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Risk Factor Profiles among Intravenous Drug Using Young Adults: A Latent Class Analysis (LCA) Approach

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Abstract

Using data from a cross-sectional study that examined health risk behaviors among urban intravenous drug-using (IDU) adolescents and young adults, this study investigated risk profiles among a high-risk sample ($n=274$). Risk profiles were empirically derived through latent class analysis based on indicators of engagement in health-risking behaviors, experience of abuse and violence as well as individual and family risk factors. The best fitting model was a 3-class model. Class 1 ($n=95$) captured participants with the lowest risk across all indicators. Compared to Class 1, Class 2 ($n=128$) and Class 3 ($n=51$) had elevated rates of engagement in health-risking behaviors as well as individual and family risk factors; however, Class 3 had the highest rate of engagement in sexual risk behavior, and backgrounds of substantial abuse and violence as well as familial psychopathology. Class 2 was the group most socioeconomically disadvantaged, with the highest percentage of participants coming from poor backgrounds, spending the longest time homeless and working the fewest months. Identifying subgroups of IDU has the potential to guide the development of more targeted and effective strategies for prevention and treatment of this high-risk population.

Keywords

intra-venous drug use; young adults; latent class analysis; risk factor profiles

1. Background and Study Purpose

Injection drug use (IDU) is associated with significant social and economic costs. As an ideal transfer mechanism for blood-borne infections, including human immunodeficiency virus (HIV), hepatitis C virus (HCV), and hepatitis B virus (HBV) (Aceijas, Stimson, Hickman & Rhodes, 2004; Armstrong et al., 2006; Burt et al., 2007) it increases disease burden and mortality rates (Evans, Hahn, Lum, Stein & Page, 2009; French, McGeary, Chitwood & McCoy, 2000). In the U.S., it is estimated that 425,000 individuals (0.17

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Conflict of Interest

All three authors declare that they do not have any actual or potential conflict of interest that could inappropriately influence, or be perceived to influence their work.

percent of individuals aged 12 or older) inject heroin, cocaine, methamphetamine, or other stimulants (SAMHSA, 2009).

IDU has been linked to multiple risk factors including childhood physical and sexual abuse (Dube et al., 2003; Kalichman, Williams, Cherry, Belcher & Nachimson, 1998; Ompad et al., 2005; Wu, Schairer, Dellor & Grella, 2010) as well as other types of violence, such as intimate partner violence (El-Bassel, Gilbert, Wu, Go & Hill, 2005; Montgomery et al., 2002; Testa, Livingston & Leonard, 2003). Forms of familial and social instability, including parental drug use (Kerr et al., 2009; Khobzi et al., 2009), lack of parental monitoring, family instability during childhood (Corsi, Winch, Kwiatkowski & Booth, 2007; Crofts, Louie, Rosenthal & Jolley, 1996) as well as incarceration, homelessness, and unemployment (Crofts et al., 1996) have also been associated with a higher likelihood of IDU.

The rate of injection drug use among youth and young adults is of particular concern because the early onset of injection drug use is strongly associated with progression to abuse, HIV infection, and long term dependence (Hyucksun & Amodeo, 2007; Novelli, Sherman, Havens, Strathdee & Sapun, 2005). Multiple studies have shown that IDU tends to be part of a cluster of risk behaviors for HIV that includes sexual risk behaviors (e.g., multiple sexual partners and inconsistent condom use), unsafe IDU behaviors (e.g., needle-sharing), and alcohol and other non-injection drug consumption (DeRosa, Montgomery, Hyde, Iverson & Kipke, 2001; Friedman et al., 1997; Fuller et al., 2001; Kral, Lorvick & Edlin, 2000). The engagement in multiple health-risking behaviors poses a significant challenge in the development of prevention and intervention efforts for this population (Harocpos, Goldsamt, Kobrak, Jost & Clatts, 2009; Novelli et al., 2005; Small, Fast, Krusi, Wood & Kerr, 2009).

For those who already inject drugs, interventions only work with about half of the population, (Zule, Costenbader, Coomes & Wechsberg, 2009), and treatments for some groups, such as Hepatitis C Virus positive individuals, tend to be very expensive and have severe side effects (Firpi & Nelson, 2007; Rajendra & Wong, 2007). Individual level cognitive and behavioral interventions and methadone programs have been somewhat successful but have high relapse rates (Faulkner, Vollick & Judson, 2010; Mattick, Breen, Kimber & Davoli, 2009). Structural or community-level interventions are mostly harm reduction-oriented in their approach (Hilton, Thompson, Moore-Dempsey & Janzen, 2001; Marlatt, 1998), and include needleexchange programs that usually serve as a point of service and treatment referrals for users. However, while such programs have been found to be safe and cost-effective (Wodak & Cooney, 2006), it has been noted that IDUs who could benefit most from these prevention services and drug intervention, such as younger IDUs, also tend to be the least likely to utilize them (Lambert, 1990). Given the challenges in engaging and keeping IDUs in treatment, identifying interventions that are effective, relevant, and easy to access for the majority of this population remains an important goal.

The primary objective of this analysis was to investigate subgroups of injection drug users among a group of high risk IDU young adults along multiple dimensions of risk behaviors and risk factors, which have been found to be conceptually or empirically related to IDU. Our study extends the existing literature through the use of latent class analysis (LCA), a statistical approach that has been successfully used to discover subgroups in other high-risk populations (Green et al., 2010; Monga et al., 2007; Strauss, Rindskopf, Astone-Twerell, Des Jarlais & Hagan, 2006). Using empirical means to identify subgroups has the potential to pinpoint differences in characteristics and needs of IDU young adults and may serve as a guide toward the development of more targeted, and ultimately, more effective interventions.

2. Methods

2.1. Sampling and recruitment

Participants for this study were recruited as part of a larger project that explored the social contexts and risk behaviors of youth and young adults who reported injection drug use (IDU). A detailed description of the original methods have been published (Montgomery et al., 2002) and are described here briefly. Ethnographic research techniques helped identify high concentrations of IDUs. Recruitment sites included needle exchange service centers, drop-in centers for homeless people and street-based sites in a large urban area in Southern California. Using purposive sampling, the study recruited youth and young adults, age 15–23, who reported an episode of IDU within the 30 days prior to the study into the core sample (n=193). Snowball sampling was subsequently employed to recruit social network respondents from the core sample (n=127) yielding a total sample of 320. There were no age limitations for referral respondents; however, 93% of the final sample was 24 or younger. Given the original study's interest in gender differences, female respondents were purposively recruited.

2.2. Study procedures

Once eligibility was established, consent was obtained and interviews, lasting between 60–90 minutes, were conducted in cafés, parks, or an office at a community-based agency. Interviews were conducted by trained interviewers similar in age and ethnicity to the participants. Core and social network respondents received the same protocol. All study procedures were approved by the Institutional Review Boards of Children's Hospital of Los Angeles and Loma Linda University.

2.3. Measures

The interview schedule consisted of close-ended questions addressing multiple domains of functioning, including a comprehensive assessment of engagement in health-risking behaviors (drug use and sexual risk behavior), abuse and violence history as well as individual and family risk factors. The indicators used for the current analysis were chosen because of their conceptual and empirical relevance as established by prior literature (see above).

2.3.1. Sexual risk behaviors—For this analysis we used four sexual risk behavior variables commonly used in studies of sexual risk in adolescents and young adults (e.g., Arthur, Hawkins, Pollard & Baglioni, 2002; DiClemente et al., 2004; Schumacher et al., 2003). (1) Age at onset of sexual activity (continuous); (2) 'Safe sex practices' - computed average of two variables with five categories (1=never, 2=less than half the time, 3=half the time, 4=more than half the time, 5=every time); combining condom use during vaginal or anal sex with main partner and/or condom used during vaginal or anal sex with other partners; (3) 'Ever received money/drugs for sex' (yes/no); (4) 'Ever been pregnant' (yes/no).^a

2.3.2. Substance use risk behaviors—Substance use risk behavior was captured in three ways for this analysis (e.g., Friedman et al., 2008; Lankenau et al., 2007): (1) number of times of IDU during the past 30-day period; (2) number of times of non-injecting drug use during the past 30-day period; and (3) number of times drunk during the past 30-day period.

^aWe attempted to include the variable 'Number of Sex Partners During Past Month.' However, it was skewed even after transformation, preventing a well-fitting model.

2.3.4. Abuse and violence history—The study measured participants' exposure, experience and perpetration of partner as well as community violence. Exposure and experience of community violence 'ever' was measured through 11 dichotomous items (Cronbach's $\alpha=.70$), which were combined into a sum score (range 0–11). Items included: Have you ever (1) seen someone being physically attacked by another person? (2) seen someone being killed by another person? (3) seen a dead person somewhere in the community? (4) been in a physical fight with someone other than a sexual partner of parent/guardian? (5) been sexually assaulted, molested, or raped by someone other than a sexual partner of parent/guardian? (6) been attacked or stabbed with a sharp object? (7) been shot at or hit by gun fire? (8) carried a knife or other sharp weapon? (9) carried a gun? (10) attacked or stabbed someone with a knife? (11) shot someone with a gun?

Experience of intimate partner violence was measured through the sum score of 12 dichotomous items (range 0–12) (Cronbach's $\alpha=.82$): Did any of your sexual partners ever (1) insult you or frequently make you feel like you are stupid? (2) get abusive when he/she was drinking or using? (3) slap or punch you with his/her fists? (4) beat you up so badly that you needed medical help? (5) threaten to use a weapon to hurt you? (6) use a weapon to hurt you? (7) get violent when you suggested using a condom? (8) demand sex whether you wanted it or not? (9) rape you? (10) make you feel like you couldn't disagree with him/her because you were afraid of what he/she might do? (11) scare you without laying a hand on you?

Perpetration of partner violence was measured through the sum score of 3 dichotomous items (range 0–3) (Cronbach's $\alpha=.64$): Did you ever (1) threaten to use a weapon to hurt a sexual partner? (2) use a weapon to hurt a sexual partner? (3) slap or punch a sexual partner around his/her face and head?

Finally, experience of child physical and/or sexual abuse was measured through a single computed dichotomous item (yes/no), which reflected a 'yes' response to either or both of two items. Child Physical and/or Sexual Abuse was captured through a 'yes' response to any of the following 2 items: When you were growing up (1) did either your parents or guardians, or any other adults, hit you so hard that it left bruises or you had to get medical help? (2) did either of your parents or guardians, or any other adults in your home, ever sexually abuse you?

2.3.5. Individual/family risk factors—For the current analysis, nine individual and family risk factors were used. They included: (1) lived with bio/adoptive family while growing up (yes/no); (2) SES while growing up (less than average, average, more than average); (3) runaway before age 18 (yes/no); (4) number of out-of-home placements, i.e. foster care, group home, psychiatric hospital, juvenile hall, jail, prison (sum score ranging from 0–6); (5) years spent homeless (continuous); (6) number of months worked during past year (continuous); (7) ever diagnosed with a mental health problem by a psychiatrist, psychologist, doctor or therapist (yes/no); (8) ever had family Members in jail (yes/no); (9) parental drug use (yes/no).^b

2.3.6. Sociodemographics—For post-hoc analyses the following sociodemographic variables were used: gender (1=male, 2=female), age (continuous), race/ethnicity (1=white, 2=black, 3=Hispanic, 4=other), sexual orientation (1=heterosexual, 2=gay, lesbian, bisexual), and education (1=below HS, 2=HS diploma, 3=beyond HS).

^bWe did not include the variable 'sibling drug use' due to a high percentage (16.3%) that did not report on this variable, and lack of clarity whether this implied not having a sibling or was missing data. Of the 233 young adults reporting on this variable, 66.4% had a sibling who had used drugs.

2.4. Analysis

For this analysis, we used data for 274 participants for whom data on all indicators was available. Sensitivity analyses indicated no significant differences between the original sample of 320 and the sample of 274 used for analyses described below.

2.4.1. Latent class analysis—We used Latent Class Analysis (LCA) (Goodman, 1974; Lazarsfeld & Henry, 1968) to empirically derive risk profiles among this IDU sample. LCA is an appropriate analytic method to discover subgroups or classes of observations that are similar to each other along multiple observed variables, and is considered particularly useful in risk behavior research (Beadnell et al., 2005; Carlson, Wang, Falck, & Siegal, 2005; Roesch, Villodas & Villodas, 2010). LCA is similar to traditional cluster analysis in terms of its aim and logic; however, while LCA identifies latent classes and assigns observations to subgroups using model-based posterior membership probabilities, cluster analysis uses ad hoc definitions of distance to form clusters (Cleland, Rothschild, & Haslam, 2000; Magidson & Vermunt, 2004).

LCA classifies observations into their most likely latent classes. High diagonal and low off-diagonal values in the class classification table indicate good classification. The entropy statistic provides summary information about the classification. Entropy values range between 0 to 1, and an entropy value close to one indicates clear classification (Ramaswamy, Desarbo, Reibstein, & Robinson, 1993). However, there is no clear cut point for average posterior probabilities or for the entropy value to ensure a minimum level of good classification.

The number of latent classes in a given data set is unknown and cannot be estimated directly. Rather, various models are set up, each with a different number of latent classes, and results are compared. Selecting the model with the “optimal” number of classes is assessed by use of fit indices, such as the Bayesian Information Criterion (BIC) (Raftery, 1995; Schwarz, 1978) where lower values indicate better fit. In addition, the Lo-Mendel-Rubin likelihood ratio (LMR LR) test provides data that helps to discern whether the K -class model fits the data better than a $(K-1)$ -class model (Lo, Mendell, & Rubin, 2001). A low p -value for a LMR LR test indicates that the $(K-1)$ -class model has to be rejected in favor of a model with at least K -classes. We used the statistical software package Mplus 4.2 (Muthén & Muthén, 1998–2006) to run all LCA analyses.

A common LCA approach in some knowledge areas is to derive the classes or clusters first around one behavioral or risk dimension (e.g., drug use), and then to examine differences between the classes by covariates (e.g., Carlson et al., 2005). This approach has inherent weaknesses as inclusion of covariates may alter the classification. Reflecting the multi-risk background of IDUs we chose to derive the classification based on inclusion of risk behaviors and indicators across multiple domains (e.g., drug use, sexual risk, abuse/violence history, individual/family risk). However, in a final step, and because of constraints in sample size, we examined class differences by socio-demographic variables (gender, race/ethnicity, age, sexual orientation, and education), which were conceptually not central to the main analysis. Post-hoc analyses were conducted using SPSS 18.0.

3. Results

3.1. Sample characteristics

Table 1 describes the study sample, including participants' socio-demographic characteristics, their engagement in sexual risk behaviors and substance use as well as their backgrounds of abuse and violence and individual and family risk factors. The sample was

predominantly white and included a high percentage of young adults who identified as gay or lesbian. The majority of participants had a middle-class background and three-quarters had finished at least High School. The sample was further characterized by extended periods of homelessness, mental health problems and parental and familial problems, such as drug abuse and incarceration. With regard to IDU, 82.1% of the sample reported having injected heroin, 74.1% speed, 61.3% cocaine and 51.8% speedball. Almost 80% reported poly-IDU (not shown in table).

3.2. Model selection

BIC, BIC Adjusted Sample Size, AIC and LMR LR statistics for five sets of models are shown in Table 2. The 3-class model was selected as the best fitting model given the totality of the evidence: While the BIC Adjusted Sample Size and AIC fit criteria continue decreasing as the number of classes increases, the 4- and 5-class models had non-significant LMR LRTs, lower classification probabilities and lower entropy values compared to the 3-class model. Finally, *p* values for the LMR LR test are statistically significant for both the 2- and 3-class models. The lower BIC value for the 3-class model supports preference for this model.

3.3. Quality of classification

Table 3 shows the average individual posterior probabilities for being assigned to a specific latent class. The values on the diagonal range from 93% to 96%, and the values off the diagonal are low. This indicates good classification. The entropy value of 0.87 further supports that the 3-class model provides good classification.

3.4. Model results

The analysis identified three distinct risk profiles (see Table 4). Class 1 captured 95 young adults and Class 2 included 127; Class 3 was the smallest group with 51 young adults. Class 1 differed from Classes 2 and 3 along almost all indicators: participants in this class engaged in less risk-taking behavior in almost all areas and scored lower in terms of personal/family risk factors. Differences between Classes 2 and 3 are more subtle.

3.4.1. Sexual risk behaviors—Participants captured in Class 1 reported less risky engagement in sexual risk behaviors across all variables compared to Class 2 and Class 3. For instance, onset of sexual activity was close to two years later than for Classes 2 and 3. With regard to ever receiving money and/or drugs for sex and pregnancy, there was a 30 percent spread between the three classes, with Class 1 reporting the lowest rate, Class 2 being in the middle and Class 3 being the highest. Almost one half of Class 3 participants reported having received money and/or drugs for sex, and almost two-thirds reported having been pregnant before.

3.4.2. Substance abuse risk behaviors—All groups reported high rates of substance use behaviors ranging from being drunk 5 times in a month (Class 1) to 22 instances of non-injecting drug use in one month (Class 2). However, Class 1 reported comparatively less engagement in substance abuse risk behaviors than Classes 2 and 3. Classes 2 and 3 reported similar rates overall with Class 2 scoring slightly higher with regard to alcohol consumption.

3.4.3. Abuse and violence history—Class 1 reported far less exposure to violence and experience of partner violence than either Class 2 or Class 3. Class 1 reported a similarly low rate of partner abuse than Class 2. With regard to child abuse history, Class 2 and 3 reported more than double the rate than Class 1. Of note are the high scores of abuse and violence across all variables for Class 3. They rated high in exposure to violence, experience

of partner violence, partner abuse and child abuse history. In fact, three-quarters of young adults in Class 3 reported a history of child sexual and/or physical abuse.

3.4.4. Individual/family risk factors—Consistent with the earlier described pattern, Class 1 scored lowest in all areas of personal and family risk. Yet, even in this group there was a substantial background of risk in all areas. With regard to Classes 2 and 3, there were several differences. Class 3 had the highest percentage of young adults (68.6%) not living with their parents while growing up. Young adults in this group also spent more years being homeless (mean 3.7; SD=2.9), and had the highest percentage of individuals running away before the age of 18 (86.3%). Three-quarters reported having been diagnosed with a mental health problem and having had a family member in jail compared to 66 percent and 56 percent for Class 2, respectively. The vast majority of members in Classes 2 and 3 (86.7% and 84.3% respectively) reported parental drug use in their history. Despite high risk in some areas, Class 3 seemed to have more resources than Class 2 (but less than Class 1). A smaller percentage of young adults reported growing up poor; they also had worked more months during the past year than members in Class 2.

3.4.5. Post-Hoc Analysis—To examine class differences by socio-demographic variables Chi-Square and One-Way ANOVA tests were conducted. Multinomial regression analysis with the three classes had originally been planned and was attempted; however, small cell sizes related to Class 3 led to unstable parameters and poor classification. As such, we restricted post-hoc analyses to descriptive statistics. Statistically significant class differences were determined by gender ($\chi^2(4, N=274) = 48.28, p<.001$), sexual orientation ($\chi^2(2, N=274)=9.61, p<.01$), and education ($\chi^2(4, N=274)=15.12, p<.01$). Class 2 had about double the number of males than Class 1 or Class 3 (81.7% versus 42.6% [Class 1] and 36.7% [Class 3]). With regard to sexual orientation, Class 3 had a much higher percentage of young adults who identified as gay, lesbian or bisexual (54.9% versus 32.6% [Class 1] and 31.2% [Class 2]). Finally, Class 1 had a much higher percentage of members who obtained at least a High School education (83.2% versus 71.9% [Class 2] and 70.6% [Class 3]).

4. Discussion

This analysis was guided by the question whether among a sample of young adults who are somehow directly (users) or indirectly (sex partners of IDUs) IDU-involved, subgroups with a particular constellation of characteristics could be identified, using LCA, a useful analytic method that has been utilized with other risk samples to examine within-group differences.

4.1. Differences between classes

Our analysis generated a well-fitting 3-class model with distinct differences across a range of risk factors and risk behavior variables. To synthesize the study's findings, a table was created that captures the common as well as distinguishing features of each class (see Table 5).

Of the three classes, Class 1 was the least severe along almost all indicators in each of three domains – risk behaviors, abuse and violence, individual/family risk. It also had the highest high school graduation rate of the three groups, which implies better prospects for work and advanced education. It may suggest that the sequelae of the drug use started occurring later or was less disruptive to academic functioning and that there may be an “easier” path to community reintegration if treatment was offered and accepted. While differences in some areas between Class 1 and Classes 2 and 3 were subtle, e.g., safe sex practices, number of times IDU, etc., along other indicators, Class 1 presented with half the rate on most risk variables compared to Classes 2 and 3, e.g., ever received money/drugs for sex, number of

times drunk, exposure to violence, child abuse history, mental health problems, and incarceration of family members. We also found substantial similarities between Classes 2 and 3, especially in the area of substance abuse risk behaviors. However, Class 3 appears to be the highest risk group overall, with higher rates of engagement in some sexual risk behaviors (likely due to offering sex for drugs), substantially more severe backgrounds of abuse and violence both as victims and perpetrators, and overall elevated personal and family risk factors except in the area of resources. Despite this, members in Class 3, compared to Class 2, had a lower percentage of young adults growing up in poverty, had spent more months working and less time being homeless (which may well be related to their slightly higher SES backgrounds). Yet, the percentage of members who had experienced runaway behavior during adolescence, had been diagnosed with mental health problems and had incarcerated family members was highest. Class 3's level of risk-taking, violence perpetration and disturbance may be related to members' experiences of child abuse, violence and familial drug use and incarceration. This subgroup also contained the greatest percentage of young adults who identified as gay, lesbian, or bisexual. Class 2 was primarily characterized by its disadvantaged socioeconomic status and lack of resources. Post-hoc analyses also indicated that this subgroup was comparatively less educated than members in Class 3 and that males made up 80 percent.

Finally, the exceptionally high percentages of incarceration of a family member and parental drug use in this sample deserve noting. As indicated earlier, IDU risk has been correlated with familial drug use and family disruption (Corsi et al., 2007; Flewelling & Bauman, 1990; Fuller et al., 2002). However, our rates for measures of familial dysfunction such as parental drug use (80.7%) appear to be higher than in other studies (Dube et al., 2003). Additionally, 56.6 percent of respondents in our sample indicated that they experienced sexual abuse or were exposed to childhood violence. This is at the high end of the range (14.3–62%) reported across multiple other IDU studies (Dube et al., 2003; Ompad et al., 2005; Plotzker, Metzger & Holmes, 2007; Roy et al., 2003). While speculative, it is possible that this study's recruitment strategies through drop-in centers for the homeless, needle exchange programs and other community-based programs captured a particularly high risk group of IDU with significant histories of running away as youth and intermittent, and in some cases, prolonged periods of homelessness; factors, that are in turn correlated with histories of abuse and violence (e.g., Dunlap, Stürzenhofecker, Sanabria & Johnson, 2004).

There is need for additional studies that examine whether the profiles found in this study can be replicated for other IDU populations. While the identification and confirmation of subgroups of IDU with their descriptive profiles will be of value, there is also need to test whether different explanatory models apply for different subgroups. A question emerging from these findings, for instance, is whether there is variability, across the three classes, in the pathways that connect the various risk factors and behaviors. Research has amply documented intergenerational processes in the development of substance abuse, child abuse, family violence, and homelessness (e.g., Dunlap et al., 2004; Whiting, Simmons, Havens, Smith, & Oka, 2009). Various studies have examined mediating processes to unravel the mechanisms through which influence among the range of risk factors and behaviors is exerted and to identify points of leverage that may be amenable to early intervention (Plotzker et al., 2007; Stein, Leslie & Nyamathi, 2002). Plotzker et al., for instance, confirmed a mediating role of posttraumatic stress disorder and depression for women with histories of child sexual and physical abuse and current engagement in IDU. While common predictors have been identified for IDU, the identification of different subgroups in this study points to the possibility that developmental pathways to IDU may differ for the three classes. Differences may be one of degree of severity and frequency in experiences, such as abuse and violence. However, it is possible that different mediating processes operate for different subgroups. Understanding the developmental pathways for subgroups of IDU

would be important to elucidate each group's unique needs, identify mediators that are amenable to change as well as point to the optimal points for early intervention to disrupt trajectories toward poor outcome.

4.2. Implications for prevention and intervention

Practice implications should be considered cautiously as studies are needed to investigate whether subgroups of IDUs respond differentially to prevailing approaches to the treatment of IDU. However, our findings suggest that participants in Classes 2 and 3 need the most attention due to the extent of abuse and violence exposure, the presence of individual and familial risk factors (particularly Class 3) and the lack of financial resources (particularly Class 2), factors, which may have contributed to the development of IDU or exacerbate participants' current situation. The level of abuse and violence experienced by Class 3 would indicate needed expansion of current public health approaches to IDU intervention to include mental health referral and treatment. Prior studies with populations at risk for HIV have established a link between trauma experiences and elevated risk of engagement in health-risking behaviors, prompting a call to focus on the reduction of trauma symptoms (Brown, Danovsky, Lourie, DiClemente, & Ponton, 1997; Gore-Felton & Koopman, 2002). Trauma-focused interventions, such as Trauma Focused Cognitive Behavioral Therapy (e.g., Deblinger, Pollio & Neubauer, 2012) may be useful modules, but would likely have to be adapted for the particular needs of the IDU population.

Similarly, the high degree of familial drug use and incarceration raises questions about the chronicity of substance use problems in these families and suggests the need for family-focused intervention models. Parental substance abuse has serious consequences, and has been implicated as a significant factor in one-third to two-thirds of child maltreatment cases (Dunn et al., 2002). A number of evidence-based family-focused substance-abuse interventions, e.g., Multidimensional Family Therapy (Liddle et al., 2001), Functional Family Therapy (Alexander et al., 1998), Family Behavior Therapy (Donohue, Allen & Dapota, 2009), have been developed during the past two decades and have shown great promise in alleviating both parental and youth substance abuse. Again, these interventions would have to be tested for their suitability for this population and adapted to address the treatment challenges particular to IDU. However, much can be learned from these interventions about engaging families with severe and chronic problems in substance-abuse treatment.

Finally, Class 2, which resembled Class 3 in drug use behavior but had slightly lower rates of sexual risk behavior, appears to be co-affected by poverty, and may thus require more tangible help in terms of vocational rehabilitation, housing and case management services. Such services should again be delivered with a family-focused orientation in order to address intergenerational patterns of poverty, addiction and violence (De Bellis, 2012). Treating the multiple, chronic and often severe needs of IDU will continue to be a challenge, and it is unlikely that single-focus interventions will yield success. However, the growing availability of community-based, family-focused substance abuse interventions with significant empirical support (see interventions mentioned above) provide a promising starting point from which to adapt and further develop interventions for individuals struggling with IDU.

Our findings further suggest that comprehensive assessment tools could be useful in identifying subgroups of IDU with different needs and risks. Such tools should not only focus on past or current engagement in risk behaviors, but also address salient background variables, such as individual and family characteristics and histories of violence and abuse. If this study's findings are generalizable to other IDU populations (which remains to be shown), histories of significant abuse and violence and family risk factors, such as parental

incarceration, may in fact signal the need for interventions that go beyond attempts to aid in the reduction of risk behaviors.

4.3. Limitations

The study had a number of limitations. It employed ethnographic methods to recruit young adults into the study. Although less rigorous than random sampling and thus limited in generalizability, this approach has been shown to be an appropriate and successful technique for hard-to-access populations (Corsi, et al., 2007). However, our sample is quite similar to other samples of young IDUs in regards to race, age, education, gender composition, and homeless status (Kral, Lorvick, & Edlin, 2000; Novelli, et al., 2005; Thorpe, Bailey, Huo, Monterroso & Ouellet, 2001). It differs from a few recent IDU studies that had a majority of male respondents (Ompad et al., 2005), were predominantly African American (Fuller et al., 2002), and had not completed high school (Evans et al., 2003; Fuller, et al., 2002; Hahn, Page-Shafer, Lum, Ochoa, & Moss, 2001; Roy et al., 2003). Our sample may also differ from IDUs who do not seek contact with community-based agencies.

Sampling techniques used in the study may also have increased the likelihood of discovering similar clusters due to the probability that people within social networks may share common patterns of risky behaviors and/or historical trauma. To confirm whether the profiles found in the current sample may be meaningful for the larger population of IDU young adults, similar studies will have to be conducted.

Objective measures of IDU (e.g. urinalysis, verification of needle marks) were not used. We relied on self-report and used a comprehensive interview to assess participants' engagement in sexual and substance abuse risk behaviors. Although the reliability of self-reporting of risk behaviors has been questioned (Kerr et al., 2008; Turner et al., 1998), responses of noninstitutionalized populations may be accurate enough depending on length of time of recall (Napper, Fisher, Reynolds, & Johnson, 2010), which in this study was less than 30 days recall. The reliability is further enhanced if respondents are asked about their drug use in a nonthreatening manner, are assured of the confidentiality of their results as was the case in this study (Weatherby Richard & Cesari Robert, 1994)

Additional limitations include the lack of standardized measures in several areas, e.g., child abuse, mental health problems. Unfortunately, the study did not inquire about child neglect, which is the type of maltreatment mostly associated with parental substance abuse (Dunn et al., 2002). Finally, LCA does not establish causal relationships, and as discussed earlier, there is need to uncover the causal pathways that underlie each of the class profiles.

4.4. Conclusions

This study identified three subgroups of IDUs with distinct risk profiles that would likely affect treatment openness and success. While all groups engaged in IDU and sexual risk behaviors, Class 1 presented as least severe, and therefore might be more amenable to traditional intervention approaches to IDU. The risks for Classes 2 and 3 were compounded by a lack of resources (Class 2) and significant abuse histories, family dysfunction, and exposure to violence (Class 3), calling for interventions that provide structural supports, and, in the case of Class 3 for intensive mental health treatment in addition to substance abuse treatment. Currently treatment engagement and success are limited for young IDUs. If future studies can replicate these findings, identifying the particular vulnerabilities of subgroups of IDUs has the potential to guide the development of more targeted and tailored treatment planning that could respond more effectively to the IDU's need profiles, thereby promising better treatment success.

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Research Highlights

- Using LCA, three classes of IDU young adults were identified in a sample of 274.
- Class 1 captured participants with the lowest risk across all indicators.
- Class 2 was socioeconomically disadvantaged with long episodes of homelessness.
- Class 3 had backgrounds of severe exposure to abuse/violence and family dysfunction.
- Identifying subgroups of IDU can inform the development of effective interventions.

Table 1

Characteristics of Study Sample (n=274)

Variables	N (%)	Mean (SD)
<i>Sociodemographic Characteristics</i>		
Gender		
Female	108 (39.4)	
Male	161 (58.8)	
Transgender	5 (1.8)	
Age		20.7 (3.6)
Race/Ethnicity		
White	189 (69.0)	
Black	11 (4.0)	
Hispanic	22 (8.0)	
Other	52 (19.0)	
Sexual Orientation		
Heterosexual	175(64.0)	
Gay, Lesbian, Bisexual	99 (36.0)	
Education		
Below HS	67 (24.5)	
HS Grad	166 (60.5)	
Beyond HS	41 (15.0)	
<i>Sexual Risk Behaviors</i>		
Age at 1 st consensual sex		14.2 (2.3)
Condom use overall		2.9 (1.5)
Ever received money/drugs for sex		
Yes	89 (32.5)	
No	185 (67.5)	
Ever pregnant		
Yes	140 (51.1)	
No	134 (48.9)	
<i>Substance Use Risk Behaviors</i>		
No. of days injected drugs last 30 days		16.3 (17.9)
No. of times used non- IDU last 30 days		18.9 (15.7)
No. of times drunk during last 30 days		9.4 (10.9)
<i>Abuse and Violence History</i>		
Violence exposure (range 0–11)		5.6 (2.8)
Experienced partner violence (range 0-12)		3.8 (3.1)
Partner abuse (range 0-3)		0.8 (0.9)
Child abuse history		
Yes	155 (56.6)	
No	119 (43.4)	
<i>Individual/Family Risk Factors</i>		

Variables	N (%)	Mean (SD)
Lived with bio/adoptive parent growing up		
Yes	187 (68.2)	
No	87 (31.8)	
SES while growing up		
Less than average	78 (28.5)	
Average	106 (38.7)	
More than average	90 (32.8)	
Number of out-of-home placements		2.5 (1.7)
Runaway before age 18		
Yes	176 (64.2)	
No	98 (35.8)	
Years spent homeless		3.2 (2.9)
Number of months worked past year		3.3 (3.8)
Ever diagnosed with mental health problems		
Yes	153 (56.8)	
No	121 (44.2)	
Ever had family members in jail		
Yes	143 (52.2)	
No	131 (47.8)	
Parental drug use		
Yes	221 (80.7)	
No	53 (19.3)	

Table 2

Comparisons of Different LCA Models (N=274)

Model	Sample-Size Adjusted			LMR LRT
	BIC	BIC	AIC	<i>p</i> -value
One-class	19961.47	19860.00	19845.85	-
Two-class	19711.11	19539.89	19516.00	0.0000
Three-class	19648.54	19407.56	19373.94	0.0088
Four-class	19681.67	19370.94	19327.59	0.4831
Five-class	19730.70	19350.21	19297.13	0.2839

Notes. (-) Not applicable. BIC—Bayesian Information Criterion.. AIC- Akaike Information Criterion. A smaller BIC and AIC indicate a better model fit. LMR LRT—Lo-Mendell-Rubin LRT test *p*-value for (*K*-1)-classes. A low *p*-value indicates the (*K*-1)-class model has to be rejected in favor of a model with at least *K*-classes

Table 3

Class Assignment Probability by Class (n=274)

	Class 1	Class 2	Class 3
	N=95; 34.7%	N=128; 46.7%	N=51; 18.6%
Class 1	0.933	0.064	0.003
Class 2	0.046	0.944	0.010
Class 3	0.011	0.029	0.960
Entropy		0.865	

Table 4

Risk Profiles (n=274)

	Class 1	Class 2	Class 3
	Mean (SD) or n (%) (n=95)	Mean (SD) or n (%) (n=128)	Mean (SD) or n (%) (n=51)
<i>Sexual Risk</i>			
Age of 1 st sex	15.4 (1.9)	13.4 (2.2)	13.8 (2.4)
Safe sex practices	2.8 (1.4)	3.0 (1.5)	3.1 (1.4)
Ever received money/drugs for sex			
Yes	17 (17.9)	49 (38.3)	28 (45.1)
No	78 (82.1)	79 (61.7)	28 (54.9)
Pregnant			
Yes	32 (33.7)	76 (59.4)	32 (62.7)
No	63 (66.3)	52 (40.6)	19 (37.3)
<i>Substance Abuse Risk</i>			
Number of times IDU (30 days)	15.5 (18.1)	16.8 (18.8)	16.8 (15.6)
Number of times non-IDU drugs (30 days)	14.1 (14.0)	21.7 (15.7)	21.3 (16.9)
Number of times drunk (30 days)	5.0 (8.0)	12.1 (11.5)	10.7 (11.4)
<i>Abuse and Violence History</i>			
Exposure to violence (range 0-11)	3.2 (1.6)	6.6 (2.4)	7.5 (2.3)
Experienced partner violence (range 0-12)	2.7 (2.4)	3.4 (2.7)	6.9 (2.9)
Abuse of partner (range 0-3)	0.4 (0.6)	0.3 (0.5)	2.4 (0.5)
Child abuse history (sexual and/or physical)			
Yes	30 (31.6)	87 (68.0)	38 (74.5)
No	65 (68.4)	41 (32.0)	13 (25.5)
<i>Individual/Family Risk Factors</i>			
Lived with parent growing up			
Yes	78 (82.1)	74 (57.8)	35 (68.6)
No	17 (17.9)	54 (42.2)	16 (31.4)
Socioeconomic status while growing up			
Poor/less than average	18 (18.9)	47 (36.7)	13 (25.5)
Had average	36 (37.9)	50 (39.1)	20 (39.2)
Had more than most / well to do	41 (43.2)	31 (24.2)	18 (35.3)
Number of out-of-home placements	1.0 (1.0)	3.3 (1.4)	3.2 (1.6)
Runaway before age 18			
Yes	40 (42.1)	92 (71.9)	44 (86.3)
No	55 (57.9)	36 (28.1)	7 (13.7)
Years spent homeless	1.2 (1.6)	4.4 (3.0)	3.7 (2.9)
Number of months worked past year	4.5 (4.4)	2.5 (2.9)	3.4 (4.0)
Ever diagnosed with mental health problems			
Yes	31 (32.6)	84 (65.6)	38 (74.5)
No	64 (67.4)	44 (34.4)	13 (25.5)

	Class 1	Class 2	Class 3
	Mean (SD) or n (%) (n=95)	Mean (SD) or n (%) (n=128)	Mean (SD) or n (%) (n=51)
Ever had family members in jail			
Yes	33 (34.7)	72 (56.3)	38 (74.5)
No	62 (65.3)	56 (43.8)	13 (25.5)
Parental drug use			
Yes	67 (70.5)	111 (86.7)	43 (84.3)
No	28 (29.5)	17 (13.3)	51 (18.6)

Table 5

Synthesis of Classes

Class 1	Class 2	Class 3
Less sexual risk and drug use	High sexual risk High drug use	High+ sexual risk High drug use
Less abuse and violence	High abuse and violence	High+ abuse and violence
Less individual and family risk	High individual and family risk Lack of resources	High+ individual and family risk