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Characteristics associated with nonmedical methadone use among people who inject drugs in California

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Abstract

Background: Illicit, nonmedical use of opioid agonist medications such as methadone is an ongoing concern. Yet, few studies have examined nonmedical use of methadone by people who inject drugs (PWID).

Objectives: This study describes the prevalence of nonmedical methadone use in a community sample of PWID and examines factors associated with recent use of nonmedical methadone.

Methods: A cross-sectional sample of PWID (N=777) was recruited using targeted sampling and interviewed in California (2011–2013). Descriptive, bivariate, and multivariate logistic regression analyses were used to determine characteristics associated with nonmedical methadone use in the last 30 days. To determine if nonmedical methadone use was associated with overdose in the last 6 months, a separate multivariate analysis was conducted.

Results: Among PWID sampled, 21% reported nonmedical methadone use in the last 30 days. In multivariate logistic regression analysis, nonmedical methadone use was associated with recent methadone maintenance treatment (adjusted odds ratio [AOR]= 2.86; 95% confidence interval [CI]=1.90, 4.30), recent nonmedical buprenorphine use (AOR=3.12; 95% CI=1.31, 7.47), higher injection frequency (referent <30 injections; 30–89 injections AOR=1.89; 95% CI=1.19, 3.02; 90-plus injections AOR=2.43; 95% CI=1.53, 3.87), schizophrenia diagnosis (AOR=2.36; 95% CI=1.36, 4.10), recent non-injection opioid prescription use (AOR=2.97; 95% CI=1.99, 4.43), and recent injection opioid prescription misuse (AOR=2.13; 95% CI=1.27, 3.59). Nonmedical

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Contributors

Ricky N. Bluthenthal, Alex H. Kral, and Lynn Wenger designed the study. Ricky Bluthenthal conducted the statistical analysis. Johnathan Zhao wrote the initial draft of the paper. Other authors provided assistance with interpretation of final results. All authors contributed to revisions and approved the final version of the paper.

Declarations of interest

The authors have no financial relationships that are related to the topic of this manuscript and no conflicts of interest.

Data availability

The data that support the findings of this study are available from author Ricky N. Bluthenthal upon reasonable request.

methadone use was found not to be associated with nonfatal overdose (AOR=0.77; 95% CI=0.38, 1.56).

Conclusion: Nonmedical methadone use identifies a vulnerable subpopulation among PWID, is not associated with elevated nonfatal overdose risk, and evidences a need to expand methadone treatment availability.

Keywords

PWID; nonmedical methadone use; diversion; opioid agonist therapy

Introduction

Opioid use disorder (OUD) is characterized by tolerance, craving, unsuccessful attempts to decrease or control use, failure to conduct major daily activities, continued use despite adverse consequences, and symptoms upon withdrawal (American Psychiatric Association, 2013). The prevalence of OUD has increased over the last two decades in the United States and has largely been attributed to increased rates of prescribing opioids for noncancer chronic pain (American College of Obstetricians and Gynecologists, 2017; Boscarino et al., 2010; Centers for Disease Control, 2018). Opioid dependence and its associated morbidity and mortality are a health concern worldwide; in the U.S., opioid overdose mortality rates increased nearly six-fold in the last two decades, from 8,048 in 1999 to 47,600 in 2017 (Degenhardt et al., 2014; National Center for Health Statistics, 2017; National Institute on Drug Abuse, 2019).

Methadone and buprenorphine are opioid agonist analgesics that suppress cravings and withdrawal symptoms with reduced euphoric effects. Methadone has been prescribed in the settings of noncancer chronic pain and opioid dependence (U.S. Government Accountability Office, 2009). Among people with OUD, opioid agonist therapy (OAT) reduces opioid use, reduces likelihood of relapse, and increases treatment retention (Richard P. Mattick, Breen, Kimber, & Davoli, 2009; Strain, Stitzer, Liebson, & Bigelow, 1993) more effectively than medically supervised withdrawal alone (R. P. Mattick & Hall, 1996).

Nonmedical methadone use refers to the use of methadone without a prescription and/or outside of its prescribed indication. From 2002–2014, rates of methadone prescription for pain in the U.S. were positively associated with both reported nonmedical methadone use and fatal methadone-related overdose (Jones, Baldwin, Manocchio, White, & Mack, 2016; Rudd, Seth, David, & Scholl, 2016). In 2014, while methadone accounted for approximately 1% of U.S. opioid prescriptions, methadone-associated fatal overdoses accounted for approximately 23% of all prescription opioid-associated mortality (Faul, Bohm, & Alexander, 2017). A decline in methadone-associated fatal overdoses since 2007 may be attributed to the removal of methadone from preferred medication lists of state Medicaid programs (Jalal et al., 2018). Previous studies have suggested that increased prevalence of reported nonmedical methadone use is found in settings with greater access to OAT (Duffy & Baldwin, 2012; Roche, McCabe, & Smyth, 2008; Winstock, Lea, & Sheridan, 2009), methadone prescribed for pain rather than for opioid dependence (Dasgupta et al., 2010;

Madden & Shapiro, 2011), and more flexible OAT regimens that allow doses outside of clinics (Ritter & Di Natale, 2005; Strang, Hall, Hickman, & Bird, 2010).

Due to these associations, the regulation of OAT has been controversial. Stringent OAT regimens, with supervised administration and without takeaway doses, may curb nonmedical methadone use (Obadia, Perrin, Feroni, Vlahov, & Moatti, 2001), but may also increase drop-out rates of OAT participants (Pani, Pirastu, Ricci, & Gessa, 1996). Participants have cited lack of access, rigorous inclusion criteria, strict penalties surrounding nonattendance and relapse, management of withdrawal symptoms, and curbing of heroin use as major reasons for nonmedical methadone and buprenorphine use (Gwin Mitchell et al., 2009; Harris & Rhodes, 2013; Richert & Johnson, 2015; Schulte et al., 2016).

Designing optimal OAT regimens requires an understanding of characteristics and behaviors of those who use nonmedical methadone. The vast majority of studies report the association between nonmedical methadone use, opioid dependence, and frequency of injection drug use (Genberg et al., 2013; Ompad et al., 2008; Reddon et al., 2018; Tucker et al., 2015). A Canadian study of people who inject drugs (PWID) identified characteristics associated with nonmedical methadone use that included homelessness, frequent heroin injection, frequent crack cocaine use, and, notably, nonfatal overdose (Tucker et al., 2015). Conversely, a Norwegian study found no association between nonmedical methadone use and nonfatal overdose (Bretteville-Jensen, Lillehagen, Gjersing, & Andreas, 2015). A German study found a negative association between nonmedical methadone use and enrollment in an OAT program (Schulte et al., 2016). A study of PWID in Baltimore, Maryland identified homelessness and physician prescription of buprenorphine to be associated with nonmedical buprenorphine use (Genberg et al., 2013). More studies are needed to identify characteristics associated with nonmedical methadone use and elucidate its relationship with overdose. In this study, we contribute to the growing body of literature by identifying characteristics associated with nonmedical methadone use in a community sample of PWID in California, including nonfatal overdose, frequency of injection drug use, and recent participation in OAT programs.

Materials and Methods

Study Sampling and Recruitment

Using targeted sampling and community outreach strategies as described elsewhere (Bluthenthal & Watters, 1995; Kral et al., 2010; Watters & Biernacki, 1989), we recruited a cross-sectional sample of PWID in Los Angeles and San Francisco, California between April 2011 and April 2013. Eligible participants were at least 18 years of age who self-reported injection drug use in the last 30 days, which was verified by visual inspection for signs of recent venipuncture or track marks, as described by Cagle, Fisher, Senter, Thurmond, & Kastar, 2002. After providing informed consent, participants completed survey questionnaires administered in one-on-one computer-assisted interviews (Questionnaire Development System, NOVA Research, Bethesda, MD) by trained interviewers. Participants were compensated \$20 after completion of the survey. This analysis includes questionnaire data from 777 PWID, of whom 397 participants were recruited in Los Angeles and 380 in San Francisco. All study procedures were approved by

the Institutional Review Boards at RTI International and the University of Southern California.

Study Measures

Nonmedical methadone use was determined by asking: “Have you ever used methadone not acquired from a doctor or a drug treatment program?” Those responding “yes” were asked if they had used nonmedical methadone in the last 30 days. Participants responding “yes” to the questions were classified as recent nonmedical methadone users. Other variables collected included injection frequency, types of drugs used, years of injection, and public injection. In our analyses, injection frequency was the sum of self-reported injection episodes with the following drugs in the last 30 days: cocaine, crack cocaine, methamphetamine, heroin, speedball (admixture of cocaine and heroin), goofball (admixture of heroin and methamphetamine), prescription opioids, stimulants, sedatives, tranquilizers, methadone, and buprenorphine. Injection frequency in last 30 days was considered as a continuous variable and as a categorical variable with the following classifications: less than daily use (<30 injections), once or twice a day (30 to 89 injections), and three or more times a day (≥90). Any injection use and non-injection use of the drugs listed above, reported multi-route drug use (injection and non-injection use of any drugs), and polysubstance use (reported 2 or more drugs used in the last 30 days) were also considered. Participants were also asked if they had experienced an opioid overdose in the last 6 months, and whether they participated in drug treatment programs (e.g. methadone detoxification, methadone maintenance, and buprenorphine treatment) in the last 30 days.

Socio-demographics (e.g. age, gender, race/ethnicity, sexual partner types, sexual orientation) and socioeconomic characteristics (e.g. housing status, monthly income, income sources) were treated as potential covariates in all analyses.

As injection drug use is associated with incarceration (DeBeck et al., 2009; Genberg, Astemborski, Vlahov, Kirk, & Mehta, 2015; Koehn et al., 2015), risk for bacterial and viral infection (Aceijas & Rhodes, 2007; Aceijas, Stimson, Hickman, & Rhodes, 2004; Ebright & Pieper, 2002), and psychiatric disorders (Mackesy-Amiti, Donenberg, & Ouellet, 2012), the domains of contact with law enforcement (e.g. arrest, legal status i.e. on probation or parole) and health and healthcare (e.g. receiving a positive HIV result, receiving a major mental health diagnosis, requiring medical care) were also included in the survey questionnaire as potential covariates.

The questions used to elicit these characteristics may be found in Appendix 1.

Statistical Analysis

Descriptive statistics (e.g. frequencies, means, standard deviations, among others) were examined for all study variables. Bivariate analysis was conducted to determine characteristics associated with recent nonmedical methadone use. To reduce the risk of mass significance in the setting of multiple comparisons, we used a Bonferroni correction such that bivariate significance was set at $p < 0.002$, as calculated $0.05/25$ (Curtin & Schulz, 1998). Variables significant ($p < 0.002$) in bivariate analysis were assessed for collinearity. Collinear variables were removed from the final analysis based on strength of association with recent

nonmedical methadone use as the dependent variable. Associations were assessed using multivariate logistic regression with the dependent variable. Variables found to be significant at $p<0.05$ were considered to be independently associated with recent nonmedical methadone use. Variables excluded due to multicollinearity (Pearson coefficient at 0.300) were recent non-injection tranquilizer use, recent crack cocaine injection, recent powder cocaine injection, recent methamphetamine injection, and methadone detoxification program enrollment. Variables excluded at the multivariate level due to non-significance at $p<0.05$ were monthly income; recent non-injection use of heroin, speedball, and goofball; and recent injection use of heroin, speedball, and goofball.

A similar approach was used to determine whether nonmedical methadone use was associated in bivariate and multivariate analysis with nonfatal opioid overdose in the last 6 months. We included nonfatal opioid overdose in the final model as we deemed it to be an important characteristic of which to assess significance.

Results

Sample characteristics were as follows: 26% female, 50% at least 50 years old in age, 34% white, 30% African American, 25% Latinx, 15% gay, lesbian, or bisexual, and 7% HIV-positive. Study participants were low-income, with 81% reporting a total monthly income of less than \$1,350 (current U.S. poverty line), and 62% considered themselves homeless.

Factors associated with recent nonmedical methadone use

Nonmedical methadone use within the last 30 days was reported by 21% ($N=163$) of participants; 43% reported having ever consumed methadone nonmedically. Nonmedical methadone use was almost exclusively orally ingested (98.6% of participants and 99.6% of the time). Mean frequency of nonmedical methadone use was 13.33 times per 30 days (standard deviation=13.55; median=8.00; interquartile range=2, 28). Bivariate analysis (Table 1) identified a broad range of characteristics associated with recent nonmedical methadone use, including age, income amount and source(s), injection behaviors and frequency, recent use of specific drugs such as buprenorphine, injection opioid prescription misuse, injection polysubstance use, age at first injection, years of injection use, past history of arrest, diagnosis of schizophrenia, and recent participation in drug treatment programs. Gender, race, sexual orientation, homelessness, receiving a positive HIV result, and diagnosis of depression, bipolar disorder, or posttraumatic stress disorder were not significantly associated with recent nonmedical methadone use.

In multivariate logistic regression (Table 2), factors associated with recent nonmedical methadone use included recent methadone maintenance treatment (adjusted odds ratio [AOR]= 2.86; 95% confidence interval [CI]=1.90, 4.30), recent nonmedical buprenorphine use (AOR=3.12; 95% CI=1.31, 7.47), higher injection frequency (referent <30 injections; 30–89 injections AOR=1.89; 95% CI=1.19, 3.02; 90-plus injections AOR=2.43; 95% CI=1.53, 3.87), self-reported diagnosis of schizophrenia (AOR=2.36; 95% CI=1.36, 4.10), recent non-injection opioid prescription use (AOR=2.97; 95% CI=1.99, 4.43), and recent injection opioid prescription misuse (AOR=2.13; 95% CI=1.27, 3.59). Nonfatal overdose

was not independently associated with nonmedical methadone use (AOR=0.65; 95% CI=0.32, 1.34; $p=0.25$).

Given the concern with nonmedical methadone use as a potential facilitator of overdose, we developed a multivariate logistic regression model of nonfatal, self-reported overdose in the last 6 months. Nonmedical methadone use was not statistically associated with overdose (AOR=0.77; 95% CI=0.38, 1.56; $p=0.47$) while adjusting for significant demographic and drug use variables (data not shown).

Discussion

In this study, recent nonmedical methadone use was reported by 21% of PWID, which is similar to the 16% reported over a similar timeframe in Oslo, Norway (Bretteville-Jensen et al., 2015), the 22% reported in Germany (Schulte et al., 2016), and the 11% and 29% reported in studies in Australia (S. Darke, Ross, & Hall, 1996; Shane Darke, Topp, & Ross, 2002; Humeniuk, Ali, McGregor, & Darke, 2003). Reports from other settings (Lauzon et al., 1994; Ompad et al., 2008) are difficult to compare to our data due to difference in observation window. Oral ingestion was almost exclusively the consumption method of nonmedical methadone. Injection of nonmedical methadone was rare in our sample (approximately 2%), as has been reported of PWID elsewhere (Chevalley et al., 2005; Lintzeris, Lenné, & Ritter, 1999).

In our study, nonmedical methadone use was not associated with nonfatal overdose in the last 6 months. This finding has been reported in Oslo, Norway (Bretteville-Jensen et al., 2015) and contradicts a study in Vancouver, Canada that found such an association (Tucker et al., 2015). In the context of calls for rapid expansion of OAT (Perlman & Jordan, 2018; Saloner et al., 2018), this finding is important, as it supports that nonmedical methadone use, a sequela of OAT, may not lead to increased risk for overdose as is commonly thought.

The association of use of other opioids (e.g., nonmedical use of prescription opioids and buprenorphine) with nonmedical methadone use is consistent with behaviors in the setting of opioid dependence. However, this association may suggest a preference for legally produced substances. Such substances are less likely than heroin to contain unknown, potentially dangerous contaminants and adulterates (Broséus et al., 2016; Cole et al., 2011); thus, they can be reasonably viewed as safer as compared to street-purchased heroin. In addition, we found that people who used nonmedical methadone were more likely to have participated in methadone treatment. With this in mind, nonmedical use of methadone may be related to inadequate dosing in OAT clinics. A recent study (D'Aunno, Park, & Pollack, 2018) found that in 2017, 43% of U.S. OAT participants received <80 mg/day, although 80–120 mg/day is recommended for long-term methadone treatment; this prevalence of under-dosing appears to have been stable from 2011–2017. In studies of patients who use opioid agonist medications nonmedically, most reported nonmedical use for the purposes of withdrawal management and self-treatment of opioid dependence (Carroll, Rich, & Green, 2018; Harris & Rhodes, 2013; Kenney, Anderson, Bailey, & Stein, 2018; Schuman-Olivier et al., 2010), further supporting the relationship between under-dosing and nonmedical methadone use. In a recent study among OAT participants (Johnson & Richert, 2019), major reasons cited for

nonmedical methadone or buprenorphine use were avoiding withdrawal symptoms while avoiding illicit opioids and, notably, “taking care” of their own OAT; these data are consistent with the notion of underdosing. Conversely, higher dosing has been found to be associated with retention in methadone maintenance treatment. As our study did not include dosing levels for methadone-maintained participants, we cannot directly test this association. However, in the context of these studies, our data also evidences a need to expand OAT availability and reexamine dosing.

In our study, self-reported diagnosis of schizophrenia was associated with nonmedical use of methadone. This is interesting as, per a recent analysis of a large database for substance use treatment centers (Chiappelli, Chen, Hackman, & Elliot Hong, 2018), those with schizophrenia were significantly less likely to report use of heroin and non-heroin opioids compared to the overall patient population. Mental health disorders and narcotic use often co-occur; a large U.S. cross-sectional study estimated that people with non-alcohol substance use disorders had a 4.5-fold greater odds of having a comorbid mental health disorder (Regier et al., 1990). Further, in a recent study (Spivak et al., 2018), prescription opioid use among those with serious mental illness, including schizophrenia, predicted a history of heroin use. Of note, however, cocaine and amphetamine intoxication can be incorrectly diagnosed as schizophrenia (Shaner et al., 1993). Additionally, it has been proposed that providers may favor a diagnosis of mental health disorders, in lieu of substance use disorder, to increase their patients’ opportunities for social services and housing (Knight, 2015).

That said, growing evidence supports that the presence of comorbid psychiatric disorders plays a role in treatment of OUD. A significantly lower quality of life has been measured among methadone maintenance participants with psychiatric comorbidity when compared to all methadone maintenance participants (Teoh Bing Fei, Yee, & Habil, 2016). Further, those with psychiatric comorbidity have been found to report lower levels of abstinence self-efficacy following treatment for substance use disorders (Majer, Payne, & Jason, 2015). However, at least one study (Parpouchi, Moniruzzaman, Rezansoff, Russolillo, & Somers, 2017) has found that adherence to methadone maintenance treatment is higher specifically in patients with schizophrenia. Together, these data suggest that mental illness may play a major role in those with OUD and how they interact with treatment, namely OAT. More research of comorbid schizophrenia among PWID is indicated to optimize treatment modalities and recovery resources for this subpopulation.

Limitations

Interpretations of these results should be considered in light of a number of potential limitations. First, the study’s cross-sectional design precludes determining temporal causality. Also, different timeframes were used to measure variables. For example, a 30-day timeframe was used for injection frequency, while variables regarding overdose were assessed over 6 months. Thus, the nature of associations between nonmedical methadone use and these characteristics is unclear. Further, while the fidelity and validity of items used in this study have been established in prior studies (Dowling-Guyer, Johnson, Fisher, Needle,

& et al, 1994; Needle et al., 1995; Weatherby et al., 1994), the self-reports of participants are subject to recall and social desirability biases.

In the United States, two significant drug use transitions have developed since 2013: (1) the growing use of heroin by people who formerly used prescription opioids (Jones, 2013), and (2) the contamination of the heroin supply with fentanyl and other synthetic opioids (O'Donnell, Gladden, & Seth, 2017). Fentanyl has become more prevalent in the U.S. Northeast and Midwest in recent years (Mars, Rosenblum, & Ciccarone, 2018). In comparison, fentanyl contamination is only now reaching California, including Los Angeles and San Francisco, and has not yet overtaken the heroin market; however, it may do so in the future. In light of this, these data from a prior era might be considered an important baseline that has not been reported elsewhere for a similar type of sample.

Conclusion

The ongoing opioid crisis requires rapid expansion in OAT. Yet, concerns persist about unintended consequences of nonmedical use of opioid agonist medications. In this study, we found that nonmedical methadone use was not associated with nonfatal overdose, a chief concern surrounding OAT. Our data suggest that nonmedical methadone use may be linked to lack of access to methadone treatment and self-reported schizophrenia diagnosis, which affirms a need to expand availability of OAT to PWID, reexamine dosing guidelines, and optimize treatment modalities for those with comorbid psychiatric disorders.

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Appendix 1:: Questions in the questionnaire administered to study participants.

Socio-demographics

Gender: "What is your biological sex? (Probe: What were you born as?)"

Race: "What do you consider to be your racial or ethnic group? (Choose the best fit.)"

Age: "What is your date of birth?" "How old are you?"

Identify as gay, lesbian, or bisexual: "What do you consider your sexual orientation to be? (Read list aloud.)"

Any sex partner, last 6 months: “Have you had any sex partners in the last 6 months?”

- Steady sex partner: “In the last 6 months, did you have a steady sex partner?”
- Casual sex partner: “In the last 6 months, did you have a casual sex partner (a sex partner who was not steady and not paid)?”
- Paying sex partner: “In the last 6 months, did you have any sex partners who paid you in cash or drugs for sex?”

Sex partner is a PWID

- Steady sex partner: “Does your steady sexual partner shoot drugs?”
- Casual sex partner: “Did any of your casual sexual partner(s) shoot drugs?”
- Paying sex partner: “Did any of your paying sex partner(s) shoot drugs?”

Homeless: “Do you consider yourself to be homeless?”

Income source: “In the last six months, did you receive income from: (Read list aloud. Check all that apply.)”

Monthly income: “In the past month, how much money did you make from all sources, including legal and illegal sources? (Read list [of income ranges]. Choose one.)”

Injection behaviors

Years of injection: “The first time you injected drugs, how old were you?”

Any public injection, last 30 days: “How often do you inject in public places (e.g., a park, alley, parking lot)? (Choose one.)”

Inject with others: “How often do you inject with other people? (Choose one.)”

Ever helped anyone inject for first time: “Have you ever helped someone get their first hit (the first time they ever injected)?”

Source of needles, last 6 months: “In the last six months, from where have you obtained syringes? (Check all that apply.)”

Syringe sharing, last 30 days

- Distributive sharing: “In the last 30 days, how many times did you give or loan syringes/needles that you had used to someone else (including a close friend or lover) who then used them?”
- Receptive sharing: “In the last 30 days, how many times did you inject using syringes/needles that you know had been used by someone else (including a close friend or lover)?”

Peer-to-peer injection, last 30 days

- Injected by other person: “In the last 30 days, have you been injected by another person?”
- Injected other person: “In the last 30 days, did you inject another person?”

Overdose, last 6 months

- Experienced nonfatal overdose: “In the last 6 months, have you overdosed (i.e., where you had a negative reaction from using too much drugs)?”
- Witnessed overdose: “In the last 6 months, have you witnessed a heroin overdose?”

Drug use items

Crack cocaine: “Have you ever used crack cocaine?” If “yes”: “Have you used crack in the last 30 days?” If “yes”:

- Non-injection crack cocaine, last 30 days: “In the last 30 days, how many times have you used crack without injecting?”
- Injected crack cocaine, last 30 days: “In the last 30 days, how many times have you injected crack?”

Powder cocaine: “Have you ever used powder cocaine?” If “yes”: “Have you used powder cocaine in the last 30 days?” If “yes”:

- Non-injection powder cocaine, last 30 days: “In the last 30 days, how many times have you used powder cocaine without injecting?”
- Injected powder cocaine, last 30 days: “In the last 30 days, how many times have you injected powder cocaine?”

Heroin: “Have you ever used heroin?” If “yes”: “Have you used heroin in the last 30 days?” If “yes”:

- Non-injection heroin, last 30 days: “In the last 30 days, how many times have you used heroin without injecting?”
- Injected heroin, last 30 days: “In the last 30 days, how many times have you injected heroin?”

Methamphetamine: “Have you ever used methamphetamine?” If “yes”: “Have you used methamphetamine in the last 30 days?” If “yes”:

- Non-injection methamphetamine, last 30 days: “In the last 30 days, how many times have you used methamphetamine without injecting?”
- Injected methamphetamine, last 30 days: “In the last 30 days, how many times have you injected methamphetamine?”

Speedball: “Have you ever used a speedball (mixed heroin with cocaine or with crack)?” If “yes”: “Have you used speedball in the last 30 days?” If “yes”:

- Non-injection speedball, last 30 days: “In the last 30 days, how many times have you used speedball without injecting?”
- Injected speedball, last 30 days: “In the last 30 days, how many times have you injected speedball?”

Goofball: “Have you ever used a goofball (mixed heroin with methamphetamine)?” If “yes”: “Have you used goofball in the last 30 days?” If “yes”:

- Non-injection goofball, last 30 days: “In the last 30 days, how many times have you used goofball without injecting?”
- Injected goofball, last 30 days: “In the last 30 days, how many times have you injected goofball?”

Marijuana: “Have you ever used marijuana?” If “yes”: “Have you used marijuana in the last 30 days?”

Prescription misuse: “The next set of questions is about drugs that are typically prescribed by physicians. We are interested in your use of these medications without a doctor’s prescription or your use of these medications not as directed by your physician.”

- Opioids: “Have you ever used opiates such as Vicodin, oxycontin, Dilaudid, Percocet, Percodan, Darvon?” If “yes”: “In the last 30 days, how many times have you used an opiate without injecting?” If “yes”:
 - Non-injection misuse of prescription opioid, last 30 days: “In the last 30 days, how many times have you used an opiate without injecting?”
 - Injected misuse of prescription opioid, last 30 days: “In the last 30 days, how many times have you injected an opiate?”
- Tranquilizer: “Have you ever used a tranquilizer such as Klonopin, Xanax, Valium, Ativan?” If “yes”: “Have you used a tranquilizer in the last 30 days?” If “yes”:
 - Non-injection misuse of tranquilizer, last 30 days: “In the last 30 days, how many times have you used a tranquilizer without injecting?”
 - Injected misuse of tranquilizer, last 30 days: “In the last 30 days, how many times have you injected tranquilizers?”
- Sedative: “Have you ever used a sedative such as Restoril, Tuinal, phenobarbital, Placidyl?” If “yes”: “Have you used a sedative in the last 30 days?” If “yes”:
 - Non-injection misuse of sedative, last 30 days: “In the last 30 days, how many times have you used a sedative without injecting?”
 - Injected misuse of tranquilizer, last 30 days: “In the last 30 days, how many times have you injected a sedative?”
- Buprenorphine: “Have you ever used buprenorphine or suboxone not from a doctor or a program?” If “yes”: “Have you used buprenorphine in the last 30 days?” If “yes”:

- Non-injection misuse of buprenorphine, last 30 days: “In the last 30 days, how many times have you used buprenorphine without injecting?”
- Injected misuse of tranquilizer, last 30 days: “In the last 30 days, how many times have you injected buprenorphine?”

Law enforcement and violence

Any law enforcement contact

- Police: “In the past 6 months, have you had direct contact with the police?”
- Arrest: “Have you been arrested in the past 6 months?”
- Security guard: “In the last 6 months, have you had any encounters with security guards?”

Currently on probation: “Are you currently on probation?”

Health, healthcare, and drug treatment

Ever received positive HIV test result: “Has a doctor, nurse, or counselor ever told you that you are HIV positive?”

Mental health diagnosis

- Any major mental health diagnosis: “As an adult, have you ever been diagnosed with a psychiatric illness (e.g. major depression, bipolar disorder)?” If “yes”: “Were you diagnosed with: (Check all that apply.)”

Needed medical care, last 6 months

- Urgent care: “In the past 6 months did you need care for an urgent health problem such as an abscess, strep throat, or the flu?”
- Chronic care: “In the past 6 months did you need care for an ongoing health problem such as high blood pressure or diabetes?”
- Dental care: “In the past 6 months did you need dental care?”

Drug treatment, last 30 days

- Methadone detoxification: “Have you ever participated in methadone detox?” If “yes”: “In the past 30 days, have you been in methadone detox?”
- Methadone maintenance: “Have you ever participated in methadone maintenance?” If “yes”: “In the past 30 days, have you been in methadone maintenance?”
- Buprenorphine treatment: “Have you ever participated in buprenorphine (Suboxone)?” If “yes”: “In the past 30 days, have you been in buprenorphine (Suboxone) treatment?”

Nonmedical methadone use

“Have you ever used methadone not acquired from a doctor or a drug treatment program?” If “yes”: “Have you used a methadone in the last 30 days?”

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Table 1.

Descriptive statistics of cross-sectional sample of PWID in Los Angeles and San Francisco, California, with vs. without recent nonmedical methadone use (N=777).

Characteristics	Total N = 777 (100%)	Recent nonmedical methadone use	
		Yes N = 163 (21%)	No N= 614 (79%)
Socio-demographics			
Gender			
Female	203 (26%)	50 (31%)	153 (25%)
Male	572 (74%)	113 (69%)	459 (75%)
Race			
White	265 (34%)	50 (31%)	215 (35%)
African American	233 (30%)	47 (29%)	186 (30%)
Latino	192 (25%)	48 (30%)	144 (23%)
Other	82 (11%)	17 (10%)	65 (11%)
Study site			
Los Angeles	397 (51%)	76 (47%)	321 (52%)
San Francisco	380 (49%)	87 (53%)	293 (48%)
Age			
Less than 30	80 (10%)	10 (6.1%)	70 (11%)
30–39	86 (11%)	24 (15%)	62 (10%)
40–49	223 (29%)	38 (23%)	185 (30%)
50 or more	388 (50%)	91 (56%)	297 (48%)
Identify as gay, lesbian, or bisexual	118 (15%)	21 (13%)	97 (16%)
Any sex partner, last 6 months			
Steady sex partner	398 (51%)	95 (58%)	303 (49%)
Casual sex partner	236 (30%)	46 (28%)	190 (31%)
Paying sex partner	90 (12%)	19 (12%)	71 (12%)
Sex partner is a PWID			
Steady sex partner	212 (27%)	54 (33%)	158 (26%)
Casual sex partner	139 (18%)	28 (17%)	111 (18%)
Paying sex partner	56 (7.2%)	10 (6.1%)	46 (7%)
Homeless	484 (62%)	112 (69%)	372 (61%)
Income source			
VA benefits	12 (1.5%)	6 (3.7%)	6 (1%)
SSI	267 (34%)	45 (28%)	222 (36%)
Welfare, food stamps, AFDC, GA/GR	273 (35%)	59 (36%)	214 (35%)
Spouse	60 (7.7%)	19 (12%)	41 (7%)

Characteristics	Total N = 777 (100%)	Recent nonmedical methadone use	
		Yes N = 163 (21%)	No N= 614 (79%)
Panhandling	203 (26%)	42 (26%)	161 (26%)
Illegal or possibly illegal income	286 (37%)	77 (47%) *	209 (34%)
No income	20 (2.6%)	7 (4.3%)	13 (2%)
Monthly income *			
<\$1350	627 (81%)	117 (72%)	510 (83%)
\$1,350 or more	150 (19%)	46 (28%)	104 (17%)
Injection behaviors			
Any public injection, last 30 days	392 (50%)	96 (59%)	296 (48%)
Inject with others	628 (81%)	134 (82%)	494 (80%)
Ever helped anyone inject for first time	268 (35%)	71 (44%)	197 (32%)
Source of needles, last 6 months			
Unauthorized source (street, friend)	270 (35%)	69 (42%)	201 (33%)
Needle exchange	644 (83%)	135 (83%)	509 (83%)
Syringe sharing, last 30 days			
Distributive sharing	114 (15%)	31 (19%)	83 (14%)
Receptive sharing	106 (14%)	30 (18%)	76 (12%)
Peer-to-peer injection, last 30 days			
Injected by other person	182 (23%)	44 (27%)	138 (22%)
Injected other person	215 (28%)	61 (37%)	154 (25%)
Overdose, last 6 months			
Experienced nonfatal overdose	57 (7.4%)	14 (8.6%)	43 (7%)
Witnessed overdose	174 (23%)	48 (29%)	126 (21%)
Drug use items			
Non-injection drug use, last 30 days			
Crack cocaine	323 (42%)	86 (53%)	237 (39%)
Powder cocaine	61 (7.9%)	19 (12%)	42 (7%)
Heroin	106 (14%)	38 (23%) *	68 (11%)
Methamphetamine	192 (25%)	43 (26%)	149 (24%)
Speedball	20 (2.6%)	12 (7.4%) *	8 (1%)
Goofball	16 (2.1%)	9 (5.5%) *	7 (1%)
Marijuana	416 (54%)	81 (50%)	335 (55%)
Prescription misuse			
Opioids	189 (24%)	73 (45%) *	116 (19%)
Tranquilizer	192 (25%)	70 (43%) *	122 (20%)

Characteristics	Total N = 777 (100%)	Recent nonmedical methadone use	
		Yes N = 163 (21%)	No N= 614 (79%)
Sedative	34 (4.4%)	14 (8.6%)	20 (3%)
Buprenorphine	28 (3.6%)	15 (9.2%) *	13 (2%)
Injected drug use, last 30 days			
Crack cocaine	70 (9%)	28 (17%) *	42 (7%)
Powder cocaine	83 (11%)	32 (20%) *	51 (8%)
Heroin	613 (79%)	158 (97%) *	455 (74%)
Methamphetamine	290 (37%)	41 (25%) *	249 (41%)
Speedball	128 (16%)	49 (30%) *	79 (13%)
Goofball	93 (12%)	33 (20%) *	60 (10%)
Prescription misuse			
Opioids	93 (12%)	39 (24%) *	54 (9%)
Injection frequency, last 30 days *			
<30	362 (47%)	55 (34%)	307 (50%)
30–89	214 (28%)	48 (29%)	166 (27%)
90 or more	201 (26%)	60 (37%)	141 (23%)
2+ injected drugs, last 30 days *			
Yes	290 (37%)	88 (54%)	202 (33%)
No	487 (63%)	75 (46%)	412 (67%)
2+ non-injected drugs, last 30 days *			
Yes	312 (40%)	101 (62%)	211 (34%)
No	465 (60%)	62 (38%)	403 (66%)
Law enforcement and violence			
Any law enforcement contact			
Police	399 (51%)	92 (57%)	307 (50%)
Arrest	206 (27%)	55 (34%)	151 (25%)
Security guard	167 (21%)	42 (26%)	125 (20%)
Currently on probation	172 (22%)	35 (21%)	137 (22%)
Health, healthcare, and drug treatment			
Ever received positive HIV test result	53 (7.2%)	7 (4.5%)	46 (7%)
Mental health diagnosis			
Any major mental health diagnosis	363 (47%)	91 (56%)	272 (44%)
Depression	233 (30%)	56 (34%)	177 (29%)
Bipolar	147 (19%)	33 (20%)	114 (19%)

Characteristics	Total N = 777 (100%)	Recent nonmedical methadone use	
		Yes N = 163 (21%)	No N= 614 (79%)
Schizophrenia	80 (10%)	29 (18%) *	51 (8%)
Posttraumatic stress disorder	68 (8.8%)	17 (10%)	51 (8%)
Needed medical care, last 6 months			
Urgent care	255 (33%)	69 (42%)	186 (30%)
Chronic care	285 (37%)	70 (43%)	215 (35%)
Dental care	420 (54%)	96 (59%)	324 (53%)
Drug treatment, last 30 days			
Any drug treatment	292 (38%)	86 (53%) *	206 (34%)
Methadone detoxification	71 (9.1%)	28 (17%) *	43 (7%)
Methadone maintenance	189 (24%)	64 (39%) *	125 (20%)
Buprenorphine treatment	11 (1.4%)	0 (0.0%)	11 (2%)

* chi-square $p < 0.002$

Variables with * represent variables rather than responses with $p < 0.002$.

Table 2.

Multivariate logistic regression analysis of characteristics associated with recent nonmedical methadone use among cross-sectional sample of PWID in Los Angeles and San Francisco, California.

Variable	AOR (95% CI)	p-value
Experienced nonfatal overdose, last 6 months	0.65 (0.32, 1.34)	0.25
Methadone maintenance treatment, last 30 days	2.86 (1.90, 4.30)	<0.001
Nonmedical non-injection buprenorphine use, last 30 days	3.12 (1.31, 7.47)	0.01
Injection frequency, last 30 days		
<30 injections	Referent	
30–89	1.89 (1.19, 3.02)	0.007
90 or more	2.43 (1.53, 3.87)	<0.001
Schizophrenia diagnosis	2.36 (1.36, 4.10)	0.002
Non-injection opioid prescription use, last 30 days	2.97 (1.99, 4.43)	<0.001
Injection opioid prescription misuse, last 30 days	2.13 (1.27, 3.59)	0.004

AOR = adjusted odds ratio

95% CI = 95% confidence interval