

## Original Article

# Misuse of prescription and illicit drugs among high-risk young adults in Los Angeles and New York

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## Significance for public health

Prescription drug misuse among young adults is increasingly viewed as a public health concern in the US, since it is associated with various risk practices. Research examining prescription drug misuse among high-risk groups of young adults is limited. Large metropolitan areas, such as Los Angeles (LA) and New York (NY), are primary places to study prescription misuse. Study findings suggest that prescription drugs commonly seized in NY and LA are those most commonly misused in each city, and that variability in local markets of diverted drugs may impact frequency of misuse and modes of administration. Results on ages of initiation suggest that prescription drugs may serve as pathways to illicit drugs in some cases. Findings on drug substitution, drug combinations, and polydrug use indicate that prescription drugs in both NY and LA were frequently consumed as a part of a repertoire of misuse involving prescription drugs and illicit drugs.

## Abstract

**Background.** Prescription drug misuse among young adults is increasingly viewed as a public health concern, yet most research has focused on student populations and excluded high-risk groups. Furthermore, research on populations who report recent prescription drug misuse is limited. This study examined patterns of prescription drug misuse among high-risk young adults in Los Angeles (LA) and New York (NY), which represent different local markets for illicit and prescription drugs.

**Design and Methods.** Between 2009 and 2011, 596 young adults (16 to 25 years old) who had misused prescription drugs within the past 90 days were interviewed in Los Angeles and New York. Sampling was stratified to enroll three groups of high-risk young adults: injection drug users (IDUs); homeless persons; and polydrug users.

**Results.** In both sites, lifetime history of receiving a prescription for an opioid, tranquilizer, or stimulant was high and commonly preceded misuse. Moreover, initiation of opioids occurred before heroin and initiation of prescription stimulants happened prior to illicit stimulants. NY participants more frequently misused oxycodone, heroin, and cocaine, and LA participants more frequently misused codeine, marijuana, and methamphetamine. Combining prescription and illicit drugs during drug using events was commonly reported in both sites. Opioids and tranquilizers were used as substitutes for other drugs, e.g., heroin, when these drugs were not available.

**Conclusion.** Patterns of drug use among high-risk young adults in Los Angeles and New York appear to be linked to differences in local markets in each city for illicit drugs and diverted prescription drugs.

## Introduction

Prescription drugs have become established as primary substances of abuse alongside illicit drugs among young adults in the US over the past 10 years.<sup>1</sup> Prescription opioids are the second most commonly misused drug after marijuana among persons aged 16 to 25 years old followed by cocaine, prescription tranquilizers, ecstasy, and prescription stimulants.<sup>2</sup> Prescription drug misuse among young adults is increasingly viewed as a public health concern since it is associated with risk practices, such as sexual risk behaviors,<sup>3</sup> polydrug use,<sup>4</sup> and injection drug use,<sup>5</sup> and negative health outcomes, such as drug dependence and drug overdose.<sup>2</sup>

Most research on prescription drug misuse among young adults in the US has focused exclusively on student populations<sup>6-8</sup> or utilized data from national sentinel surveys.<sup>9,10</sup> In all of these studies of young adults, lifetime prevalence of the most commonly misused prescription drug – opioids – is no greater than 20% while current misuse (30- or 90-day) is below 5%. While documenting important trends among lifetime misusers, these studies present limited data on young adults who are *current* misusers of prescription drugs – the population at the greatest risk for negative health outcomes.

Additionally, only a few studies have targeted or included high-risk groups of young adults, such as homeless persons, injection drug users, or polydrug users, into research examining prescription drug misuse.<sup>11-14</sup> While originally focused on ecstasy or ketamine users, these studies report much higher rates of prescription drug misuse, e.g., lifetime opioid misuse exceeding 80%, than studies targeting young adults who are housed, employed, or in school. Ultimately, studies that do not include high-risk groups may limit understanding of more complex patterns of prescription drug misuse.

Large metropolitan areas are primary places to study prescription misuse among diverse populations of young adults since current rates of drug use are highest in these areas.<sup>2</sup> New York (NY) and Los Angeles (LA), the two largest metropolitan areas in the US<sup>15</sup> with distinctly different cultural histories, local economies, and geographies, each represent particular local drug markets for both illicit and prescription drugs. A picture of each local drug market can be ascertained by comparing the most prevalent drugs (out of 100%) recently seized and analyzed by law enforcement in LA and NY, respectively: marijuana (38% vs 31%); cocaine (23.6% vs 38.9%); methamphetamine (16.1% vs 0.5%); heroin (5% vs 10.9%); hydrocodone (1.6% vs 0.7%); oxycodone (0.4% vs 3.5%); and alprazolam (0.7% vs 2.6%).<sup>16</sup> Furthermore, local heroin markets differ in these cities: Mexican tar heroin predominates in LA, a less pure form compared to South American powder heroin in NY.<sup>17</sup>

In this analysis, we have two primary objectives. First, we aim to describe overall differences in lifetime and recent patterns of drug use among young adults in NY and LA who report recent misuse of prescription drugs. Based upon differences in local drug markets, we hypothesize that NY participants will report greater misuse of oxycodone products, such as Percocet and OxyContin, as well as alprazolam (Xanax), than LA, while LA participants will report greater misuse of hydrocodone products, such as Vicodin, than NY. Additionally, we hypothesize that NY participants will report greater use of cocaine and heroin than LA while LA participants will report greater use of methamphetamine and marijuana than NY. Second, we aim to describe the interrelationship among prescription and illicit drug misuse among a sample of high-risk young adults, regarding ages of initiation, patterns of polydrug use, and modes administration. We hypothesize that patterns of opioid misuse, for instance, will be associated with patterns of heroin use.

## Materials and Methods

### Sampling

The analysis is based upon a sample of 596 young adults interviewed in LA and NY between October 2009 and March 2011. Eligible participants were between 16 and 25 years old and had engaged in misuse of a prescription drug, *i.e.*, opioid, tranquilizer, or stimulant, or any combination at least three times in the last 90 days. *Misuse* was defined as taking a prescription drug *when they were not prescribed for you or that you took only for the experience or feeling it caused*.<sup>2,18</sup> Sampling was stratified to enroll three groups of high-risk young adults with different access to prescription drugs: injection drug users (IDUs), homeless persons, and polydrug users. IDUs were defined as injecting a drug within the past 90 days. Homeless persons were defined as not having a consistent residence within the past 90 days and/or sleeping on the street, in a park, or squat; injecting drugs in the past 90 days was an exclusion criteria for this group. Polydrug users were defined as having used two or more drugs (alcohol, illicit, and/or prescriptions) simultaneously within the past 90 days; being homeless or injecting drugs in the past 90 days were exclusion criteria for this group.

Participants were located using a combination of sampling strategies and data sources. Interviewers employed both targeted<sup>19</sup> and chain-referral sampling<sup>20</sup> in combination with recruitment data from earlier project phases<sup>5</sup> to recruit young adults in natural settings, such as parks, streets, and neighborhoods. In New York, some participants were recruited from organizations serving homeless youth since homeless individuals meeting the enrollment criteria were more difficult to locate in natural settings. A brief screening tool was used to determine eligibility, and screened individuals received a \$3 gift card. Participants who qualified and were interviewed received a \$25 cash incentive. The study protocol was approved by institutional review boards at Drexel University, Children's Hospital Los Angeles, and National Development and Research Institutes, Inc.

Across the two sites, a total of 4432 individuals were screened and 831 (18.8%) met the enrollment criteria. Among the 831 eligible young adults, 618 (74.4%) agreed to participate and were interviewed. Twenty-two participants (3.6%) were later excluded after it was revealed that they had not misused a prescription drug at least three times in the last 90 days, resulting in a final sample of 596. Based upon the stratification criteria, the final sample was comprised of 202 IDUs (LA=100, NY=102), 192 homeless (LA=102, NY=90) and 202 polydrug users (LA=101, NY=101). In the final sample, the total number of currently homeless young adults was 355 since many in the IDU group were both IDUs and homeless.

### Data collection

The study instrument was developed using Entryware software (Technos Systems, Inc., Vancouver, Canada) and loaded onto laptop computers. The instrument was administered during face-to-face interviews with eligible participants by one of two interviewers at each site. Participants were provided with cards containing response options to facilitate standardization on some interview questions. Interviews were conducted in private offices or natural settings, such as fast food restaurants and parks. Interview data were recorded on laptop computers and with digital recorders.

### Measures

The instrument incorporated questions from standardized measures, previous studies,<sup>14</sup> and from topics that emerged during the formative qualitative phase.<sup>5</sup> Demographic indicators, such as age, gender, and race, were assessed using conventional questions. The particular questions assessing drug use are detailed in Table 1.

### Data analysis

Statistical analyses were conducted on cross-sectional data using SPSS version 18. Descriptive statistics were calculated overall and within site (LA and NY). In most cases, *t*-tests for continuous variables and Pearson's  $\chi^2$ -tests for binary variables compared differences between sites. In some cases, paired statistical tests, *e.g.*, paired *t*-tests and McNemar tests, compared within-site means or frequencies.

Due to the large number of comparisons, all P-values have been adjusted using the false discovery rate controlling procedure described by Benjamini and Hochberg.<sup>21,22</sup> The procedure involved ordering the nominal P-values associated with the entire set of comparisons, computing a Bonferroni-type adjusted critical value based on the ordered position of the test, and comparing the nominal p-value to the adjusted critical value. Using this procedure, 11 comparisons previously considered to be significant at  $P < 0.05$  were excluded after adjustment for multiple comparisons. Adjusted significance levels are presented in the text and in Tables 2-6.

## Results

### Demographics

Sociodemographic variables are summarized in Table 2. Sample participants were typically in their early 20s, white, male, and heterosexual. Over half reported being raised in a middle or upper class family. Most were currently homeless, unemployed, or had been arrested, while nearly half had health insurance or a history of drug treatment. About one-third were students. NY participants were more frequently female (38% *vs* 26%,  $P < 0.01$ ), white (64% *vs* 49%,  $P < 0.001$ ), employed (27% *vs* 16%,  $P < 0.01$ ) and had health insurance (58% *vs* 37%,  $P < 0.001$ ) than LA.

### Lifetime misuse, prescribed use, and ages of initiation—prescription and illicit drugs

Frequencies of lifetime misuse, prescribed use, and ages of initiation for prescription and illicit drugs are presented in Table 3, including a select set of illicit drugs that also may function as pain medications, tranquilizers, or stimulants. Among prescription drugs, opioids were the most frequently misused and prescribed. Regarding ages of prescribed use, stimulants were prescribed at the earliest age, followed by opioids and tranquilizers. Regarding ages of initiation into misuse, marijuana was initiated at the earliest age followed by opioids, stimulants, and tranquilizers.

**Table 1. Primary questions from survey instrument used to assess substance use and misuse in the statistical analysis.**

Key constructs	Question
Lifetime history of receiving a prescription medication	Were you ever prescribed the following [pain pills, tranquilizers, stimulants] by a doctor for any past injury or health condition?
Age of being prescribed a medication	How old were you when you were first prescribed these medications?
Lifetime history of prescription drug misuse	Have you ever, even once, used any of the following [pain pills, tranquilizers, stimulants] when they were not prescribed for you or that you took only for the experience or feeling it caused? Pain pill list: Vicodin, OxyContin, Percocet, etc. Tranquilizer list: Xanax, Klonopin, Valium, etc. Stimulant list: Adderall, Ritalin, Concerta, etc.
Age of misuse initiation of prescription drug	How old were you the first time you used [pain pills, tranquilizers, stimulants] only for the experience or feeling they caused?
Lifetime history of misusing prescription drugs via other modes of administration	Have you ever [sniffed, smoked, injected] a [pain pill, tranquilizer, stimulant]?
Polydrug use with prescription drugs	Which statement best describes how you've taken [pain pills, tranquilizers, stimulants] during the past 12 months: 1. By itself, without using any other substances before, during, or after; 2. In combination with one or more substances before, during or after.
Drug substitution with prescription drugs	Have you ever used a [pain pill, tranquilizer, stimulant] as a substitute for another drug that you wanted, but could not find? If yes, which drugs? and Have you ever used another drug as a substitute for a [pain pill, tranquilizer, stimulant] that you wanted, but could not find? If yes, which drugs?
Recent prescription drug misuse	How long has it been since you last used any [pain pills, tranquilizers, stimulants] that were not prescribed for you or that you took only for the experience or feeling it caused?
Lifetime history of using illicit drugs	Have you ever used [illicit drug list]? List of illicit drugs: marijuana, LSD, ecstasy, heroin, cocaine, crack, crystal meth, ketamine.
Age of initiation of illicit drugs	How old were you the first time you used [illicit drug list]?
Lifetime history of injecting illicit drugs	Have you ever injected any of the following [illicit drug list]?
Recent illicit drug misuse	How long has it been since you last used [illicit drug list]?
Lifetime history of receiving a prescription medication	Were you ever prescribed the following [pain pills, tranquilizers, stimulants] by a doctor for any past injury or health condition?
Age of being prescribed a medication	How old were you when you were first prescribed these medications?
Lifetime history of prescription drug misuse	Have you ever, even once, used any of the following [pain pills, tranquilizers, stimulants] when they were not prescribed for you or that you took only for the experience or feeling it caused? Pain pill list: Vicodin, OxyContin, Percocet, etc. Tranquilizer list: Xanax, Klonopin, Valium, etc. Stimulant list: Adderall, Ritalin, Concerta, etc.
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Polydrug use with prescription drugs	Which statement best describes how you've taken [pain pills, tranquilizers, stimulants] during the past 12 months: 1. By itself, without using any other substances before, during, or after; 2. In combination with one or more substances before, during or after.
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Recent prescription drug misuse	How long has it been since you last used any [pain pills, tranquilizers, stimulants] that were not prescribed for you or that you took only for the experience or feeling it caused?
Lifetime history of using illicit drugs	Have you ever used [illicit drug list]? List of illicit drugs: marijuana, LSD, ecstasy, heroin, cocaine, crack, crystal meth, ketamine.
Age of initiation of illicit drugs	How old were you the first time you used [illicit drug list]?
Lifetime history of injecting illicit drugs	Have you ever injected any of the following [illicit drug list]?
Recent illicit drug misuse	How long has it been since you last used [illicit drug list]?

**Table 2. Demographics by site (Los Angeles and New York).**

Demographic factors	LA, n=303 (%)	NY, n=293 (%)	Total, n=596, (%)	$\chi^2$ -test
Age (mean $\pm$ SD)	20.91 (2.11)	20.81 (2.00)	20.86 (2.06)	ns
Gender <sup>o</sup>				$\chi^2(1)=9.4^{**}$
Male	213 (70)	177 (61)	390 (66)	
Female	78 (26)	112 (38)	190 (32)	
Transgender	12 (4)	3 (1)	15 (2)	
Race <sup>#</sup>				$\chi^2(1)=14.0^{***}$
Non-Hispanic White	147 (49)	186 (64)	333 (56)	
Nonwhite:	155 (51)	105 (36)	260 (44)	
Hispanic	52 (17)	34 (12)	86 (15)	
Multiracial	45 (15)	46 (16)	91 (15)	
Black/African American	46 (15)	19 (7)	65 (11)	
Asian/Pacific Islander	7 (2)	4 (1)	11 (2)	
Native American	5 (2)	2 (0.7)	7 (1)	
Sexual identity				ns
Heterosexual	210 (70)	183 (63)	393 (66)	
LGBT	93 (31)	108 (37)	201 (34)	
Socioeconomic status growing up				ns
Poor or lower class	140 (47)	124 (43)	264 (45)	
Middle or upper class	161 (54)	167 (57)	328 (55)	
Completed high school/GED	222 (73)	223 (76)	445 (75)	ns
Currently in school	97 (32)	100 (34)	197 (33)	ns
Currently employed	49 (16)	79 (27)	128 (22)	$\chi^2(1)=10.3^{**}$
Currently insured	111 (37)	169 (58)	280 (47)	$\chi^2(1)=28.6^{***}$
Currently homeless	194 (64)	161 (55)	355 (60)	ns
History of arrest	241 (80)	213 (73)	454 (76)	ns
History of jail time	203 (67)	182 (62)	385 (65)	ns
Drug treatment	123 (41)	127 (43)	250 (42)	ns

<sup>o</sup> $\chi^2$ -test based on male vs female only; <sup>#</sup> $\chi^2$ -test based on white vs nonwhite only; LGBT, lesbian, gay, bisexual, or transgender; ns, non-significant; \*P<0.05; \*\*P<0.01; \*\*\*P<0.001.

Nearly all of the significant between-site differences pertain to prescription or illicit stimulants. A significantly greater percentage of LA participants had been prescribed stimulants compared to NY (51% vs 39%, P<0.05). Moreover, LA participants were prescribed stimulants at significantly earlier ages than NY (10.9 vs 12.2 years, P<0.05) and initiated stimulant misuse at significantly earlier ages than NY (15.4 vs 16.2 years, P<0.05). However, a significantly greater percentage of NY participants reported lifetime misuse of prescription stimulants than LA (84% vs 71%, P<0.001). The only significant illicit drug site difference pertained to methamphetamine: a significantly greater percentage of LA participants used methamphetamine compared to NY (61% vs 38%, P<0.001).

Regarding within site differences (*all results and paired t-tests not shown in Table 3*), participants in NY and LA were prescribed stimulants at significantly earlier ages than their first misuse of stimulants (12.4 vs 15.4 years; paired t(102)= -6.68, P<0.001; 11.0 vs 14.7 years; paired t(125)= -9.36, P<0.001, respectively). Moreover, participants in both NY and LA initiated misuse of prescription stimulants at significantly earlier ages than cocaine, methamphetamine, and ecstasy (16.1 vs 17.1 years; paired t(209)= -5.95, P<0.001; 15.2 vs 16.9 years; paired t(190)= -7.63 P<0.001, respectively). Among those prescribed opioids, no significant differences emerged between age of prescribed use and age of first misuse. In both NY and LA, participants initiated misuse of opioids at significantly earlier ages than heroin (14.8 vs 17.5 years; paired t(149)= -13.52, P<0.001; 14.6 vs 17.5 years; paired t(137)= -11.43, P<0.001, respectively).

### Specific prescription drugs misused

Frequencies of lifetime misuse of specific types of prescription drugs, which may provide insights into local prescribing practices and

drug diversion, are presented in Table 4. Participants reported lifetime misuse of a wide range of prescription opioids of differing potencies.\* The most frequently misused opioids included hydrocodone, oxycodone, and codeine. A significantly greater percentage of NY participants reported misuse of any oxycodone product compared to LA (89% vs 71%, P<0.001), whereas a significantly greater percentage of LA participants reported misuse of codeine compared to NY (62% vs 51%, P<0.05). Vicodin was the most frequently misused formulation of hydrocodone, and OxyContin was the most frequently misused formulation of oxycodone. Except for Percodan, NY participants reported significantly more misuse of all formulations and combinations of oxycodone than LA, e.g., Percocet (73% vs 40%, P<0.001). Within sites, LA participants reported significantly more misuse of any hydrocodone than any oxycodone (87% vs 71%; McNemar  $\chi^2(1)=22.0$ , P<0.001). Misuse of any opioid substitution medications, such as methadone or buprenorphine, was reported by less than half of all participants, while NY participants reported significantly more misuse of Suboxone (34% vs 17%, P<0.001) and Subutex (14% vs 6%, P<0.01) than LA.

Xanax was the most frequently misused tranquilizer, followed by Valium and Klonopin. NY participants reported significantly more misuse of Klonopin (60% vs 41%, P<0.001), while LA participants reported significantly more misuse of Seroquel (50% vs 38%, P<0.05). Adderall was the most frequently misused stimulant followed by Ritalin, Concerta, and Dexedrine. NY participants reported significantly more misuse of Adderall (75% vs 60%, P<0.001), Ritalin (51% vs 41%, P<0.05), and Concerta (23% vs 15%, P<0.05) than LA.

\*There are notable differences in the potencies of prescription opioids. For instance, oxycodone is seven to twelve times stronger than codeine, while hydrocodone is two to eight times stronger than codeine assuming similar modes of administration.<sup>23</sup>

### Prescription drug using practices and risk behaviors

Frequencies of lifetime modes of administering specific categories of prescription drugs and illicit drugs are presented in Table 5. Participants administered prescription drugs via a range of modalities other than swallowing: snorting was more commonly reported than either injecting or smoking. Opioids were more frequently sniffed, smoked, and injected than either stimulants or tranquilizers. NY participants were significantly more likely to sniff opioids (68% vs 53%,  $P<0.001$ ) and stimulants (58% vs 43%,  $P<0.01$ ) than LA. LA participants more commonly smoked all three types of drugs compared to NY participants, but only opioids exhibited a significant difference (27% vs 14%,  $P<0.001$ ). No site differences regarding injecting prescription drugs were observed; overall, approximately one-quarter of participants ever injected a prescription opioid.

Comparing histories of injecting illicit drugs revealed more site differences. NY participants reported significantly greater frequency of injecting heroin (41% vs 30%,  $P<0.05$ ), cocaine (32% vs 17%,  $P<0.001$ ), and crack (16% vs 9%,  $P<0.05$ ), while LA participants reported significantly greater frequency of injecting methamphetamine (27% vs 12%,  $P<0.001$ ). Comparing injecting heroin and opioids within sites, NY participants reported significantly greater frequency of injecting heroin than opioids (41% vs 29%,  $P<0.01$ ), whereas no significant differences in LA were observed.

Polydrug use, or combining drugs during a drug-using event, was a common feature of prescription drug misuse: a majority of misusers of

both opioids and tranquilizers reported that combining these drugs with other drugs was typical in the past 12 months. No site differences were observed. Substituting with prescription drugs, *e.g.*, prescription opioids, when other drugs, *e.g.*, heroin, could not be located was commonly reported: half of the sample's opioid users reported using an opioid as a substitute, though fewer tranquilizer and stimulant users reported this practice. No site differences were found. Substituting with other drugs when prescription drugs could not be found was less frequently reported. However, among those that did, LA participants reported significantly greater frequency of using another drug as a substitute for opioids (36% vs 27%,  $P<0.05$ ), tranquilizers (28% vs 19%,  $P<0.05$ ), and stimulants (22% vs 13%,  $P<0.05$ ) than NY participants.

### Current misuse of prescription and illicit drugs

Frequencies of 90-day misuse of prescription and illicit drugs are presented in Table 6. All participants misused at least one prescription drug within the past 90-days (an enrollment criterion for the study). Opioids and tranquilizers were the most frequently misused, followed by stimulants. No significant differences were found by site. Participants also reported frequent use of illicit drugs in the past 90 days. As predicted, NY participants reported significantly greater use of heroin (40% vs 29%,  $P<0.01$ ) and cocaine (59% vs 36%,  $P<0.001$ ), while LA participants reported significantly greater use of marijuana (97% vs 90%,  $P<0.001$ ) and methamphetamine (40% vs 12%,  $P<0.001$ ).

Participants reported co-occurring misuse of prescription and illicit

**Table 3. Lifetime misuse/use of prescription/illicit drugs, drugs prescribed, and age of initiation by site (Los Angeles and New York).**

Lifetime misuse/use	LA, n=303 (%)	NY, n=293 (%)	Total, n=596 (%)	$\chi^2$ -test
<b>Misuse of prescription drugs</b>				
Opioids	292 (96)	284 (97)	576 (97)	ns
Tranquilizers	266 (88)	267 (91)	533 (89)	ns
Stimulants	215 (71)	247 (84)	462 (78)	$\chi^2(1)=15.2^{***}$
Lifetime misuse of all 3	189 (62)	222 (76)	411 (69)	$\chi^2(1)=12.5^{**}$
<b>Drugs prescribed</b>				
Opioids	232 (77)	202 (69)	434 (73)	ns
Tranquilizers	138 (46)	133 (45)	271 (46)	ns
Stimulants	154 (51)	115 (39)	269 (45)	$\chi^2(1)=8.1^*$
Any of 3	274 (90)	248 (85)	522 (88)	ns
<b>Use of illicit drugs</b>				
Marijuana	302 (100)	292 (99)	593 (100)	ns
Ecstasy	257 (85)	245 (84)	502 (84)	ns
Cocaine	244 (81)	256 (87)	500 (84)	ns
Methamphetamine	186 (61)	111 (38)	297 (50)	$\chi^2(1)=32.9^{***}$
Heroin	140 (46)	152 (52)	292 (49)	ns
Crack	132 (44)	118 (40)	250 (42)	ns
Age of initiation	LA (mean, SD)	NY (mean, SD)	Total (mean, SD)	t-test t(df), P-value
<b>Misuse of prescription drugs</b>				
Stimulants	15.4 (3.5)	16.2 (2.5)	15.8 (3.1)	t(460)= -2.7*
Opioids	15.6 (3.1)	15.5 (2.4)	15.5 (2.8)	ns
Tranquilizers	16.3 (3.0)	16.3 (2.7)	16.3 (2.9)	ns
<b>First prescribed</b>				
Stimulants	10.9 (4.4)	12.2 (4.6)	11.5 (4.5)	t(267)= -2.4*
Opioids	15.4 (3.9)	15.4 (3.8)	15.4 (3.8)	ns
Tranquilizers	16.0 (3.6)	16.2 (3.2)	16.1 (3.4)	ns
<b>Use of illicit drugs</b>				
Marijuana	13.3 (3.1)	13.6 (2.4)	13.4 (2.8)	ns
Cocaine	16.7 (2.6)	16.6 (2.3)	16.6 (2.4)	ns
Methamphetamine	16.9 (3.3)	17.3 (2.6)	17.1 (3.0)	ns
Ecstasy	17.2 (2.6)	17.2 (2.1)	17.2 (2.4)	ns
Heroin	17.5 (2.6)	17.5 (2.3)	17.5 (2.4)	ns
Crack	17.4 (2.6)	17.9 (2.4)	17.6 (2.5)	ns

ns, non-significant; \* $P<0.05$ ; \*\* $P<0.01$ ; \*\*\* $P<0.001$ .

drugs within the past 90 days, which may indicate patterns of polydrug use or drug substitution. The co-occurrence of opioids and tranquilizers was most frequent. No significant differences by site were found. Regarding illicit drugs, the three most frequently reported co-occurrences were tranquilizers and cocaine, opioids and heroin, and tranquilizers and ecstasy. While multiple significant site differences were found, the largest differences involved LA participants reporting more frequent combinations of tranquilizers and methamphetamine (33% vs 9%,  $P < 0.001$ ) and NY participants reporting more frequent combinations of tranquilizers and cocaine (47% vs 29%,  $P < 0.001$ ). Additionally, NY participants reported more frequent combinations of stimulants and cocaine (32% vs 19%,  $P < 0.01$ ).

## Discussion

This is the first study to our knowledge that compares patterns of prescription and illicit drug misuse in two large urban areas among diverse samples of young adults who are current misusers of prescription drugs. Lifetime misuse of particular prescription drugs and recent use of illicit drugs closely tracked drug seizure data and largely confirmed our first hypotheses: more frequent misuse of oxycodone, heroin, and cocaine in NY, and more frequent use of marijuana and

methamphetamine in LA.<sup>16</sup> Hydrocodone was more frequently misused than oxycodone in LA, which is also consistent with monitoring data.<sup>16</sup> These findings suggest that prescription drugs commonly seized in NY and LA are in fact those most commonly misused in each city, and that variability in local markets of diverted drugs may impact frequency of misuse.

Moreover, variations in local drug markets may be factors in explaining differences in modes of administering opioids and heroin in each city. For instance, Mexican heroin found in LA is frequently in tar form, whereas Colombian heroin found in NY is commonly in powder form.<sup>24</sup> In NY, where sniffing powder heroin is common,<sup>25</sup> NY participants more frequently sniffed opioids than LA participants. In LA, where smoking tar heroin is common,<sup>26</sup> LA participants more frequently smoked opioids than NY participants. These results suggest that participants may have transferred local practices for administering different forms of heroin in each site, *i.e.*, sniffing and smoking, towards administering prescription opioids. These findings provide support for our second hypothesis which proposed an interrelationship between opioid and heroin use.

Furthermore, our results suggest the differences in heroin markets – both supply and form – did not impact lifetime frequency of injecting prescription opioids. NY participants reported more frequent lifetime heroin use, 90-day use, and heroin injection than LA. However, no dif-

**Table 4. Specific prescription drug type misused by site (Los Angeles and New York).**

Type of prescription drug	LA, n=303 (%)	NY, n=293 (%)	Total, n=596, (%)	$\chi^2$ -test
<b>Opioids</b>				
Any hydrocodone	263 (87)	246 (84)	509 (85)	ns
Vicodin (hydrocodone)	257 (85)	234 (80)	491 (82)	ns
Lortab (hydrocodone)	89 (29)	83 (28)	172 (29)	ns
Norco (hydrocodone)	31 (10)	28 (10)	59 (10)	ns
2 or more hydrocodones	93 (31)	85 (29)	178 (30)	ns
Any oxycodone	216 (71)	261 (89)	477 (80)	$\chi^2(1)=29.5^{***}$
Oxycontin (oxycodone)	196 (65)	220 (75)	416 (70)	$\chi^2(1)=7.6^*$
Percocet (oxycodone)	120 (40)	215 (73)	335 (56)	$\chi^2(1)=69.0^{***}$
Percodan (oxycodone)	41 (14)	44 (15)	85 (14)	ns
Roxicet (oxycodone)	32 (11)	60 (21)	92 (15)	$\chi^2(1)=11.2^{**}$
2 or more oxycodones	114 (38)	183 (63)	297 (50)	$\chi^2(1)=36.7^{***}$
Any opioid therapy	121 (40)	131 (45)	252 (42)	ns
Methadone	106 (35)	103 (35)	209 (35)	ns
Suboxone (buprenorphine/naloxone)	51 (17)	101 (34)	152 (25)	$\chi^2(1)=24.4^{***}$
Subutex (buprenorphine)	19 (6)	41 (14)	60 (10)	$\chi^2(1)=9.8^{**}$
2 or more opioid therapy	40 (13)	78 (26)	118 (20)	$\chi^2(1)=16.9^{***}$
Codeine	188 (62)	150 (51)	338 (57)	$\chi^2(1)=7.1^*$
Morphine	144 (48)	125 (43)	269 (45)	ns
Dilaudid (hydromorphone)	61 (20)	67 (23)	128 (22)	ns
Fentanyl	47 (16)	73 (25)	120 (20)	$\chi^2(1)=8.2^*$
Demerol (meperidine)	57 (19)	41 (14)	98 (16)	ns
Other	44 (15)	48 (16)	92 (15)	ns
<b>Tranquilizers</b>				
Xanax (alprazolam)	222 (73)	234 (80)	456 (77)	ns
Valium (diazepam)	157 (52)	169 (58)	326 (55)	ns
Klonopin (clonazepam)	124 (41)	177 (60)	301 (51)	$\chi^2(1)=23.1^{***}$
Seroquel (quetiapine)	150 (50)	110 (38)	260 (44)	$\chi^2(1)=8.5^*$
Ativan (lorazepam)	58 (19)	71 (24)	129 (22)	ns
Other	63 (21)	73 (25)	136 (23)	ns
<b>Stimulants</b>				
Adderall (amphetamine and dextroamphetamine)	183 (60)	220 (75)	403 (68)	$\chi^2(1)=15.2^{***}$
Ritalin (methylphenidate)	123 (41)	148 (51)	271 (46)	$\chi^2(1)=6.1^*$
Concerta (methylphenidate)	45 (15)	67 (23)	112 (19)	$\chi^2(1)=6.4^*$
Dexedrine (dextroamphetamine)	34 (11)	52 (18)	86 (14)	ns
Other	25 (8)	35 (12)	60 (10)	ns

ns, non-significant; \* $P < 0.05$ ; \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

**Table 5. Lifetime illicit and prescription drug misuse practices by site (Los Angeles and New York).**

Drug using practices	LA, n=303 (%)	NY, n=293 (%)	Total, n=596 (%)	$\chi^2$ -test
Ever sniff Rx drugs <sup>o</sup>				
Any	204 (67)	237 (81)	441 (74)	$\chi^2(1)=15.6^{***}$
Opioids	159 (53)	198 (68)	357 (60)	$\chi^2(1)=14.1^{***}$
Tranquilizers	130 (43)	140 (48)	270 (45)	ns
Stimulants	131 (43)	169 (58)	300 (50)	$\chi^2(1)=12.4^{**}$
Ever smoke Rx drugs <sup>#</sup>				
Any	95 (31)	59 (20)	154 (26)	$\chi^2(1)=9.8^{**}$
Opioids	82 (27)	41 (14)	123 (21)	$\chi^2(1)=15.5^{***}$
Tranquilizers	27 (9)	15 (5)	42 (7)	ns
Stimulants	19 (6)	14 (5)	33 (6)	ns
Ever inject Rx drugs <sup>s</sup>				
Any	77 (25)	84 (29)	161 (27)	ns
Opioids	72 (24)	82 (28)	154 (26)	ns
Tranquilizers	33 (11)	30 (10)	63 (11)	ns
Stimulants	16 (5)	25 (9)	41 (7)	ns
Ever inject illicit drugs				
Heroin	91 (30)	121 (41)	212 (36)	$\chi^2(1)=8.1^*$
Cocaine	51 (17)	94 (32)	145 (24)	$\chi^2(1)=18.6^{***}$
Crack	26 (9)	47 (16)	73 (12)	$\chi^2(1)=7.6^*$
Methamphetamine	81 (27)	36 (12)	117 (20)	$\chi^2(1)=19.9^{***}$
Polydrug use in conjunction with Rx drug				
Opioids	191 (71)	201 (78)	392 (74)	ns
Tranquilizers	169 (70)	177 (74)	346 (72)	ns
Stimulants	79 (53)	106 (61)	185 (57)	ns
Ever used Rx as substitute for another drug				
Opioids	151 (50)	149 (51)	300 (50)	ns
Tranquilizers	104 (34)	112 (38)	216 (36)	ns
Stimulants	65 (22)	74 (25)	139 (23)	ns
Ever used another drug as substitute for Rx				
Opioids	110 (36)	80 (27)	190 (32)	$\chi^2(1)=5.6^*$
Tranquilizers	86 (28)	55 (19)	141 (24)	$\chi^2(1)=7.6^*$
Stimulants	65 (22)	37 (13)	102 (17)	$\chi^2(1)=8.2^*$

<sup>o</sup> $\chi^2$ -test based on sniffed any vs none only (but as we discover much of the difference is driven by the opioids); <sup>#</sup> $\chi^2$ -test based on smoked any vs none only; <sup>s</sup> $\chi^2$ -test based on injected any vs none only; ns, non-significant; \*P<0.05; \*\*P<0.01; \*\*\*P<0.001.

**Table 6. 90-day misuse of illicit and prescription drugs by site (Los Angeles and New York.)**

Drug type(s)	LA, n=303 (%)	NY, n=293 (%)	Total, n=596 (%)	Difference test
90-day misuse of Rx drugs				
Opioids	246 (82)	229 (78)	475 (80)	ns
Tranquilizers	213 (71)	209 (71)	422 (71)	ns
Stimulants	122 (41)	143 (49)	265 (45)	ns
90-day use of illicit drugs				
Marijuana	295 (97)	263 (90)	558 (94)	$\chi^2(1)=16.0^{***}$
Cocaine	109 (36)	174 (59)	283 (47)	$\chi^2(1)=32.5^{***}$
Ecstasy	130 (43)	106 (36)	236 (40)	ns
Heroin	87 (29)	119 (40)	206 (35)	$\chi^2(1)=9.4^{**}$
Methamphetamine	120 (40)	34 (12)	154 (26)	$\chi^2(1)=61.3^{***}$
Crack	61 (20)	50 (17)	111 (19)	ns
Rx combinations				
Opioids & tranquilizers	175 (58)	167 (57)	342 (57)	ns
Opioids & stimulants	85 (28)	100 (34)	185 (31)	ns
Tranquilizers & stimulants	90 (30)	97 (33)	187 (31)	ns
Rx and illicit combinations				
Opioids & heroin	84 (28)	111 (38)	195 (33)	$\chi^2(1)=7.0^*$
Tranquilizers & heroin	75 (25)	96 (32)	171 (29)	ns
Stimulants & cocaine	59 (19)	93 (32)	152 (25)	$\chi^2(1)=11.8^{**}$
Stimulants & ecstasy	63 (21)	61 (21)	124 (21)	ns
Stimulants & methamphetamine	51 (17)	23 (8)	74 (12)	$\chi^2(1)=11.1^{**}$
Tranquilizers & cocaine	89 (29)	139 (47)	228 (38)	$\chi^2(1)=20.6^{***}$
Tranquilizers & ecstasy	100 (33)	89 (30)	189 (32)	ns
Tranquilizers & methamphetamine	101 (33)	27 (9)	128 (21)	$\chi^2(1)=102.9^{***}$

ns, non-significant; \*P<0.05; \*\*P<0.01; \*\*\*P<0.001.

ferences were found in lifetime history of injecting opioids - about one-quarter of participants in both sites had injected opioids. In other words, greater use of heroin in NY- including injection - did not translate into more frequent injection of prescription opioids in NY compared to LA.

While 90-day opioid misuse did not vary between sites, lifetime data suggest greater misuse and availability of more potent opioids in NY, such as oxycodone, fentanyl, and buprenorphine, than in LA. Significantly, the use of more potent prescription opioids in NY coincided with a more robust heroin market in NY. Previous research indicated that potent opioids were particularly useful towards self-medicating for heroin withdrawal as well as functioning as a substitute when heroin was unavailable.<sup>5</sup> While prior studies report opioid misuse in cities where heroin is scarce,<sup>27,28</sup> these results indicate active misuse of opioids in cities where heroin is frequently available.<sup>29</sup> The fact that young adults accessed both opioids and heroin, for instance, suggests the potential for overlapping markets for prescription and illicit drugs, which is in contrast to the conventional view of separate markets.<sup>30</sup>

Findings on drug substitution, drug combinations, and polydrug use indicate that prescription drugs in both NY and LA were frequently consumed as a part of a broader repertoire of misuse involving prescription drugs and illicit drugs.<sup>11,14</sup>

Opioids and tranquilizers were used as substitutes for other drugs when these drugs were not available. The most common drug combinations reported in the past 90 days were opioids and tranquilizers, cocaine and tranquilizers, and heroin and opioids. Qualitative research among young IDUs suggests that particular drug combinations, such as opioids and tranquilizers, are frequently used simultaneously or consecutively during polydrug using events.<sup>5</sup> Significantly, the misuse of prescription drugs in polydrug combinations presents a greater chance for both fatal and non-fatal overdose.<sup>31,32</sup>

Lifetime history of receiving a prescription for an opioid, tranquilizer, or stimulant was high (88%), particularly for opioids (73%).<sup>33</sup> In both sites, participants were prescribed stimulants at significantly earlier ages than the age of first misuse, suggesting that participants used these drugs as prescribed for an extended period before misusing.<sup>34</sup> In contrast, initiation into misuse of opioids and receiving a prescription for an opioid occurred at approximately the same age in both sites. In these cases, several factors may have played a role in initiation, including developing a physical dependence on the prescribed drug, enjoying the novel psychoactive features of the prescribed drug, or inadequate management of pain.<sup>5,35,36</sup> Overall, initiation of prescription drugs occurred during the early to mid-teens, after marijuana and before other illicit substances. In particular, initiation of opioids occurred before heroin and initiation of prescription stimulants happened prior to illicit stimulants. These findings on ages of initiation, in combination with the high percentage of participants who used heroin, cocaine, and methamphetamine, suggest that prescription drugs may serve as pathways to illicit drugs in some cases.<sup>5,37,38</sup>

Overall, these results suggest that metropolitan drug seizure data<sup>16</sup> may be accurate predictors of the most frequently misused prescription and illicit drugs among certain subgroups of users in some cities. This information could be useful for the other 20 cities where this data is available in confirming that existing programs are targeting the most commonly misused drugs or developing new types of drug treatment programs for both prescription and illicit drugs. Future studies should conduct longitudinal research on young adults in different cities or regions to examine local drug markets and determine how fluctuations in local drug markets impact patterns of illicit and prescription drug misuse, including use of local drug treatment services. Findings could guide drug treatment providers towards developing programs for future young adult clients who may present increasingly complex histories of drug use.

This study has some limitations. First, results are based upon cross-sectional data. Hence, only associations between variables can be determined rather than causal relationships. Second, the sample is comprised of young adults who were currently homeless and/or had engaged in high-risk behaviors, such as injection drug use or polydrug use, in NY and LA. Consequently, the results may not generalize to the larger population of young adults who are housed or who do not engage in these risk behaviors, or to high-risk young adults in other cities. Nonetheless, the sample represents an important subgroup of young adults who should be included in future studies to better describe the spectrum of prescription drug misuse.

In conclusion, patterns of prescription drug misuse among high-risk young adults in LA and NY appear to conform to and be shaped by differences in local markets for illicit drugs in each city. Our findings indicate that current misuse of prescription drugs in both cities encompasses a broad range of practices, such as sniffing, injecting, polydrug use, and drug substitution, and involves frequent misuse of illicit substances. Initiation into prescription drug misuse was often preceded by being prescribed one or more types of prescription drugs, which was then followed by initiating illicit drugs with similar psychotropic effects. Our results suggest that drug treatment providers may anticipate increasingly complex patterns of prescription and illicit drug use among newly enrolled young adult clients.

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