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Uses of diverted methadone and buprenorphine by opioid-addicted individuals in Baltimore, Maryland

Shannon Gwin Mitchell, Ph.D.^{a,*}, Sharon M. Kelly, Ph.D.^a, Barry S. Brown, Ph.D.^{a,b}, Heather Schacht Reisinger, Ph.D.^{a,c}, James A. Peterson, Ed.D.^a, Adrienne Ruhf^a, Michael H. Agar, Ph.D.^{a,d}, Kevin E. O'Grady, Ph.D.^e, and Robert P. Schwartz, M.D.^{a,f}

^aFriends Research Institute, Inc., Social Research Center, Baltimore, Maryland, USA

^bUniversity of North Carolina at Wilmington, North Carolina, USA

^cIowa City VA Medical Center, Iowa City, Iowa, USA

^dEthknoworks, Santa Fe, New Mexico, USA

^eDepartment of Psychology, University of Maryland, College Park, Maryland, USA

^fOpen Society Institute – Baltimore, Baltimore, Maryland, USA

Abstract

This study examined the uses of diverted methadone and buprenorphine among opiate-addicted individuals recruited from new admissions to methadone programs and from out-of-treatment individuals recruited from the streets. Self-report data regarding diversion were obtained from surveys and semi-structured qualitative interviews. Approximately 16% ($n=84$) of the total sample ($N=515$) reported using diverted (street) methadone 2–3 times per week for six months or more, and for an average of 7.8 days ($SD=10.3$) within the past month. The group reporting lifetime use of diverted methadone as compared to the group that did not report such use was less likely to use heroin and cocaine in the 30 days prior to admission ($ps < .01$) and had lower ASI Drug Composite scores ($p < .05$). Participants in our qualitative sub-sample ($n=22$) indicated that street methadone was more widely used than street buprenorphine and that both drugs were largely used as self-medication for detoxification and withdrawal symptoms. Participants reported using low dosages and no injection of either medication was reported.

Keywords

methadone; buprenorphine; diversion; mixed-methods

The majority of opioid-addicted individuals in the U.S. are not enrolled in drug abuse treatment (1,2,3) which contributes to transmission of HIV and hepatitis, overdose death, and crime. (4,5,6) Methadone and buprenorphine are highly effective in treating opioid withdrawal symptoms in the short-term and in reducing or eliminating heroin use in the long-term; (7,8, 9) however, the availability of these medications has inevitably led to some diversion. (10) Although the use of diverted medications is often referred to as abuse or misuse, the actual reasons for their use varies depending on social constraints and conditions.

*Corresponding Author: Friends Research Institute, Inc., 1040 Park Avenue, Suite 103, Baltimore, MD 21201, USA. Tel.: 410-837-3977, ext. 238; fax: 410-752-4218. sgmitchell@friendssocialresearch.org.

The rapid expansion of methadone availability through opioid-treatment programs in the early 1970s led to a marked decrease in crime and drug-related illnesses. (11,12) However, methadone's increased availability also led to its misuse as a euphoric agent when high-quality heroin became scarce. (13,14) Once heroin supply rebounded, researchers found that diverted methadone was most often used for self-medication for withdrawal or self-detoxification rather than for its euphoric effects. (15,16)

In recent years, the widespread availability of buprenorphine treatment through primary care physicians in France was found to be associated with a significant decrease in heroin-overdose deaths, crime, and HIV transmission, (17) yet its availability as a source of treatment has also led to some buprenorphine diversion and misuse by injection, and to some overdose deaths when injected with benzodiazepines. (17,18,19) Other recent reports indicate that buprenorphine from France and other western European countries is being diverted to Georgia, a country in which buprenorphine is not legally available, where it has contributed to rising levels of injection drug abuse. (20) Buprenorphine has also been identified as a drug of abuse for polydrug injectors in Finland, (21) Australia, (22) Singapore and Malaysia, (23) and India. (24)

The international experience with buprenorphine diversion in the 1990s (22,25) informed the decision by U.S. authorities to approve the Drug Abuse Treatment Act of 2000, which permits buprenorphine treatment by prescription with restrictions aimed at reducing the likelihood of diversion. These restrictions include specialized physician training, physician registration with the Drug Enforcement Administration, and limitations on the number of patients per physician. (22) Most buprenorphine abuse reported in non-U.S. countries involved Temgesic®, Buprenex® or Subutex®, which do not contain naloxone. (20,21,22,24) Buprenorphine is primarily utilized in the U.S. as Suboxone®, a combination tablet which includes naloxone, an opioid antagonist, to discourage its injection. (9,26)

Understanding methadone and buprenorphine diversion and its association with public health problems, as well as its connection with the drug abuse treatment process, is of considerable importance given the recent expansion of buprenorphine treatment in the U.S. and the sharp rise in methadone-related overdose deaths in the past few years. (27,28) Although there has been some recent epidemiological research concerning methadone diversion, (29) there has been limited ethnographic research since the work of Hunt and colleagues (30) more than two decades ago. Additionally, little is currently known regarding the uses of diverted buprenorphine or how it compares to the uses of diverted methadone. The purpose of the present study is to explore the uses of diverted methadone and buprenorphine among opioid-addicted individuals in Baltimore, Maryland.

Methods

Participants

This study was part of a larger longitudinal examination of methadone treatment entry and engagement, which included both newly-admitted MTP patients and a comparable out-of-treatment sample. (31) Eligibility for study entry required that participants were at least 18 years of age and met the federal criteria for methadone maintenance treatment (one continuous year of opioid dependence). A total of 515 heroin-addicted individuals from the Baltimore City area were recruited for the study, including 351 participants who were entering treatment at one of the six MTPs associated with the study and 164 participants who were neither enrolled in nor seeking treatment. (32,33) There were no statistically significant differences between the in-treatment and out-of-treatment participants in terms of their demographic characteristics (including age, gender, marital status), level of education, number of days employed, or route of heroin administration. (31) All participants received the surveys described below.

A subset of the in-treatment and out-of-treatment participants were invited to participate in in-depth, semi-structured interviews with ethnographers. The qualitative sub-sample was recruited based on a two-tiered sampling design, first selecting participants from the larger study so as to achieve a geographically representative sub-sample based on neighborhood of recruitment (out-of-treatment sample) or methadone treatment center (in-treatment sample). Secondly, participant selection was further refined to achieve a representative sub-sample of the larger study sample in terms of race, gender, number of treatment episodes, and route of administration. A total of 22 participants in the qualitative subsample (24%) (8 in-treatment participants and 14 out-of-treatment participants) described using either diverted methadone or buprenorphine: 17 described methadone use only, one described buprenorphine use only, and four described using both methadone and buprenorphine.

All participants provided informed written consent at recruitment into the parent study (recruited between November 2004 and November 2007) and were given \$20 for completing the baseline survey and for each of the qualitative interviews. The study was approved by Friends Research Institute's Institutional Review Board.

Surveys

Participants were administered the Addiction Severity Index (ASI) (34) and the Friends Research Supplemental Questionnaire (35) at baseline. The ASI is a valid and reliable instrument that measures current and lifetime functioning in seven different domains. (36,37, 38) The ASI defines “lifetime” years of use for heroin, street methadone, and other opiates and analgesics as the use of that substance for a minimum of 2–3 times per week, for six months or more. Lifetime cocaine use is defined as using cocaine at least twice per week, for six months or more. The Friends Research Supplemental Questionnaire asks participants to answer detailed questions regarding early criminal behavior, arrests, drug use, and previous treatment experiences. (35)

Survey Analysis—Bivariate inferential analyses were used to compare street methadone users to non-street-methadone users on demographic characteristics and lifetime and past-30-day drug use and treatment history variables. The χ^2 goodness-of-fit test was used for categorical variables and the independent-samples *t* test for continuous variables.

Qualitative Interviews

In-depth, semi-structured interviews were developed and administered by the ethnographic research team at baseline and again at months four, eight and twelve, for a total of four interviews per ethnographic participant. Each interview lasted 30–90 minutes and was conducted in participants' homes, other locations in their neighborhoods, or at our research site. All qualitative interviews began with specific questions concerning the participants' drug use and treatment histories, but the flow of the interviews was guided by the participants themselves, and follow-up questions were often asked in order to elicit greater detail.

Interview Analyses—All interviews were recorded, transcribed, reviewed for accuracy, and entered into Atlas.ti for analysis. Grounded theory methodology, a qualitative research approach that systematically analyzes data and inductively builds theory with respect to a specific dataset, was used in our analysis. (39) During the open coding phase, the investigators approached the data looking for descriptions of diversion, thus the data were first coded into either “methadone diversion” or “buprenorphine diversion.” During the selective coding phase, the data were further categorized into sub-themes depicting different aspects of participants' experiences with the diverted medications. The following sub-themes emerged from the participants' interview data during this phase of analysis: source of the medications, cost of the medications, reason for purchasing methadone or buprenorphine, dose taken, short-term effects

of the medications, and long-term outcomes. These sub-themes were then further explored by identifying and comparing the causal conditions, context, and consequences among them. For instance, a participant's reasons given for acquiring the medication would be compared to their description of self-dosing as well as the physical, social and/or emotional outcomes associated with the use.

The lead author read each transcript and classified the responses based upon the diverted medication being described. After the initial coding phase was completed, inter-rater reliability was assessed by first having each coded text segment read and coded independently by two different research team members. The team members then met, discussed, and reached consensus concerning the more detailed levels of content coding.

Results

The mixed-methodological design of this study permitted us to examine the issue of diversion at multiple levels, including the reported incidence of diversion across the larger study sample (using the ASI and Friends Research Supplemental Questionnaire), as well as the more detailed, contextual responses gleaned from the qualitative interviews. For this reason we will first present the survey findings regarding methadone and buprenorphine diversion within the larger study sample to show who is participating in the diversion activities, and then present the qualitative findings to illuminate facets of the issue in greater detail.

Survey Findings

Sample characteristics: Lifetime street methadone users v. non users—The total sample's ($N = 515$) mean age was 42 years ($SD = 8.0$), 55% were men, and 76% were African American. As shown in Table 1, the mean age for first using heroin was 21.7 years ($SD = 6.5$), the mean age for first using street methadone was 33.3 ($SD = 9.2$) and for other opioids (including buprenorphine) was 27.2 ($SD = 10.4$). Thus, most participants had five or more years of heroin use prior to first using either street methadone or other opioids, including buprenorphine. Of the total sample, 84 participants reported using street methadone 2 to 3 times per week for six months or more (defined by the ASI as “lifetime use”).

There were no statistically significant differences between the lifetime and non-lifetime street methadone users in terms of their demographic characteristics (including age, gender, marital status), level of education, or number of days worked in the past 30 days. The lifetime and non-lifetime street methadone use groups also did not differ in terms of their in-treatment v. out-of-treatment composition.

Drug use—The two groups did not differ with respect to lifetime drug use practices, such as their lifetime use in years of heroin, cocaine, or other opiates, whether they had ever injected drugs, or their usual route of heroin administration (see Table 1). There were no differences between lifetime street methadone users and non users in terms of the age at which they first tried heroin $t(512) = .94$, cocaine $t(495) = .24$, other narcotic drugs $t(153) = .14$, or street methadone $t(323) = 1.02$, all $ps > .05$.

With respect to past 30 day drug-related behaviors, group differences were more apparent. The lifetime street methadone users reported using significantly less heroin $t(513) = 6.54$, $p < .01$ and cocaine $t(513) = 3.14$, $p < .01$ and significantly more street methadone $t(513) = 11.85$, $p < .01$ and other opiates $t(513) = 2.73$, $p < .01$ in the past 30 days, when compared to the non-lifetime street methadone users.

Treatment history—There were no significant differences between the lifetime street methadone users and the non-users in terms of the mean age at which they first entered

methadone treatment ($M = 31.5$ vs. 33.5 , respectively) or buprenorphine treatment ($M = 36.7$ vs. 34.3), but there were significant group differences regarding how many times they had ever been in a drug abuse treatment program ($M = 3.2$ vs. 2.2), $t(513) = 3.47$, $p < .01$, how many of them had participated in methadone treatment (62% vs. 47%), $\chi^2(df=1, N=515) = 6.36$, $p = .01$, and how many times they had been to methadone treatment ($M = 1.3$ vs. $.8$), $t(513) = 3.41$, $p < .01$, with more lifetime street methadone users having all of these types of treatment experiences. The groups did not differ with respect to having ever participated in buprenorphine treatment (16% vs. 14%), $\chi^2(df=1, N=515) = .241$, $p = .61$. This last point may partially reflect the limited experience of the total sample with respect to buprenorphine treatment, with only 13.8% of the 515 reporting such experiences.

Addiction Severity Index Composite Scores—The comparison of lifetime street methadone users with non-users was significant only for the Drug Use composite score, $t(513) = 3.86$, $p < .05$, which showed a significantly lower score for the lifetime street methadone users ($M = .29$) compared to the non-street methadone users ($M = .33$), indicating less serious current drug use problems for the lifetime street methadone use group. The ASI drug use composite score is calculated from the following items considered over the 30 day period prior to the interview: 1) the frequency of drug use; 2) how many days they have experienced problems with drug use; 3) how troubled or bothered respondents have been by drug problems; and 4) how important respondents feel it is to obtain drug treatment. As we noted above, the lifetime street methadone users reported less frequent heroin and cocaine use in the past 30 days but not methadone and other opioids when compared with non-lifetime street methadone users. The lifetime users also reported being significantly less troubled by drug problems in the past 30 days $t(513) = 4.59$, $p < .01$ than did the non-lifetime street methadone users ($M = 2.36$ vs. 3.06 , respectively), and feeling that it was less important to obtain treatment for their drug problems ($M = 2.37$ vs. 3.07), $t(513) = 4.42$, $p < .01$.

Qualitative Findings

To clarify the motivations for using diverted methadone and buprenorphine, and to detail the practices of such users, attention was focused on the 22 ethnographic study participants who reported use of diverted methadone and buprenorphine. Eight in-treatment participants and 14 out-of-treatment participants discussed using diverted medications. As seen below, participants described the use of these diverted medications in similar ways, providing details concerning what was being purchased, the source of the diverted medication, what it cost, the reason for purchasing it, the dosage and methods of use, and the effects obtained.

What is being purchased—Of those using diverted methadone, the vast majority reported purchasing liquid methadone, often identifying the contents of the diverted bottle as ranging from 60 mg to 120 mg. Only two participants reported purchasing non-liquid methadone, which comes in two formulations: scored 40mg diskettes and unscored 5mg or 10mg tablets. Both participants stated that they preferred the non-liquid form, indicating that they had used both types of diverted methadone at some point in the past.

The use of diverted buprenorphine was reported by five different participants, all of whom talked about taking the sublingual tablets or “pills.” Buprenorphine comes in three formulations. The first is an injectable liquid, Buprenex®, which is approved for pain treatment. None of our participants reported using this product. The two formulations approved for opioid dependence treatment are Suboxone®, a combination of buprenorphine with naloxone in a 4:1 ratio, or Subutex®, which does not contain naloxone. Both Suboxone® and Subutex® come in either 2 mg or 8 mg sublingual tablets and can be prescribed by office-based physicians or provided through drug-treatment programs.

Four of the five participants who discussed using buprenorphine also discussed prior experiences using diverted methadone, in either the liquid or non-liquid form, indicating that they had tried multiple, sometimes even simultaneous methods in detoxing from heroin.

I know somebody that sell bupermorphine (sic) and meth pills. So I started off and took the bupermorphines and I took them for like three days and they knock out, you don't even have any effects from not having heroin. So I was alright. And then after, you know, like the fourth day I took a meth pill (sic) and, you know, that held me. And then after that I just was like, man, I just ain't going to do nothing. So I didn't do anything for like two weeks.

(35 year-old, African-American female)

Participants who reported using either diverted methadone or buprenorphine often expressed preferences regarding the use of one form or type of medication over another, usually based on previous experiences. No one in our sample mentioned injecting methadone or buprenorphine.

Sometimes, purchases depended on the amount of money they had or what was available at the time. One participant mentioned changing from liquid methadone to the non-liquid form when the person who supplied her left a treatment program. Others mentioned going back to heroin for brief periods of time when they were unable to obtain methadone for a variety of reasons.

Source—Given the fact that the majority of participants reported purchasing liquid methadone, it can be safely concluded that most of the diverted methadone obtained by our participants originated from MTPs because the liquid form is used most often in these types of programs in the Baltimore area and is not available by prescription from pharmacists. In fact, our participants often identified the specific source of the diverted methadone as MTP patients who either brought it directly to them or to the streets for re-sale.

Although many of the participants were vague about their sources (e.g., “a girl” or someone “on the street”), approximately half reported purchasing methadone from someone that they knew.

I'm saying, every now and then I might take \$20, but I got a cousin in on that methadone program and like he get like 120 mg. And every now and then I might buy a bottle from him.

(45 year-old, African-American male)

Buying from a known source was identified as being both a reliable and safe way to obtain methadone or buprenorphine on the street. One participant mentioned purchasing what looked like a regular bottle of methadone on the streets, only to find out that it wasn't effective and had probably been tampered with by someone who diluted the bottle.

Buprenorphine was usually purchased off the streets, sometimes from an acquaintance but often identified as just a general street source. When asked where he bought his buprenorphine, a 42 year-old, African American male participant said the following.

You can buy it anywhere. [Ethnographer: Anywhere?] You can get scripts (prescriptions) for it. That's the only thing you can get scripts for though. [Ethnographer: And they resell them on the street?] Yeah, they sell them on the street.

Both methadone and buprenorphine appear to be diverted by people selling small quantities as they become available, as they acquire their take-home doses (from MTPs) or their

prescriptions are filled. No one in our sample mentioned buprenorphine being more or less difficult to obtain than methadone on the streets; it was simply mentioned less often.

Cost—The cost of diverted methadone appeared to reflect variations in the dosage being purchased. People reported paying as little as \$15 for a bottle of methadone but most reported paying approximately \$20 for an 80 mg bottle, and up to \$40 for a higher dose bottle.

The price paid for a methadone diskette was reported as \$20. Many people mentioned purchasing either a portion of a bottle or diskette from the source, or purchasing the methadone with another person who would split the cost with them.

They big orange pills (40 mg scored methadone diskettes) and they cut in quarters. So what she do is, you can buy the whole pill for twenty (dollars) or you could, she sell you, she'll break them down and sell them in quarters. [Ethnographer: Each quarter?] Mmhm, five dollars.

(58 year-old, African-American female)

The cost of purchasing diverted buprenorphine at \$5 a tablet, or methadone at \$20 dollars a bottle, divided and taken over the course of several days was considered cost-effective by some of our participants when compared to the expense of purchasing heroin (ranging in purity between 20% and 48%, depending on the source), (40) which reportedly costs \$10 per unit dose but is often taken in more than one unit dose, several times per day. The cost of purchasing diverted methadone or buprenorphine may or may not be enticing when compared to the cost of entering treatment, however. Two different participants who had purchased street methadone mentioned that they were spending more money to buy the medication on the streets than it would cost them to obtain methadone from a treatment program.

I was paying \$49, \$50 a week in the program, and on the street I probably spend \$100 a week. Doesn't seem right. I am paying twice as much as you could the other way. I'd spend \$200 a week to keep from withdrawing off methadone.

(38 year-old, Caucasian male)

This particular participant was discharged from methadone treatment for non-compliance and being in arrears with fees. He reported purchasing methadone on the street to detox from methadone rather than heroin and, ironically enough, ended up spending more for his methadone on the street. However, he was willing to pay the high cost of illegally obtaining methadone to avoid methadone withdrawal.

The street price for buprenorphine was reported to be \$5 a tablet. Given the fact that most of the participants who used diverted buprenorphine said that they took only ½ tablet per day (probably 8 mg tablets), it was considered by them to be a cost-effective way to detox from heroin.

Reason—The two most common reasons for taking diverted methadone or buprenorphine were avoidance of heroin or methadone withdrawal symptoms, and a desire to stop using heroin. A 51 year-old, African-American female participant who had recently been discharged from an MTP found that her use of diverted methadone served multiple functions.

It was rough coming off of it (methadone), I can tell you. And that's why, um, I've been buying it on the street, you know. Just to keep me away from the heroin. And plus, you know, you go through changes once you come off of it. I mean, it's not peaches and cream coming off.

This participant said that when she was feeling ill and was unable to obtain methadone she went back to using heroin, at least temporarily.

Those who opted to stop using heroin by purchasing street methadone usually mentioned either that they were unable to get into a treatment program (because of lack of insurance, lack of open treatment slots, etc.) or were unwilling to take methadone for prolonged periods of time and so were uninterested in joining MTPs.

Only one participant reported that he had purchased diverted methadone in an attempt to get high. However, he had no prior experiences with methadone and found that he was not able to achieve the kind of results he was expecting. Upon experimenting with methadone this participant found that he felt more “normal” than high. He also found that if he took it in small doses he began to crave heroin within a few days. This participant reported that he now uses street methadone to detox from heroin, consuming an 80mg bottle each time.

All participants who mentioned using diverted buprenorphine did so either to avoid withdrawal symptoms, temporarily “rest” from using heroin, or detox from heroin. One participant said that he had been holding on to a buprenorphine tablet and saving it for a time when he needed it. He subsequently took it just prior to his arrest and found that it helped him avoid heroin withdrawal during incarceration.

Some participants reported that they used diverted buprenorphine or methadone to help them temporarily stop using heroin, with the idea that they would resume their drug use at some point in the future. The following quote by a 35 year-old, African-American male illustrates this type of reasoning.

I know I needed a rest but I guess in the back of my mind I always was like, “Well, you're going to rest for a little while and then you know you gonna get high again.”

Others took the medications intending to detox from heroin and remain drug-free for a prolonged period of time. No matter the reasoning behind taking the medication, successful experiences with diverted buprenorphine and methadone often showed the participants that they now had an effective tool that they could use again in the future.

Dose—The dosage levels, frequency, and duration of methadone and/or buprenorphine use reported by our participants support their claims that their aim was usually to detox from heroin or to mitigate withdrawal symptoms rather than to get high.

A hundred milligram bottle would last me two to three days, and that's with me being well all day.

(49 year-old, Caucasian male)

Many of the participants who used liquid methadone talked about taking only a portion of their bottle and reported skipping a day or more between doses. Self-reported street methadone doses were commonly around 30 to 40 mg in size. Such low doses are adequate in preventing withdrawal symptoms but inadequate in blocking the reinforcing effects of heroin. (15)

Individually driven, low dosing with diverted buprenorphine was similar to the pattern used with methadone. The highest buprenorphine dosing regimen was described by a 47 year-old African-American woman who reported taking one tablet twice a day for three days to come off heroin and remain abstinent for two months.

Although the participants did not describe their buprenorphine dosage in terms of milligrams, as they often did when describing their methadone dosage, it can be deduced that our participants often took approximately 4 mg per day, frequently skipping one or more days between doses. The U.S. Department of Health and Human Services' Buprenorphine Treatment Improvement Protocol (26) considers 4 mg a standard buprenorphine induction dose for opioid addiction treatment purposes.

Many of our participants mentioned trying different medications in different doses at different times, indicating that they either experimented independently or learned alternative techniques from others in order to maximize the effectiveness of their self-treatment. When participants talked about simultaneously using heroin and methadone, the former was used to ward off opioid cravings, indicating that they were taking an insufficient methadone dose.

Short-term effects—Most participants reported that taking diverted methadone or buprenorphine was effective at reducing their heroin consumption and alleviating withdrawal symptoms. The following quote reflects a common short-term outcome from the use of these medications.

Well every now and then I might buy a bottle (of methadone) off of somebody. That's like, if I say I got to go to work every day, you know, I can't get up and go out there and get something before I go to work because it's too early. If I work late I know I ain't going to be hanging around at night trying to find something. So I need that (methadone) so I don't, just in case I get a little ill or whatever, during the day I drink a little bit of that.

(55 year-old, African-American male)

Participants often indicated that taking the medications made them feel “normal” or “well.” Because methadone and buprenorphine have longer half-lives than heroin and other short-acting opioids, these medications often helped them go about their daily routine, in some cases permitting them to work, without experiencing withdrawal or having to be on the streets repeatedly to obtain heroin. For many, this was all they desired.

Those who took methadone or buprenorphine in order to completely stop using heroin for longer periods of time reported that they were able to do so for as little as a few days to as long as several months.

Long-term outcomes—When asked when the last time was that she had purchased methadone off the street, a 43 year-old, African-American female said, “*Right before I went into treatment.*” The use of methadone, both in and out of MTPs, was not at all uncommon for some of our ethnographic participants. Positive experiences with the use of methadone or buprenorphine on the street as self-medication were sometimes enough to make participants receptive to entering treatment programs. One participant found that methadone was highly effective at curbing heroin cravings. He ultimately made the decision to go into a methadone treatment program because he realized it would be less expensive than purchasing it off the street.

Discussion

A main finding from this study was that participants reported using diverted methadone or buprenorphine for self-medication for detoxification or withdrawal symptoms rather than to get high. With respect to the use of diverted methadone, these findings are consistent with previous research (16,30,41,42) and seem to indicate that the sources (e.g., legitimate MTP patients) and reasons for using diverted methadone (e.g., self-medication) have remained relatively stable over the past 20 years. (14,15,43) Spunt and colleagues identified an out-of-treatment subgroup of illicit methadone users that consisted of younger individuals who used little heroin but purchased diverted methadone for its euphoric effects. (16) In contrast, the mean age for our out-of-treatment sample was 42.3 years and only 3% of all participants identified themselves as primarily illicit methadone users. (31)

No study participants reported using buprenorphine to get high and only one reported using methadone to get high. The latter's use of methadone for its euphoric effect eventually led him to "self-medicate" with diverted methadone. The fact that participants reported sipping methadone, dividing the content of the methadone bottles or splitting buprenorphine tablets for use over several days supports their contention that they were using diverted methadone and buprenorphine for self-medication. Furthermore, none of the study participants mentioned combining buprenorphine with cocaine or benzodiazepines, a practice reported among individuals misusing buprenorphine in France and elsewhere, (18) which likewise supports their claims that they were not using the medication to get high.

The lifetime street methadone users reported significantly lower past 30-day heroin and cocaine use rates than did the non-lifetime street methadone users but significantly higher rates of street methadone use during the same time period, supporting the qualitative findings that most users of street methadone are "self-medicating" their addiction.

Attempts to minimize the diversion and abuse of methadone helped inform the creation of the methadone regulatory system for drug abuse treatment (in contrast to pain management) that continues to the present day. In the early 1970s there were concerns that patients would try to enroll in multiple methadone programs in order to obtain more medication due to the heroin shortage in the U.S. (14) For this reason practices were instituted in certain areas to monitor such behaviors. (44) The use of methadone as an intoxicant noted in the 1970s is in sharp contrast to our study findings, although the abundant availability of low-cost and potent heroin in Baltimore over the course of our study period may explain why participants did not report using methadone to get high.

Significantly more of the lifetime street methadone users had formal treatment experience, including more methadone treatment experiences, as compared to the non-lifetime street methadone users. These findings are in accord with those recently published by Wu and colleagues (41) who found that patients entering opioid treatment with a regular history of illicit methadone use also had more years of methadone or LAAM treatment and other prescribed opioid use than did those without a history of illicit methadone use. It is theoretically possible that for some opioid-dependent individuals, familiarity with methadone and buprenorphine in treatment settings may enhance their receptivity to using these diverted medications on the street. On the other hand, it is possible that for others, "successful" experiences of self-medication with methadone or buprenorphine on the street may enhance their receptivity to seeking treatment.

Although we were unable to further dissect the temporal nature of the use of diverted methadone or buprenorphine, we identified three general patterns of use: 1) as a bridge to treatment entry or the precursor to a formal treatment episode, 2) as a mechanism for detoxification following a formal treatment episode, and 3) as a form of self-medication distinct from any formal treatment episode.

Some users of these diverted medications may choose to do so because of social constraints and conditions. Our findings indicated that some of our participants may have been unable to enter treatment while others may have simply wished to avoid the "hassles" of treatment (e.g., the need to go to the clinic daily for their medication, attend required counseling) (45) or would have preferred short-term detox if it had been available. (32) There have been long waiting lists in Baltimore (and elsewhere) for methadone treatment (2,3) for many years. The relative difficulty in obtaining treatment is in contrast with the relative ease of obtaining heroin, methadone, or other opioids on the streets. (15) To address this issue, barriers to methadone treatment entry could be reduced, lower threshold programs could be implemented, and ambulatory detox made more widely available. (46,47)

Despite the reported association of increased availability of methadone by prescription for the treatment of chronic pain with the increasing number of methadone overdose deaths in the U.S., (48) most participants in the present study reported obtaining diverted liquid methadone from individuals attending opioid-treatment programs. This finding is most likely due to the fact that our sample was obtained from among newly enrolling methadone patients and out-of-treatment heroin addicts recruited from the streets. It confirms a recent study in NYC that also indicated that, among street-recruited addicts, only 2.8% indicated having received methadone through a physician or pharmacy. (28)

Not surprisingly, more methadone than buprenorphine was reportedly used outside of medical supervision. Buprenorphine has only been available in the U.S. since 2003 and early reports indicate that diversion of buprenorphine has not been widespread nor created significant public health problems when compared with other opioids. (48) Although the number of patients treated with buprenorphine in Baltimore (and elsewhere) has been on the rise, its use is still relatively low compared to the number of patients treated in the city's over 4,000 methadone slots and the unknown additional number of medical/surgical patients who receive methadone prescriptions for pain management. Our baseline data were collected between 2004 and 2007. It is possible and even likely that buprenorphine diversion patterns will change as it becomes more widely prescribed (50), as has been noted with other prescription opioids. (51)

A recent study by Davis and Johnson (28) examining prescription opioid diversion among street drug users in New York City found that far fewer people had heard of the prescription brands of buprenorphine (Subutex® and Suboxone®) than had heard of methadone or other prescription opioids, such as Oxycodone or Vicodin. Fewer participants in our sample mentioned buprenorphine than methadone but those who were aware of the medication (nearly always referred to it as generic "buprenorphine" rather than by a brand name) tended to have favorable attitudes towards it. (33)

None of our study participants reported injecting methadone or buprenorphine. Methadone has rarely been abused by injection in the U.S. (15) although it has been reportedly injected in Australia and elsewhere.(20,22,23,52,53) Whether the lack of buprenorphine injection was due to heroin's high purity, wide availability, and low cost, or the presence of naloxone in Suboxone® is not known. A recent study by Smith and colleagues (49) examining U.S. trends in reported abuse of buprenorphine products between 2003 and 2005 found that out of the 77 buprenorphine abuse cases reported through poison control centers involving the intentional improper or incorrect use of buprenorphine, twice as many involved Suboxone® as compared to Subutex®, although route of administration in these cases was not reported.

One highly significant concern related to the unsupervised use of methadone or buprenorphine is the potential for overdose, particularly in light of the recent rise in methadone overdoses. (48,54) We found little evidence of methadone contributing to overdose among the sample we interviewed. This was not entirely surprising given the long histories of heroin addiction in our sample and their familiarity with and tolerance to methadone. One of our study participants reported believing that his methadone dose was tampered with, although he appears to have purchased a lower methadone dose than he anticipated. Individuals obtaining liquid methadone cannot be sure what dose they are ingesting and thus run the risk of inadvertent overdose, particularly if their tolerance is low because of recent detoxification from heroin, discharge from methadone treatment, or release from prison or hospitalization.

In other populations, such as pain patients, adolescents, new heroin users, and other opioid-naive individuals, the risk of methadone over-dose is substantial. (48) This concern is less heightened for buprenorphine, which is a partial opioid agonist and has a ceiling effect on respiratory depression and therefore a decidedly better safety profile than methadone, (55,9)

although there have been reported overdose deaths attributed to the combination of buprenorphine and benzodiazepines.

Limitations

Since participants were recruited as part of an investigation of methadone treatment, study entry demand characteristics may have inclined people to discuss methadone rather than buprenorphine. Our findings must be interpreted with caution due to our limited sample size.

In general, our sample consisted of older opiate-addicted individuals (mean age of 42) and the results cannot necessarily be generalized to younger opiate users or other populations known to abuse prescription opiates, such as adolescents or medical/surgical patients. More research concerning the use of methadone and buprenorphine among these diverse groups is warranted.

Conclusions

Most of the methadone and buprenorphine obtained by our participants was used for self-medication of opioid addiction rather than for achieving euphoric effects and was reported to be taken in a manner consistent with these purposes. There is some indication that familiarity with methadone and buprenorphine in treatment settings may enhance the receptivity to using these diverted medications on the street and vice versa. A variety of factors, particularly the ability and/or desire to enter long-term treatment, may influence the decision to purchase and use diverted methadone or buprenorphine. Longitudinal and repeated cross-sectional studies may help to increase our understanding of issues such as the uses to which diverted medications are put in periods of high and low potency and availability of illicit opiates, the transition – if any – from experimentation with illicit medications in the community to program entry, and changes – if any – in illicit medication preferences between methadone and buprenorphine.

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Table 1

Drug use history, treatment history, and past 30 day drug use for participants with lifetime use of street methadone v. those without lifetime use of street methadone

Variable	Total Sample (N = 515)	Users of Street Methadone (n = 84)	Non-Users of Street Methadone (n = 431)
<i>Lifetime</i>			
Mean years of use (SD):			
Heroin	13.0 (7.7)	11.9 (6.7)	13.2 (7.8)
Cocaine	9.1 (8.1)	8.8 (7.8)	9.2 (8.2)
Street methadone	0.9 (3.0)	5.5 (5.3)	-
Other opiates/analgesics	1.0 (3.7)	1.3 (3.9)	0.9 (3.7)
Mean age of first use (SD):			
Heroin	21.7 (6.5)	22.3 (6.1)	21.6 (6.6)
Cocaine	23.6 (8.0)	23.4 (7.0)	23.6 (8.2)
Street methadone	33.3 (9.2)	32.5 (8.6)	33.6 (9.4)
Other opiates/analgesics	27.2 (10.4)	27.4 (9.9)	27.1 (10.5)
No. who have had methadone treatment (%)	254 (49.3%)	52 (61.9%)	202 (46.9)
No. who have had buprenorphine treatment (%)	71 (13.8%)	13 (15.5%)	58 (13.5%)
No. who have ever injected any drug (%)	316 (61.4%)	49 (58.3%)	267 (62.0%)
<i>Past 30 Days (adjusted for days in the community)</i>			
Mean days of use (SD):			
Heroin	27.8 (6.7)	23.6 (11.4)	28.6 (5.0)*
Cocaine	12.8 (12.6)	8.9 (10.8)	13.5 (12.8)*
Street methadone	2.1 (5.5)	7.8 (10.3)	1.0 (2.8)*
Other opiates/analgesics	0.9 (3.8)	1.9 (6.0)	1.7 (3.1)*

Note: Past 30-day items were adjusted for number of days spent in the community by dividing the number of days used by the number of days in the community and then multiplying by 30. *N*s are as follows: age of first use of heroin ($n = 514$), age of first use of cocaine ($n = 497$), age of first use of street methadone ($n = 325$), and age of first use of other opiates/analgesics ($n = 155$). Differences are due to 1 non-street methadone user who reported never having used heroin, 17 non-street methadone users and 1 street methadone user who reported never having used cocaine, 190 non-street methadone users who reported never having used street methadone, and 304 non-street methadone users and 56 street methadone users who reported never having used other opiates/analgesics.

* Significant difference between the Users and Non-Users of Street Methadone at $p < .01$