01**	**0.02**
Depressive Symptoms									
Moderate (CES-D >=16 but <23)	252 (24)	39 (29)	30 (34)	89 (22)	56 (20)	38 (24)	**0.001**	**0.002**	0.61
Severe (CES-D>=23)	436 (41)	44 (33)	43 (49)	183 (45)	109 (40)	57 (36)			
HIV Injection Risk	374 (36)	58 (44)	44 (51)	239 (60)	18 (7)	15 (10)	**<0.001**	**0.003**	0.25
Drug Network Composition									
Presence of Injectors									
Heroin Injectors	332 (32)	67 (51)	32 (36)	144 (36)	68 (25)	21 (13)	**<0.001**	**0.008**	**0.004**
Speedball Injectors	406 (39)	55 (42)	43 (49)	235 (58)	38 (14)	35 (22)	**<0.001**	**0.002**	**0.03**
Cocaine Injectors	86 (8)	9 (7)	8 (9)	48 (12)	7 (3)	14 (9)	**0.001**	0.22	**0.004**
Presence of Non-injectors									
Heroin Snorters	437 (42)	49 (37)	42 (48)	106 (26)	189 (69)	51 (32)	**<0.001**	**<0.001**	**<0.001**
Cocaine Snorters	65 (6)	4 (3)	6 (7)	20 (5)	19 (7)	16 (10)	0.096	0.43	0.25
Crack Smokers	402 (38)	31 (24)	38 (43)	92 (23)	113 (42)	128 (81)	**<0.001**	**<0.001**	**<0.001**

Table 4

Adjusted Association of Most Likely Class Membership with Depressive Symptoms, Injection Risk and Drug Network Composition, SHIELD study (n=1,061)[1,2]

		Among IDUs			Among LIDUs
	Low proportion of IDUs (LIDUs) (ref: IDUs)	**Heroin injecting (ref: Heroin and cocaine injecting)**	**Polydrug and polyroute injecting (ref: Heroin and cocaine injecting)**	**Polydrug and polyroute injecting (ref: Heroin injecting)**	**Crack smoking (ref: Heroin snorting)**
	AOR (95%CI)	**AOR (95%CI)**	**AOR (95%CI)**	**AOR (95%CI)**	**AOR (95%CI)**
Depressive Symptoms					
Moderate vs. None	0.74 (0.53–1.03)	1.33 (0.84–2.13)	3.50 (1.80–6.80)***	3.32 (1.70–6.48)***	0.95 (0.61–1.50)
Severe vs. None	0.74 (0.56–1.00)*	0.83 (0.53–1.30)	2.63 (1.40–4.94)**	2.92 (1.55–5.53)**	0.85 (0.57–1.29)
Injection Risk	-	0.54 (0.35–0.83)**	0.79 (0.47–1.32)	1.46 (0.82–2.60)	-
Drug Network Composition					
Presence of Injectors					
Heroin Injectors	0.42 (0.32–0.56)***	1.86 (1.22–2.85)**	0.95 (0.56–1.60)	0.51 (0.29–0.91)*	0.53 (0.31–0.91)*
Speedball Injectors	0.23 (0.17–0.30)***	0.50 (0.33–0.77)**	0.74 (0.45–1.23)	1.48 (0.83–2.64)	1.41 (0.86–2.31)
Cocaine Injectors	0.58 (0.35–0.96)*	0.62 (0.29–1.36)	0.86 (0.37–2.02)	1.38 (0.50–3.86)	3.38 (1.42–8.03)**
Presence of Non-Injectors					
Heroin Snorters	2.12 (1.63–2.75)***	1.53 (0.98–2.39)	2.41 (1.43–4.06)**	1.58 (0.88–2.83)	0.32 (0.21–0.48)***
Cocaine Snorters	1.92 (1.14–3.22)*	0.62 (0.20–1.93)	1.37 (0.48–3.95)	2.22 (0.56–8.83)	1.11 (0.55–2.22)
Crack Smokers	3.50 (2.67–4.58)***	0.93 (0.56–1.52)	2.52 (1.48–4.29)**	2.72 (1.46–5.04)**	5.18 (3.24–8.29)***

- indicates models not estimated

*** p<0.001;

** p<0.01;

* p<0.05

[1] Adjusted for gender, race, age, education, unemployment in the past 6 months, homeless in the past 6 months, HIV self-report status and lifetime drug treatment

[2] IDUs refers to Classes 1–3 and LIDU refers Classes 4 and 5, which consists of low proportion of IDUs