

# Infrequent Illicit Methadone Use Among Stimulant-Using Patients in Methadone Maintenance Treatment Programs: A National Drug Abuse Treatment Clinical Trials Network Study

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*We sought to determine the prevalence, patterns, and correlates of past-month illicit methadone use and history of regular illicit use among stimulant-using methadone maintenance treatment patients. We obtained self-reported information on illicit methadone use from 383 participants recruited from six community-based methadone maintenance programs. Overall, 1.6% of participants reported illicit use in the past month, and 4.7% reported a history of regular use. Younger age and history of outpatient psychological treatment were associated with increased odds of past-month illicit use. Illicit methadone use among patients in maintenance programs is infrequent; however, a number of factors may increase risk of illicit use. (Am J Addict 2008;17:304–311)*

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The misuse and abuse of opioids has emerged as a major health issue in the United States.<sup>1</sup> Approximately 227,000 Americans met criteria for past-year heroin abuse or dependence, and 1.5 million Americans abused or were dependent on prescription opioids (eg, oxycodone [OxyContin<sup>®</sup>], hydromorphone [Dilaudid<sup>®</sup>], and hydrocodone) in 2005.<sup>2</sup> The financial cost of untreated opioid dependence to individual users, their families, and society at large is estimated to be approximately \$20 billion annually.<sup>3</sup>

Methadone is a synthetic, long-acting opioid agonist approved for treatment of chronic pain and opioid addiction.<sup>4</sup> Since the first study conducted by Dole and Nyswander,<sup>5</sup>

methadone maintenance therapy has been one of the most widely used treatments for opioid addiction, and methadone maintenance treatment decreases heroin and other drug use, criminal activity, medical comorbidity, HIV transmissions, and mortality.<sup>3,6</sup>

Prior to 2003, an estimated 97% of patients treated with opioid agonist medications received methadone; the remaining 3% received levo-alpha-acetyl-methadol (LAAM).<sup>7</sup> Although LAAM was approved for use by the Food and Drug Administration, the manufacturer discontinued the sale and distribution of LAAM in the United States in 2003 due to reports of severe cardiac-related adverse events.<sup>8</sup> Since 2002, sublingual preparations of the partial opioid agonist buprenorphine and buprenorphine/naloxone combination (Subutex<sup>®</sup> and Suboxone<sup>®</sup>) have been approved to treat opioid addiction in the United States.<sup>9</sup>

## METHADONE DIVERSION

Concerns about the safety of methadone and its potential for diversion and misuse have recently increased.<sup>10–12</sup> Data from the U.S. Drug Abuse Warning Network indicate a substantial increase in methadone-related deaths in metropolitan areas and use of methadone exceeds that of oxycodone or hydrocodone in opioid-related deaths.<sup>13–15</sup> A recent U.S. study found that between 1999 and 2002, the number of methadone poisonings noted on death certificates increased 213%, comparable to the increase in sales of methadone through pharmacies for pain management (175%), but less comparable to the increase in methadone distribution through narcotics treatment programs (43%).<sup>16</sup>

Methadone may be prescribed as an analgesic by any physician with a Drug Enforcement Administration Controlled Substances License and may be dispensed by any licensed

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pharmacy; however, it may be illicitly diverted by means that include fraudulent prescriptions, as well as actions of unscrupulous or inexperienced physicians and pharmacists.<sup>17</sup> Methadone prescriptions for pain have increased from fewer than 1 million in 2002 to 2.6 million in 2003.<sup>11</sup> A scientific report from the National Assessment Meeting for Methadone-Associated Mortality has concluded that recent increases in diverted methadone and methadone-related mortality is related to growth in the use of prescription methadone for outpatient pain management and distribution through pharmacy channels, not from methadone treatment programs.<sup>10</sup>

Methadone may also be diverted through maintenance programs.<sup>17</sup> When administered for opioid addiction treatment, methadone typically is dispensed by a nurse under physician supervision in a methadone maintenance clinic. Federal law also permits opiate treatment programs to dispense a single take-home dose of methadone to patients for any day that the clinic is closed,<sup>18</sup> and additional take-home doses of methadone are permitted for patients who have been in successful treatment for an extended period. For example, after one year of continuous successful treatment as determined by a medical director, a patient may be given a maximum two-week supply of take-home medication.<sup>18</sup> Such take-home doses of methadone can be sold or traded for other drugs.<sup>17</sup>

Additionally, methadone could be diverted through misrepresentation (eg, misleading treatment providers into prescribing more methadone than is actually needed) and theft from treatment programs, pharmacies, or manufacturers.<sup>17,19</sup> When opioid medications are stolen from the supply chain, they reach the illicit market without having been prescribed by a physician or dispensed by a pharmacist.<sup>19</sup>

Despite the long history of methadone maintenance treatment, empirical data on the magnitude and correlates of illicit methadone use are sparse.<sup>20</sup> An early study of 336 narcotic addicts admitted to a clinical research center at Lexington, Kentucky, found that 43% of patients reported a history of illicit methadone use.<sup>21</sup> However, recent findings suggest that the use of methadone outside drug abuse treatment programs or other supervised medical settings is less frequent than expected. Vlahov and colleagues<sup>20</sup> examined 2811 injection drug users recruited from community outreach between 1988 and 1989 and in 1994 who participated in a study of the natural history of HIV infection. At the follow-up in 2003, the 2811 injection drug users contributed 12,316 person-years, with 493 users reporting illicit methadone use in the past six months, reaching a rate of 4.0/100 person-years of follow-up.

## RESEARCH QUESTIONS

In light of the limited data on illicit methadone use among methadone patients, we examined the prevalence, patterns, and correlates of illicit use among methadone patients recruited from six community-based outpatient treatment programs—the only multisite study of methadone patients<sup>22</sup> in the National Drug Abuse Treatment Clinical Trials Network that collects most information related to illicit methadone use. Prior studies

have suggested illicit methadone use as a form of self-medication for symptoms of opioid withdrawal by addicts at times when their opiate of choice was not available, or as a part of patterns of polydrug use.<sup>20,23</sup> In this study, we determined the extent of illicit methadone use among help-seeking opioid users in the community to improve our understanding of such misuse. We also examined whether illicit use was influenced by multiple factors, including prior histories of medical methadone use (having access to methadone), years of heroin and other drug use, DSM-IV criterion symptoms of opioid dependence, histories of chronic medical problems (self-medication for pain), HIV risk, criminality, and histories of mental health treatment (psychiatric comorbidity). We hypothesized that past-month illicit methadone use would be associated with recent factors, such as symptoms of opioid dependence, and that a history of regular illicit methadone use would be associated with prior histories of medical health, drug use, and criminal characteristics.

## METHODS

### Data Source

Statistical analyses were performed on data from the public-use files of a multisite study of the National Drug Abuse Treatment Clinical Trials Network (CTN) of the National Institute on Drug Abuse.<sup>24,25</sup> The study of Peirce and colleagues<sup>22</sup> is the *only* one from more than 20 currently completed or ongoing CTN studies that focused exclusively on methadone maintenance patients. A few other CTN studies have recruited a mix of patients from non-methadone and methadone programs, but sample sizes of methadone patients from these studies were much smaller than in the Peirce study. Statistical analysis of the aggregated data across studies and the interpretation of results are often complicated due to variations in design and sample characteristics (eg, type of primary drugs used and inclusion/exclusion criteria).

The original randomized drug abuse treatment trial evaluated stimulant use outcomes of an abstinence-based contingency management intervention as an addition to usual care.<sup>22</sup> Participants were recruited from six community-based methadone maintenance treatment programs associated with the CTN and were major providers in their regions. The programs were located in urban areas in the northeastern, eastern, or southwestern regions of the United States. The average static patient census was 490 (range, 270–870), and all noted a substantial problem with stimulant abuse in their patient populations.<sup>22</sup>

Potential subjects were referred by counselors or responded to information available at the clinic. Eligible participants included opioid-dependent patients who performed the following:

1. enrolled in methadone maintenance treatment for a minimum of 30 days but no longer than three years (1,095 days);

2. submitted a stimulant-positive (cocaine, amphetamine, or methamphetamine) clinic urine sample within two weeks of study entry that was verified from clinic records;
3. reported that they were not in recovery from a gambling problem; and
4. demonstrated understanding of study procedures by passing a simple informed consent quiz with a score of 80% or better.<sup>22</sup>

Because one mission of the CTN is to improve treatment services nationwide by disseminating research-based interventions to community-based treatment programs, the ability to generalize study results to real-world treatment populations is an important consideration. Hence, minimal exclusion criteria were specified (ie, failed a simple informed consent quiz and in recovery from a gambling problem), and use of other substances (eg, alcohol and sedatives) other than stimulants was not used as a criterion to exclude participants.

All participants were enrolled into the study between April 30, 2001 and February 28, 2003. Before randomization, participants completed the intake assessment, which gathered information on demographics, psychosocial problems, and drug use and diagnoses. On completing the assessment, participants provided their first study urine sample, which was tested on site; the results were then used to stratify participants before randomization. Participants were randomly assigned to one of two study conditions: usual care or usual care plus abstinence-based incentives for 12 weeks.

## Study Variables

### Dependent Variable

*Illicit methadone use* was obtained from participants' self-reports. At intake, participants were questioned about use of both "illicit" and "prescribed" methadone/LAAM, including use in the previous month (30 days), years of regular use, and route of administration (injection versus non-injection use). Past-month illicit methadone use was defined as the use of illicit methadone on one or more days during the 30 days prior to the interview; it identified current users of illicit methadone regardless of their frequency of use. A history of regular illicit use was defined as use of illicit methadone three or more times per week for at least six months; it encompassed lifetime (current and former) regular users of illicit methadone. The sources of methadone/LAAM (addiction treatment programs or pain physicians) were not collected. Analyses were conducted with both the sample of current users and of past regular users.

### Independent Variables

*Social and demographic variables* were collected at time of intake: age, sex, race/ethnicity (White, African American, Hispanic, other), current or past-month employment status, years of education completed, and marital status. Age was categorized into two groups, 18–34 y and  $\geq 35$  y, representing young adults and older adults, respectively.

*History of regular substance use* was defined as use of a substance  $\geq 3$  times per week for at least six months. The following substances were examined: alcohol (use to intoxication), marijuana, cocaine, amphetamines, heroin, prescribed methadone/LAAM, other opioids, barbiturates, other sedatives (hypnotics, tranquilizers, and benzodiazepines), tobacco, and multiple substances (including alcohol). We created binary variables to identify sample sizes of users for each regular use variable. We also created continuous variables to determine years of regular use in relation to illicit methadone use.

*Past-year substance dependence* at intake was assessed by a revised version of the DSM-IV checklist. The Checklist has undergone several revisions<sup>26</sup> from the original version done for DSM-III-R criterion.<sup>27</sup> According to Robert K. Brooner, PhD, the Checklist used in the present study was modified to reflect DSM-IV criteria and create a more structured version of the instrument for use in multisite trials that employed a large number of non-expert diagnostic interviewers (written and oral communication, March 2007). Participants were asked about use and occurrences of seven DSM-IV dependence criterion symptoms resulting from the use of each of the five classes of substances: cocaine, amphetamines, alcohol, marijuana, and opioids. Participants who reported having experienced three or more symptoms of the dependence syndrome were classified as having substance dependence.<sup>28</sup> Diagnoses that resulted from the use of other drugs were not assessed because they were not the focus of the original trial.

*Recent use of substance abuse treatment (in the past 90 days)* included the use of prescribed methadone/LAAM; methadone dosage at intake; admissions to emergency room for medical, psychiatric, or drug-related problems; attendance at a 12-step meeting (eg, Alcoholics Anonymous); and receipt of treatment in an inpatient detoxification setting.

*Physical health* included chronic medical problems, use of prescribed medication, and physical disability. A chronic medical problem was defined as a serious medical or physical condition that interfered with the respondent's life and required regular care. The use of prescribed medication was defined as taking any prescribed medication on a regular basis for a physical condition. Physical disability was defined as the receipt of a pension for a physical disability, including worker's compensation but excluding psychiatric disability.

*HIV risk, criminality, and mental health* included HIV status, injection drug use, number of days in jail during the past 90 days, and history of outpatient mental health treatment. HIV status was assessed by subject self-report. Injection drug use, defined as an injection of any drugs addressed by the study, was assessed by several questions regarding participants' most recent route of drug use. History of outpatient mental health treatment was defined as any treatment for psychological or emotional problems in an outpatient setting, not counting treatment for employment and substance abuse.

## Data Analysis

We first examined distributions of demographics, opioid dependence, and medical methadone use. We then determined

the prevalence of illicit methadone use by study variables. We also examined associations of seven DSM-IV criterion symptoms of opioid dependence and dosage of medical methadone with illicit methadone use to explore the influence of severity of dependence (number of symptoms), symptoms of opioid tolerance and withdrawal, and methadone dosage on illicit use. Categorical variables were examined with the  $\chi^2$  test; continuous variables were examined with the *t* test. Finally, we conducted logistic regression procedures to determine correlates of illicit methadone use.

## RESULTS

### Demographics, Opioid Dependence, and Medical Methadone Use in the Study Sample

The study sample comprised 383 patients, aged 18 years or older, who were recruited from six community-based outpatient methadone maintenance treatment programs and who reported past-year use of stimulants (cocaine, amphetamines, or methamphetamine) as defined by the DSM-IV checklist.

The majority (81%) of participants were aged 35 years or older (mean = 41.96 y). Approximately three-quarters were members of non-white minority groups: African American (49%); Hispanic (18%); and other (6%). More than one-half (55%) were male, 35% had fewer than 12 years of education, 50% had never been married, and 68% were not employed.

Overall, 80% met criteria for past-year opioid dependence, which reflected the dependence status at study intake, not the status at admission to the methadone maintenance treatment program. The great majority (83%) reported a history of regular use of prescribed methadone/LAAM (mean = 3.43 y). All participants were currently receiving methadone/LAAM maintenance treatment. The mean dosage of methadone was 86.7 mg/day, and 82% received a dosage of more than 60 mg (61–100 mg, 60%; more than 100 mg, 22%). The remaining participants received a dosage of 60 mg or lower (less than 40 mg, 3%; 40–60 mg, 15%). LAAM dosage was not collected.

### Patterns of Illicit Methadone Use

At intake, 1.6% (*n* = 6) of participants reported any use of illicit methadone in the past month, and 4.7% (*n* = 18) reported a history of regular illicit use; none used illicit methadone intravenously. Of subjects who reported a history of regular illicit use (*n* = 18), 61% (*n* = 11) had used methadone for approximately one year, 22% (*n* = 4) had used it for >1 to 4 years, and 17% (*n* = 3) had used it for 5 or more years. Only two participants with a history of regular illicit methadone use were included in the sample reporting illicit methadone use in the past month.

### Prevalence of Illicit Methadone Use by Sociodemographic Variables

We then examined the prevalence of past-month illicit methadone use and history of regular illicit methadone use by sociodemographic variables. Past-month illicit methadone use was more common among young adults (18–34 y) compared

with older adults ( $\geq 35$  y) (5.5% versus 0.6%), and among whites compared with African Americans (4.4% vs. 0%). Sex, education, marital status, and employment status were unassociated with past-month illicit methadone use. None of the sociodemographic variables was significantly correlated with history of regular illicit use.

### Prevalence of Illicit Methadone Use by Substance Use and Physical Health Variables

#### *Past-Month Illicit Methadone Use*

The prevalence of past-month illicit methadone use was higher among subjects with past-year marijuana dependence compared with subjects without past-year marijuana dependence (6.5% versus 1.1%), and among subjects with a history of outpatient treatment for psychological problems compared with subjects without such a history (3.6% versus 0.4%). All past-month illicit methadone users had a history of regular use of cocaine, heroin, prescribed methadone/LAAM, and tobacco; met criteria for cocaine and opioid dependence; and had a history of injection drug use.

#### *History of Regular Illicit Methadone Use*

Subjects with histories of regular use of prescribed methadone/LAAM (5.6% vs. 0%), other opioids (10.8% vs. 3.2%), and barbiturates (11.4% vs. 4.0%) were more likely than those without such histories to engage in regular illicit methadone use. Similar to the results from past-month illicit methadone use, none of recent use of substance abuse treatment and physical health variables was associated with history of regular illicit methadone use.

### DSM-IV Symptoms of Opioid Dependence and Illicit Methadone Use

We also examined the relation between illicit methadone use and the seven DSM-IV criterion symptoms of opioid dependence. Our findings show that past-month illicit methadone use was limited to participants with multiple symptoms of opioid dependence and with two or more substance dependencies. All past-month illicit methadone users had five or more criterion symptoms of opioid dependence in the past year, and met criteria for two or three substance dependencies. Probably due to the low prevalence of illicit methadone use, the relation between illicit methadone use and each of the specific symptoms of opioid dependence did not reach the level of statistical significance.

We also compared the mean number of the seven opioid dependence criterion symptoms between users and non-users of illicit methadone. Past-month illicit methadone users had on average more opioid dependence symptoms than non-users (6.0 vs. 4.5 symptoms; *t*-test *p* < .01). In contrast, each of the past-year opioid dependence symptoms and the number of dependence diagnosis were all unassociated with a history of regular illicit methadone use.

## Dosage of Methadone Treatment and Illicit Methadone Use

We compared mean methadone dosage and number of days in methadone/LAAM maintenance treatment between users and non-users of illicit methadone. The mean dosage of methadone (93.0 versus 86.6 mg) and the mean number of days in methadone/LAAM maintenance treatment during the previous 90 days (79.3 versus 78.6 days) did not differ significantly by past-month illicit methadone use. None of these variables differs significantly by a history of regular illicit methadone use.

## Logistic Regression Analysis of Illicit Methadone Use

We conducted logistic regression analysis of past-month illicit methadone use and of history of regular illicit methadone use, respectively, to identify correlates of use. We examined the association between illicit methadone use and each of the independent variables. Because our descriptive analysis found that all illicit methadone users used other drugs, we investigated the variables of regular substance use and treatment use (days in treatment) as continuous variables to determine whether greater involvement with these characteristics was associated with increased odds of illicit methadone use. Because of the relatively small sample of illicit methadone users, we included significant variables in the adjusted mode. Both crude and adjusted odds ratios of the variables from the logistic regression models are summarized in Table 1.

### *Correlates of Any Past-Month Illicit Methadone Use*

Younger age (18–34 y) and a history of outpatient treatment for psychological problems were associated with increased odds of past-month illicit methadone use. For instance, young adults were approximately 10 times as likely as older adults ( $\geq 35$  y) to have used illicit methadone in the previous month. Past-year marijuana dependence was associated with past-month illicit methadone use in the unadjusted analysis, but was not significant after the age group variable was controlled for in the logistic regression model, suggesting that the association between marijuana dependence and illicit methadone use was partly confounded by age-related differences in marijuana dependence.

### *Correlates of a History of Regular Illicit Methadone Use*

The adjusted logistic regression analysis found that more years of regular use of prescribed methadone/LAAM and other opioids, as well as an increased number of days in prison during the previous 90 days, were associated with increased odds of having a history of regular illicit methadone use, and that such associations were independent of the influences of a history of regular use of multiple substances. It is worth noting that sex, race/ethnicity, and the level of methadone doses were not associated with illicit methadone use, and they were not included in the adjusted logistic model.

## Supplemental Analysis of Illicit Methadone Use among Stimulant-Using Non-Methadone Subjects

Finally, we examined illicit methadone use in another CTN study<sup>29</sup> that included the same assessments as our study in order to provide an additional check on our findings of low prevalence of illicit methadone use. This study also focused on outpatient stimulant users, but participants were all recruited from non-methadone psychosocial treatment programs. In this sample ( $n = 415$ ; mean age = 35.8 y [SD = 8.6 y]), we found that only one subject (0.2%) reported past-month illicit methadone use, and 0.7% ( $n = 3$ ) reported a history of regular illicit methadone use.

## DISCUSSION

In this study, 1.6% of participants reported any use of illicit methadone in the past month, and about 1 in 20 reported a history of regular use of illicit methadone. The great majority (89%) of participants with a history of regular use of illicit methadone had not used any illicit methadone in the past month. None of the illicit methadone users injected it. Our supplemental analysis of a parallel CTN study of stimulant users supports our findings that illicit methadone use occurs infrequently and is much rarer among non-methadone stimulant-using patients (<1%).

A recent U.S. study of non-treatment-seeking injection drug users also found a low rate of illicit methadone use (4.0/100 person-years).<sup>20</sup> In contrast, studies outside of the United States have reported a high prevalence of illicit use. Scherbaum and colleagues<sup>23</sup> examined illicit use of medical opioids among 142 opioid patients consecutively admitted to a detoxification ward in Germany and found that 53.5% reported a history of illicit use of medical opioids, mainly methadone, at least once. Lauzon and colleagues<sup>30</sup> studied injection drug users in Montreal, Canada, and found a history of illicit methadone use to be prevalent: 59.4% among heroin users, 26.7% among heroin and cocaine users, and 3.6% among cocaine users. Data from the United Kingdom suggest that illicit methadone ampoules (50 mg), but not methadone tablets, are widely available to injection drug users and are inexpensive (£8–£15 each).<sup>31</sup>

Reports from Australia note that methadone syrup intended for oral consumption has been misused intravenously, and methadone injection appears to be common among some Australian heroin or injection drug users.<sup>32,33</sup> In the United States, methadone hydrochloride is available as an oral solution and as 5 and 10 mg tablets. The tablets are typically prescribed to treat moderate to severe pain.\* There were no reported incidents of methadone injection in this study.

Together, differences noted between our study and others may be due to variations in sample characteristics, regulations

\*The 40 mg methadone formulation is not FDA approved for use in the management of pain; it is indicated only for the detoxification and maintenance treatment of opioid addiction ([http://www.deadiversion.usdoj.gov/pubs/pressrel/methadone\\_advisory.htm](http://www.deadiversion.usdoj.gov/pubs/pressrel/methadone_advisory.htm)).

**TABLE 1.** Odds ratios (OR) and 95% confidence intervals (CIs) from logistic regression analysis of illicit methadone use among patients in methadone maintenance treatment programs ( $n = 383$ )

Logistic regression analysis	Unadjusted model			Adjusted model <sup>  </sup>		
	OR	95%	CIs	OR	95%	CIs
Past-month illicit methadone use <sup>  </sup>						
Age in years						
18–34 years vs. 35 years or older	8.93	1.60	49.72 <sup>‡</sup>	10.10	1.64	62.26 <sup>‡</sup>
Past-year marijuana dependence						
Yes vs. no	6.00	1.05	34.15 <sup>†</sup>	3.46	0.51	23.52
History of outpatient mental health treatment						
Yes vs. no	9.28	1.07	80.26 <sup>†</sup>	13.65	1.48	125.92 <sup>†</sup>
History of regular illicit methadone use <sup>#</sup>						
Years of regular use of prescribed						
Methadone/LAAM						
Continuous variable	1.12	1.05	1.20 <sup>§</sup>	1.09	1.01	1.18 <sup>†</sup>
Years of regular use of other opioids						
Continuous variable	1.14	1.06	1.23 <sup>§</sup>	1.12	1.00	1.25 <sup>†</sup>
Years of regular use of sedatives, not including barbiturates						
Continuous variable	1.08	1.01	1.17 <sup>†</sup>	0.99	0.89	1.10
Years of regular use of multiple substances						
Continuous variable	1.06	1.01	1.11 <sup>‡</sup>	1.04	0.98	1.11
Days in prison in the past 90 days						
Continuous variable	1.05	1.00	1.10 <sup>*</sup>	1.06	1.00	1.12 <sup>†</sup>

*p* values: \*  $p = .06$ ; †  $p \leq .05$ ; ‡  $p \leq .01$ ; §  $p \leq .001$ .

<sup>||</sup>The adjusted logistic regression model of past-month use included age, past-year marijuana dependence, and history of outpatient mental health treatment.

<sup>#</sup>The adjusted logistic regression model of history of regular use included years of regular use of prescription methadone, years of regular use of other opioids, years of regular use of other sedatives (not including barbiturates), years of regular use of multiple substances, and days in prison in the past 90 days.

governing the prescription of methadone and the take-home policy, ease of access to methadone maintenance treatment programs, and the framing of questions regarding illicit methadone use (eg, timing and frequency of use).<sup>20,30,34</sup> More liberal regulations regarding methadone take-home policy and a longer wait to enter methadone maintenance treatment programs may be associated with increased odds of methadone diversion and illicit use, such as self-treating opioid withdrawal symptoms.<sup>30</sup>

Additionally, studies have typically focused on *any* illicit methadone use; there is only limited information on *regular* use of illicit methadone. We have found only one study that reported the prevalence of weekly illicit use. In the study of injection drug users in Canada,<sup>30</sup> the six-month prevalence of any illicit methadone use was relatively high (42% among heroin users and 7% among heroin and cocaine users), but the six-month prevalence of at least weekly illicit use was low (6% among heroin users and 2% among heroin and cocaine users).

Our data indicate increased odds of past-month illicit methadone use among younger (18–34 y) methadone patients and among subjects with a history of treatment for mental health problems. Younger patients may have fewer prior

enrollments for methadone maintenance treatment than do older patients and hence have greater odds of using diverted methadone. Opioid abusers may use diverted methadone as an informal self-treatment before entering a formal methadone treatment program.<sup>23</sup> Previous studies have not addressed the relation between illicit methadone use and psychiatric comorbidity. Methadone patients with psychiatric comorbidity may have a greater need for methadone for self-treating psychological distress and/or opioid withdrawal symptoms.

Nonetheless, because all past-month illicit methadone users in this study had five or more opioid dependence symptoms and met criteria for cocaine and opioid dependence in the past year, it is possible that past-month illicit methadone use reflects a form of self-medication for symptoms of opioid dependence (eg, withdrawal) or a general pattern of polydrug abuse.<sup>23,31</sup> In the latter group, methadone might be used to compensate for heroin or other drugs when access to these drugs was reduced, or as a base for drug cocktails.<sup>23,31</sup>

Our findings also suggest that occurrences of a history of regular use of diverted methadone are limited to methadone patients with histories of using prescribed methadone and other opioids regularly, or to subjects who had been incarcerated during the 90 days prior to the intake assessment. However, the

data do not allow us to determine whether illicit methadone use is related to subjects' self-perceived need for higher dose levels during treatment, self-detoxification while not in treatment, or to a general tendency among some opioid abusers to misuse methadone and other drugs. Also, due to the lack of data on age of first illicit methadone use and age of first methadone treatment entry, we cannot determine their temporal relation. It is worth noting that in this sample, chronic medical problems, regular receipt of prescribed medication for chronic medical problems, and physical disability were each unassociated with illicit methadone use. There also was no association between methadone doses and illicit use.

### Study Limitations

Our study has a number of limitations. First, these findings are based on treatment-seeking opioid users who also used stimulants recently. The study sample is not necessarily representative of all outpatient methadone maintenance patients. Some opioid abusers may not want formal treatment, preferring to use diverted methadone as an informal self-treatment, and they are not included in our study. Despite the nature of our sample, a major problem among methadone patients is the combined use of opioids and stimulants;<sup>35</sup> thus, these results may be generalizable to an important subgroup of patients.

Second, the analysis of illicit methadone use is constrained by the interview question combining the use of illicit methadone and LAAM and by the lack of data on LAAM doses. This concern is mitigated by findings that approximately 97% of patients treated with opioid agonist medications received methadone, while only 3% received LAAM,<sup>7</sup> and is further mitigated by the fact that LAAM is not provided in take-home doses.<sup>36</sup>

Third, like all other studies of illicit methadone use of which we are aware, our measure of illicit methadone use depends on subjects' self-reporting. Self-reported information should be considered conservatively because it can be influenced by memory biases and respondents' willingness to disclose illicit methadone use. Due to the constraints of available resources, self-reported data frequently comprise the information that we are able to obtain from participants.

Fourth, information on sources of methadone, motives for illicit use, and consequences of illicit use is not available. This study was conducted before office-based treatment for opioid dependence using oral buprenorphine became widely available; the introduction of buprenorphine may affect illicit methadone use.

Last, our analyses were constrained by the small number of illicit methadone users. Hence, we examined the only parallel CTN study of stimulant users as an additional check on our findings, which showed that illicit methadone use was relatively rare. We also reviewed questionnaires of the National Survey on Drug Use and Health<sup>2</sup> and the National Epidemiologic Survey on Alcohol and Related Conditions.<sup>37</sup> The former survey does not specifically assess the use of

methadone treatment, and the latter does not collect specific information on illicit methadone use.

### CONCLUSIONS

Methadone maintenance treatment is strictly regulated in the United States according to federal and state guidelines.<sup>18,36</sup> The low rates of recent or regular illicit methadone use observed in this study suggest that opioid addicts do not generally use diverted methadone for its pleasurable effects,<sup>31</sup> raising the possibility that illicit methadone use may not be a problem of concern. These data suggest that past-month illicit use may occur in the context of multiple symptoms of opioid dependence and dependence on other abused substances in the past year.

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