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Depressive Symptoms and Patterns of Drug Use among Street Youth

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Abstract

Purpose—Rates of depression among street youth are poorly characterized, particularly as they pertain to concurrent drug use. We sought to assess associations between drug type and degree of depression in this population.

Methods—From October 2005 to November 2007, data were collected for the At-Risk Youth Study (ARYS), a cohort of street-recruited youth aged 14–26 in Vancouver, Canada. Active drug users were classified by predominant substance of use: daily marijuana use, weekly cocaine/crack use, weekly crystal methamphetamine use, or weekly heroin use. Adjusted mean number of depressive symptoms (measured by the Center for Epidemiological Studies Depression [CES-D] scale) was compared among the four groups using multiple linear regression. Logistic regression was also used to assess adjusted odds of CES-D score ≥ 22 .

Results—Among 447 youth, mean CES-D score was highest among heroin users (adjusted mean [SD], 22.7 [1.2]), followed by crystal methamphetamine users (21.8 [1.1]), then cocaine/crack users (19.1 [1.0]), and finally, marijuana users (18.3 [1.1]), a difference significant among groups

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Conflict of Interest Statement

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Contributors

Drs. Hadland, Marshall, Kerr and Wood designed the study. Drs Hadland and Wood wrote the protocol. Dr. Hadland conducted the literature review and wrote the first draft of the manuscript. Ms. Qi undertook statistical analyses with additional input from Dr. Hadland. All authors contributed to and have approved the final manuscript.

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($p < 0.001$). When compared to daily marijuana users, odds of CES-D score ≥ 22 were higher among heroin users (adjusted odds ratio [AOR], 2.64; 95% confidence interval [CI], 1.39–4.99), and among crystal methamphetamine users (AOR, 1.88; 95% CI, 1.04–3.42) but not among cocaine/crack users (AOR, 1.41; 95% CI, 0.79–2.52).

Conclusions—To our knowledge, this is the first report of drug use typologies and depression among street youth. Policymakers might heed the apparent vulnerability of heroin and crystal methamphetamine users to even greater degrees of depression than their peers.

Keywords

street youth; adolescents; injection; drug use; initiation

Introduction

Illicit drug use is known to be intricately linked to depression, and for many users, the interrelationship between substance use and mood disorder becomes firmly established in adolescence and early adulthood [1,2]. Particularly vulnerable to the harms of substance use are ‘street youth’, a term applied to adolescents and young adults who spend all or most of their time living and working on the street [3]. This socially and economically disadvantaged population is marked by perilous living conditions, including poverty, homelessness and drug use [4]. Perhaps not surprisingly, street youth often experience substantially greater mortality when compared to their peers in the general youth population [5], with reports indicating the greatest portion of deaths attributable may be due to suicide and overdose [6].

Studies of street youth are difficult to conduct because, in multiple locations worldwide, street-involved populations represent a ‘hidden’ demographic that is not easily sampled by traditional research methods. Because of their high rates of residential instability and school dropout, street youth tend to elude general population- and school-based studies [7]. The data that do exist on depression among homeless youth demonstrate a concerning prevalence of depressive symptoms when contrasted with mainstream youth. One comparison of emergency shelter-based adolescents to domiciled adolescents recruited from school-based health centers in Baltimore, MD revealed that, even after adjusting for age, gender and ethnicity, odds of a recent clinical diagnosis of depression were seven times greater among homeless adolescents [8].

Closer examination of depression among street youth is merited for several reasons. Significantly excess mortality in this population is attributable to suicide [6], which is closely tied to depression [9,10]. In one study of homeless youth, the odds of a prior suicide attempt were nearly four times greater among youth with an active diagnosis of depression, and nearly two times greater among youth who reported symptoms of hopelessness [11]. In addition, depression is associated with high-risk behaviors that predispose youth to infection with human immunodeficiency virus (HIV), such as injection drug use and unprotected sexual intercourse [1,11]. HIV infection is itself a well recognized risk factor for mortality among street youth [6].

Despite this evidence for links between depression and premature death among street youth, the extent to which specific drug use patterns are tied to depressive symptoms has not been fully described. In particular, little is known about how the predominant type of drug used by youth (*e.g.*, stimulants versus narcotics versus cannabis) may be linked to depression. Such information could aid program developers in more properly allocating already scarce mental health services to this highly vulnerable population, and aid in identifying those drug-using street youth most at risk for premature mortality. In the present study, we sought

to quantify depressive symptoms among street youth who are active users of common illicit drugs and assess the association between drug type and degree of depression.

Methods

Study Sample

The At Risk Youth Study (ARYS) is a cohort of street-involved youth in Vancouver, Canada and has been described previously [12]. The present analysis draws on baseline data from youth recruited between October 2005 and November 2007. Inclusion criteria for ARYS include: (1) aged 14 to 26 at the time of enrollment, and (2) use of an illicit drug other than or in addition to marijuana during the 30-day period prior to enrollment. Participants were recruited through extensive street-based outreach and snowball sampling.

At the time of enrollment, all participants completed an extensive interviewer-administered questionnaire pertaining to sociodemographic data and information on drug use and sexual risk behaviors. Participants were provided \$20 CAN as remuneration. ARYS was approved by the University of British Columbia/Providence Health Care Research Ethics Board.

Dependent and independent variables

The primary outcome, or dependent variable, was the number of depressive symptoms as measured by the Center for Epidemiological Studies Depression (CES-D) scale, a 20-item survey measuring depressive symptoms [13] that is both valid and reliable when administered to young people [14] and homeless populations [15]. The primary independent variable was predominant drug of use. Preliminary analyses showed that participants were generally grouped into four broad categories of drug use: (i) daily marijuana use, (ii) weekly or more frequent cocaine or crack use, (iii) weekly or more frequent crystal methamphetamine use, and (iv) weekly or more frequent heroin use. Marijuana use was classified as daily, rather than weekly, because preliminary analyses revealed that many drug users who used cocaine/crack, crystal methamphetamine and heroin on a weekly basis also 'casually' used marijuana on a weekly basis. However, classifying marijuana use as a daily activity defined an entire subcategory that was distinct from all other drug-using categories.

These four categories included the vast majority of ARYS participants, and all those not included in one of these categories were excluded from the analysis ($n = 112$). Participants were only classified into one category even if they frequently used multiple drugs (*i.e.*, polysubstance users), and this was done sequentially in the order listed above (starting at *i* and proceeding to *iv*). For example, a daily marijuana user who also engaged in crack use at least weekly was categorized only as a 'weekly cocaine/crack user'. Preliminary analyses had revealed that the number of participants who could be classified into more than one category was minimal, and to examine whether the inclusion of such participants altered the final results, a sensitivity analysis was conducted in which polysubstance users were excluded.

In order to adjust for variables that might confound the relationship between drug use and depressive symptoms, we examined an array of covariates, including male gender (yes *vs.* no), age (treated as a continuous variable), Aboriginal ancestry (yes *vs.* no), partnered relationship status (married, common law or single, regular partner *vs.* single or dating), high school education (having completed or currently enrolled in high school *vs.* not having completed high school and not currently enrolled), homelessness in the last six months (yes *vs.* no), lifetime history of incarceration (yes *vs.* no), sex trade involvement in the last six months (having traded sex for money, drugs, shelter or gifts *vs.* not having traded sex), alcohol use (daily use *vs.* less than daily but more than weekly usage *vs.* less than weekly or

never), age of first drug use (treated as a continuous variable), nonfatal overdose in the last six months (yes vs. no), and enrollment in drug treatment including methadone in the last six months (yes vs. no). Preliminary analyses revealed that a great number of participants engaged in very casual alcohol usage (*e.g.*, one drinks once weekly, once monthly, or even not at all ever); these were all grouped together into one common category of use, “less than weekly or never,” since the distinction among these various types of casual usage was not felt to be clinically significant.

Statistical analyses

The distribution of the sociodemographic and risk behavior covariates among the four categories of drug use were compared using Pearson's chi-square test for categorical covariates and analysis of variance (ANOVA) for continuous variables. The mean number of depressive symptoms across the four categories was compared using ANOVA. To adjust for confounding variables, we fit a series of confounding models based on an approach described previously [16]. For a variable to have been considered a confounder of the relationship between principle drug of use and depressive symptoms, it had to be associated with both. Therefore, we employed a conservative *p*-value cut-off ≤ 0.20 to determine which candidate variables were associated with depressive symptoms in a series of bivariate analyses (employing Pearson's chi-square for categorical variables and the Kruskal-Wallis test for continuous variables). We then included all these variables in a ‘full’ multivariate model (using multiple linear regression) and, in a stepwise manner, removed all variables that did not change the coefficient for the effect of principle drug used on mean number of depressive symptoms by at least 10%. Remaining variables were considered confounders and were included in all multivariate analyses for the remainder of the analyses. In addition, age, gender and ethnicity were forced into all analyses, since relatively robust relationships between these variables and depression have been described previously among mainstream as well as at-risk youth [11,17,18]

To further examine these associations, we also conducted unadjusted analyses using Pearson's chi-square to compare the proportions with CES-D score ≥ 22 across the four categories of drug use, and then performed adjusted analyses using multivariate logistic regression, controlling for the same subset of confounders yielded using the aforementioned method. Daily marijuana users were used as a reference group. A cutoff of ≥ 22 has been used successfully in previous studies as a more specific measure of depression among high-risk populations, who tend to have higher mean numbers of depressive symptoms on the scale [1,19-21]. Although previous studies have employed a more sensitive cutoff of ≥ 16 [14], preliminary data analyses in our sample revealed that a very large number had scores ≥ 16 , so a higher cutoff of ≥ 22 was chosen to improve the specificity of the measure in our sample.

We performed all statistical analyses using SAS version 9.1 (SAS Institute, Inc, Cary, North Carolina) and Intercooled Stata 10.0 (StataCorp LP, College Station, Texas). All reported *p* values are two-sided and considered significant at $p < 0.05$.

Results

From October 2005 to November 2007, 559 youth were recruited into the ARYS cohort. Overall, 447 (80.0%) were included in the present analysis who fit the criteria of daily marijuana use ($n = 108$ [24.1%]), at least weekly cocaine/crack use ($n = 129$ [28.9%]), at least weekly crystal methamphetamine use ($n = 108$ [24.1%]), and/or at least weekly heroin use ($n = 102$ [22.8%]). Of the 112 not included in this analysis, 32 (28.5%) elected not to complete the CES-D, and the remaining 80 (71.4%) had lower levels of use of marijuana, cocaine/crack, crystal methamphetamine or heroin use than those included in this study and/

or used substances not captured in this analysis. The mean CES-D score for these 80 was 16.3 (standard deviation [SD] = 10.5).

Among those eligible for inclusion in the study, the mean age was 22.0 (SD = 2.8), 311 (69.6%) were male, and 100 (22.4%) were of Aboriginal ancestry. Other races/ethnicities represented included black participants ($n = 17$ [3.8%]), Asian participants ($n = 3$ [0.7%]), and Hispanic participants ($n = 3$ [0.7%]), with the remaining 4 participants (0.9%) classifying themselves as “Other”. Other characteristics of the sample are presented in Table 1.

Depressive symptoms across drug use categories

Mean number of depressive symptoms in the sample was 20.4 (SD = 1.1). Unadjusted mean CES-D score was highest among heroin users (adjusted mean [SD], 23.4 [1.3]), followed by crystal methamphetamine users (22.4 [1.3]), then cocaine/crack users (19.2 [1.0]), and finally, marijuana users (17.0 [0.9]), a difference significant among groups ($p < 0.001$). Figure 1 shows the adjusted mean CES-D scores across the four categories of drug use. As outlined earlier, this multivariate analysis adjusted for age, gender, ethnicity, and our confounder selection process resulted in the additional inclusion of recent sex trade involvement and history of recent nonfatal overdose in our final models. The highest adjusted mean number of depressive symptoms was observed among weekly heroin users (adjusted mean [SD], 22.7 [1.2]), then among weekly crystal methamphetamine users (21.8 [1.1]), then among weekly cocaine/crack users (19.1 [1.0]), and finally, among daily marijuana users (18.3 [1.1]), resulting in a group difference that was also significant ($p < 0.001$).

This hierarchy held after instituting a CES-D cutoff score of ≥ 22 , as shown in Table 2. Overall, the prevalence of CES-D score ≥ 22 was 43.4%. Multiple logistic regression revealed that the odds of having a score ≥ 22 were significantly higher among heroin (adjusted odds ratio [AOR], 2.64; 95% confidence interval [CI], 1.39–4.99) and crystal methamphetamine (AOR, 1.88; 95% CI, 1.04–3.42) users when compared to marijuana users, even despite covariate adjustment. Odds were not significantly different for crack/cocaine users relative to marijuana users (AOR, 1.41; 95% CI, 0.79–2.52). A sensitivity analysis was employed in which polysubstance users were removed from the overall sample, and doing so resulted in similar results (data not shown).

Discussion

In the present study, we observed a very high prevalence of depressive symptoms among street youth, with more than four in ten street youth reporting CES-D score ≥ 22 . The greatest number of depressive symptoms were observed among weekly heroin users, followed by weekly crystal methamphetamine users, then weekly cocaine/crack users, and finally, daily marijuana users. In adjusted analyses employing a conservative CES-D cutoff score of ≥ 22 , weekly heroin users and weekly crystal methamphetamine users had significantly greater odds of having a score above this threshold when compared to daily marijuana users.

It has long been observed that mood disorders and youth risk behaviors including drug use tend to cluster [1,22]. Data drawn from a nationally representative sample of US adolescents have shown, similarly, that rates of depression are lower among drug-abstaining youth [23]. However, the causal nature of this association continues to be debated in the literature, even despite large-scale epidemiological studies of mainstream youth. Some have argued that substance use results in biological, psychological or social changes that predispose an individual to depression, and from a preventive standpoint, the logical point of intervention

is to prevent substance use altogether [1,24]. Others have proposed that drug use represents a form of “self-medication” for a pre-existing mood disorder [2], and that attempts to reduce substance use should primarily target underlying depression. A third plausible mechanism is that substance use and mood disorders share some other common predisposition (*e.g.*, childhood stressors such as trauma, abuse or neglect, or poor attachment to parents, among others).

Because our data are cross-sectional in nature and describe only associations, it remains unclear which of these explanations best explains the extremely high rates of comorbid depression and drug use exhibited by our sample of street youth. Regardless, these mechanisms are likely to be very different among street youth as compared to their mainstream peers, and merit further study to aid preventive efforts targeting this population. Street youth, for example, are much more likely to have experienced important preceding and concurrent stressors such as abuse, neglect, homelessness, poverty, poor relationships with parents, among others [25-27], a fact that renders the interrelationship between substance use and depression even more complex.

Furthermore, why some drugs (*i.e.*, heroin and crystal methamphetamine) are significantly more likely than others to be associated with excessively high depressive symptoms merits further research. In part, these findings may be related to the physiologic effects of certain drugs. For example, stimulants such as cocaine, crack and methamphetamine are clearly associated with euphoria during acute intoxication, whereas withdrawal and craving are associated with dysphoria. Similar mood changes can be seen with acute intoxication with and withdrawal from heroin. A variety of other individual- (*e.g.*, biological and psychological) and meso-/macro-level (*e.g.*, social and environmental) characteristics are likely to contribute to depression and should be carefully explored in future studies. Some basic trends were noted among various drug-using categories. Marijuana users tended to be younger than other users, and were less likely to have ever been jailed previously. They were also less likely to have recently overdosed; indeed, heroin users were by far the most likely to have recently overdosed. Cocaine/crack users were more likely to be of Aboriginal ancestry and to engage in heavier alcohol use than other users. It also is unclear why depressive symptoms among weekly cocaine/crack users were not significantly different from those among daily marijuana users in the present analysis, particularly given the profound dysphoria that can accompany craving. Cocaine/crack users in our sample tended to have recently presented for drug treatment more frequently than frequent marijuana users, which may have served a protective role with regard to depressive symptoms. Ultimately, our analyses controlled for these various sociodemographic and drug-related variables where appropriate, but these data serve to inform policymakers of the characteristics of different drug users and may help further stratify users for their risk of depression.

Multiple studies of adult drug users have examined whether an individual's comorbid depression impedes abstinence following drug treatment. A series of studies have supported the notion that the prognosis of depressed users following treatment is poorer than their non-depressed counterparts, including among opiate users [28,29] and cocaine users [28,30]. Other studies, particularly among alcohol-dependent adults, have not supported the notion that depression affects drug treatment success [31-33]. Similarly, a range of studies of adult users have shown that successful drug treatment may result in a reduction in depressive symptoms, a finding found among opiate users [34] and amphetamine users [35-38]. Whether drug cessation itself results in an improvement in depressive symptoms or whether some other component of treatment (*e.g.*, social support provided by fellow participants) is responsible requires further study [39]. However, it is noteworthy that another study of young methamphetamine users showed that depressive symptoms significantly decreased

following cessation or reduction of drug use regardless of whether they received treatment [20].

This study has several limitations. In selecting our sample, we employed street-based outreach and snowball sampling, an approach that may lend itself to some degree of selection bias. However, it is worth noting that the characteristics of our sample are similar to those of other samples of street youth studied in western Canada [40]. Moreover, although efforts are made to postpone the interviews of participants who are acutely intoxicated or withdrawing from a drug, it is possible that some such participants may have completed their interviews, and the validity of the CES-D has not been established in such individuals. Finally, as outlined earlier, it is important to bear in mind that our results draw on cross-sectional rather than longitudinal data. As such, it is inappropriate to draw conclusions regarding temporality and causality of the association between drug use and depression based on the findings of our study alone.

This study adds new knowledge to the literature on depression among street youth by delineating how the degree of depression varies by the principal drug of use. In particular, it highlights the substantially increased number of depressive symptoms among frequent heroin users and crystal methamphetamine users. Although street youth remain a population both understudied and underserved, they remain at great risk for premature death, and depression may be an important contributing factor by predisposing to suicide, overdose, and HIV-related risk behaviors such as injection drug use and unprotected sex [1,6,11]. Our findings suggest that expanding mental health services to *all* street youth is merited, particularly given the alarmingly high rates of substance abuse and numbers of depressive symptoms observed among our sample. However, in redoubling efforts improve such services, policymakers might heed the apparent vulnerability of heroin and crystal methamphetamine users to even greater levels of depressive symptoms than their other street-involved peers.

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Figure 1. Unadjusted (left) and adjusted (right) mean number of depressive symptoms according to predominant pattern of substance use ($n = 447$). Error bars $\pm$ SD. For both unadjusted and adjusted analyses, $p < 0.001$ for the difference among groups.

Table 1

Characteristics of drug-using street youth by substance predominantly used ($n = 447$).

Characteristic	Total ($n = 447$) N (%)	Daily marijuana users ($n = 108$) N (%)	Weekly cocaine/crack users ($n = 129$) N (%)	Weekly crystal meth users ($n = 108$) N (%)	Weekly heroin users ($n = 102$) N (%)	p -value
Male gender	311 (69.6)	78 (72.2)	92 (71.3)	76 (70.4)	65 (63.7)	0.527
Age (mean, SD)	22.0 (2.8)	20.7 (2.8)	22.1 (2.6)	22.0 (2.7)	23.2 (2.5)	<0.001
Aboriginal ancestry	100 (22.4)	16 (14.8)	41 (31.8)	23 (21.3)	20 (19.6)	0.014
Has regular partner^a	107 (23.9)	29 (26.9)	29 (22.5)	21 (19.4)	28 (27.5)	0.468
High school education^b	168 (37.6)	52 (48.2)	44 (34.1)	37 (34.3)	35 (34.3)	0.079
Recently^c homeless	345 (77.2)	77 (71.3)	108 (83.7)	82 (75.9)	78 (76.5)	0.146
Ever incarcerated	368 (82.3)	80 (74.1)	113 (87.6)	91 (84.3)	84 (82.4)	0.050
Recent^c sex trade involvement	60 (13.4)	4 (3.7)	18 (14.0)	22 (20.4)	16 (15.7)	0.003
Alcohol use						<0.001
At least daily	64 (14.3)	17 (15.7)	25 (19.4)	8 (7.4)	14 (13.7)	
< daily but $\geq$ weekly	138 (30.9)	44 (40.7)	44 (34.1)	31 (28.7)	19 (18.6)	
< weekly, or never	245 (54.8)	47 (43.5)	60 (46.5)	69 (63.9)	69 (67.7)	
Age of first drug use (mean, SD)	12.0 (2.7)	12.2 (2.4)	12.2 (2.9)	11.7 (2.9)	11.6 (2.8)	0.269
Recent^c overdose	60 (13.4)	6 (5.6)	15 (11.6)	12 (11.1)	27 (26.5)	<0.001
Recent^c drug treatment	113 (25.3)	16 (14.8)	41 (31.8)	24 (22.2)	32 (31.4)	0.009

^aIncludes those who are married, common law, or otherwise have a single, regular partner

^bCompleted or currently enrolled in high school

^cDenotes behavior in the last six months

Table 2

Unadjusted and adjusted odds ratios for a CES-D score ≥ 22 according to predominant pattern of substance use ($n = 447$).

Pattern of substance use	OR for CES-D score ≥ 22		
	CES-D score $\geq 22^a$ N (%)	Unadjusted OR (95% CI)	Adjusted ^b OR (95% CI)
Daily marijuana users ($n = 108$)	30 (27.8)	<i>Reference</i>	<i>Reference</i>
Weekly cocaine/crack users ($n = 129$)	52 (40.0)	1.73 (1.00 – 3.00)	1.41 (0.79 – 2.52)
Weekly crystal meth users ($n = 108$)	52 (48.2)	2.46 (1.40 – 4.33)	1.88 (1.04 – 3.42)
Weekly heroin users ($n = 102$)	60 (59.4)	3.87 (2.17 – 6.89)	2.64 (1.39 – 4.99)

^a $p < 0.001$ for overall difference in proportions

^b Adjusted for gender, age, ethnicity, sex trade involvement and history of recent overdose