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The effect of methadone maintenance on positive outcomes for opiate injection drug users

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Abstract

This study examined outcome variables for 160 opiate injection drug users (IDUs) who entered methadone maintenance between baseline and 6 month follow-up. Outcome variables of interest included drug use, productivity and HIV risk behaviors. Participants were recruited through street outreach in Denver, Colorado from 2000 through 2004 using targeted sampling. The sample was primarily male, 48% White, averaged 39 years of age and had been injecting drugs for an average of nearly 20 years. Significant improvements were found in univariate tests. Logistic regression revealed that spending more time in treatment was a significant predictor of positive outcomes on drug use and HIV risk behaviors. The results underscore the importance of retaining IDUs in methadone maintenance in order to maximize their treatment success. Results from this study show that time in treatment can affect many aspects of the participant's life in a positive way, including reduction of HIV risk.

1. Introduction

Drug injection and injection of opiates (heroin) continue to be major problems in the United States. In 2006, according to the National Survey on Drug Use and Health (NSDUH), the number of current heroin users increased to 338,000, which is up from 136,000 in 2005, or a prevalence increase from .06% to 0.14% (SAMHSA 2007a). In 2006, 91,000 persons over the age of 12 reported using heroin for the first time, and the average age of first initiation for heroin use was about 21 years old (SAMHSA 2007a). This indicates that heroin use is still a problem and young people are starting use each day. Between 1995 and 2005, heroin treatment admissions increased nationwide by 12%. Of all reported treatment admissions in 2005, 21% were for opiate use, and 14% of that was for heroin, according to the Treatment Episode Data Set (TEDS; SAMHSA 2007b). The most common route of administration was injection (63%) and daily heroin use was reported by 75% of admissions (SAMHSA 2007b).

In addition to the ill health effects, social isolation, costs to society and other disadvantages of drug use, injection drug users (IDUs) are also at risk for contracting HIV and Hepatitis C (HCV) through risk behaviors such as needle-sharing and unprotected sex which often co-occur with injection drug use. Moreover, even today as we continue through the third decade of the HIV epidemic, injection drug use ranks as the second highest risk factor for contracting HIV, after homosexual contact among males (Centers for Disease Control and Prevention, 2007). Despite the success of prevention projects that raise awareness through outreach and intervention to drug users (Booth & Weibel, 1992; Watters, 1996), some marginalized groups continue to engage in risky injection and sex practices. Recent reports indicate that, among current cases

of HIV, injection drug use has contributed to transmission in 25% of cases among males and 26% among females (CDC 2007). Methadone maintenance therapy (MMT) has been successful in treating heroin dependence since its inception in 1965 (Dole and Nyswander; Dole et al., 1968; Ball and Ross, 1991; Ward et al., 1999; Glass, 1993), and more recent research has shown that MMT affects many aspect of the attendees life, including drug use, productivity, criminality and HIV risk behaviors (Millson et al 2007; Teesson et al 2006; Sheerin et al 2004; Simpson et al 1997). Methadone maintenance has been recommended by researchers and treatment providers as a modality that reduces needle-sharing and other risk behaviors, in addition to promoting drug use cessation (Gowing et al 2006; Brickner et al., 1989; Sorenson & Copeland, 2000). While reduction of sex risk behaviors has been harder to achieve, some studies of treatment participants have noticed a reduction in sex risk behavior (Sorensen and Copeland 2000). Although treatment programs do not always induce total abstinence from drug use, research has shown that contact with treatment such as MMT will likely lead the client to reduce their drug use (Corsi et al 2002; Kwiatkowski and Booth 2001; Sorenson & Copeland, 2000; Metzger et al., 1998; Booth et al., 1996), as wells as show improvements in other life areas, such as their health, employment status, personal relationships, and criminal behavior, among others (Teeson et al 2006; Kidorf et al., 1998; Farrell et al., 1994; Murray, 1998; Ball et al., 1981; Strain et al., 1991). By reducing drug use, drug users also reduce their risk of contracting blood-borne diseases, including HIV and hepatitis (Sorenson & Copeland, 2000; Metzger et al., 1998; Longshore et al., 1993; Comacho et al., 1997).

In the current study, we hypothesized that IDUs who entered treatment would show improvement on several outcomes, including drug use, productivity, criminal behavior and HIV risk behavior. Additionally, we were interested in discovering what factors might predict improvement on these outcomes for IDUs who entered MMT. The description of predictors of improved outcomes for treatment attendees is useful for substance abuse treatment providers and clinicians alike, as well as for researchers who seek effective strategies to improve health and life outcomes for drug users. These are important goals in light of the continuing dual problems of heroin use and HIV transmission.

2. Materials and Methods

From 2000 through 2004, 160 out-of-treatment opiate IDUs were recruited through street outreach in Denver, Colorado to participate in a study designed to facilitate entry into drug treatment and reduce injection-related HIV risk behaviors. Targeted sampling, using indicators such as drug-related arrests and drug treatment admissions among IDUs, were employed to estimate the number of drug users in each of the city's census tracts. Outreach workers recruited study participants and provided interventions. Eligibility criteria were: 1. self-reported opiate injection in the prior 30 days; 2. 18 years of age or older; 3. no self-reported substance abuse treatment during the previous 30 days; and 4. ability to provide informed consent. Eligibility was confirmed by urinalysis and inspection for evidence of recent venipuncture. Participants were compensated for their time as research subjects. Study procedures were approved by the Institutional Review Board of the University of Colorado School of Medicine and in accord with the Helsinki Declaration of 1975.

Trained interviewers administered the following instruments: the Risk Behavior Assessment (RBA) and the anti-social personality disorder (ASPD) measure from the Diagnostic Interview Schedule (DIS), Fourth Edition. The RBA was developed in the NIDA Cooperative Agreement Study as a measure to assess risk and behavior change in the follow-up version. Reliability and validity assessments of the RBA support its adequacy as a research tool for populations of drug users, including IDUs (Needle et al., 1995; Weatherby et al., 1994). Following the research interview, participants were offered free HIV, Hepatitis B and Hepatitis C (HCV) testing and counseling. Then they were randomly assigned to receive one of three interventions designed

to facilitate an interest in treatment and reduce HIV-related risk behaviors. A one-month period without any intervention was required prior to the six-month follow-up interview.

2.1 Interventions

The three interventions that were offered to participants were: risk reduction (RR), motivational interviewing (MI) and strengths-based case management (CM). RR and MI were the less intensive interventions of the three and were designed to facilitate more sweeping lifestyle changes (MI) or provided risk reduction education sessions (RR). The case management intervention was a community-oriented approach with an emphasis on client autonomy and skill development. Case managers met with clients to address the breadth of problems that clients had and focus on employing and increasing client strengths. Substance abuse treatment was addressed when the client was ready; typically after other basic needs, such as housing, were met.

2.2 Analysis

Interview data were entered, edited, and analyzed using SPSS and SAS. Outcomes representing five areas of concern were assessed at baseline and six-month follow-up (within a 5–9 month window after baseline). These five areas were: (1) drug use, which included having a positive UA for morphine and number of times injected heroin in the last 30 days; (2) productivity, including being employed and amount of legal income in the last 30 days; (3) criminal behavior, which included having any illegal income in the last 30 days; (4) needle risk behaviors in the last 30 days, which included using a syringe after someone else had used it and sharing paraphernalia (cooker, cotton filters, or rinse water); and (5) sex risk behaviors in the last 30 days, including having sex with multiple partners, having sex with an IDU partner, having sex with a partner who was a crack smoker, exchanging sex for drugs or money, and having vaginal or anal sex without using a condom.

Analyses first tested for significant change between baseline and follow-up. Paired t-tests were used to assess change for continuous variables (times injected heroin and legal income); McNemar's chi-square was used to test for change in the dichotomous variables. Outcome variables that had significant change from baseline to follow-up were then further analyzed to assess predictors of 6-month outcomes. Variables tested for their association with each of the outcomes included demographics (gender, race/ethnicity and age), treatment variables (prior treatment, number of days in treatment in the 6 months prior to the follow-up interview, and in treatment in the 30 days prior to the follow-up interview), and two intervention variables (number of counselor contacts and type of intervention – risk reduction, motivational interviewing, or contingency management). Univariate associations of each of the predictor variables with each 6-month outcome that had significant pre-post change were assessed using chi-square tests (when outcome and predictor were both dichotomous), t-tests (when one variable was dichotomous and the other continuous), and correlations (when both variables were continuous). For each outcome variable, predictors that had univariate associations with a *p*-value of less than 0.10 were entered into a regression analysis (logistic regression for dichotomous outcomes and least squares regression for continuous outcomes). Adjusted odds ratios (OR) and 95% confidence intervals (C.I.) are reported for the logistic regressions and the standardized beta weight is reported for the least squares regressions.

3. Results

The analysis sample consisted of 160 respondents who reported injecting opiates in the 30 days before the baseline interview and who tested positive for morphine, who were located and interviewed at the 6-month follow-up, and who entered MM treatment during the 6-month follow-up period. A total of 592 out-of-treatment opiate injectors were initially recruited. Of

these, 456 (77%) were located and interviewed at the 6-month follow-up. Those interviewed at follow-up, compared to those not interviewed, were more likely to be female (30% compared to 20%, $p = 0.025$), older (38 years of age versus 36 years, $p = 0.009$), less likely to be employed (33% compared to 43%, $p = .046$), and had been injecting longer (18 years compared to 15 years, $p = .005$). There were no significant differences on any of the other variables.

Of the 456 opiate injectors interviewed at follow-up, 167 (37%) entered MM treatment during the six months between the baseline and follow-up interview. Of these, 7 were dropped from the analyses because they spent more than 15 days in jail in the last 30 days and thus did not have sufficient time at risk to assess outcome (measured in the last 30 days).

Descriptive variables for the 160 study participants who were interviewed at follow-up are shown in Table 1. The sample was primarily male (66%), almost half were White (48%) with 20% Hispanic and 21% African American. They averaged 39 years of age and had been injecting for an average of 19 years. They averaged injecting 116 times in the 30 days prior to the baseline interview. A total of 83% had previous drug treatment experience.

Baseline levels for the twelve outcome variables are shown in Table 2. At baseline, all participants had a positive morphine urinalysis result and the sample averaged 98 heroin injections in the last month. Almost one-third were employed and they averaged legal income of \$277 per month; 42% had illegal income in the prior month. More than one-third of participants (36%) used a dirty needle in the last month and 61% used paraphernalia after someone else had used it. Just under 10% reported having sex with multiple partners in the last month. Almost half (46%) had sex with an IDU partner, 23% with a crack smoker and 19% exchanged sex for drugs or money. About half admitted having sex in the last month without using a condom.

Pre/post change figures on twelve outcome variables are also shown in Table 2. Significant positive and substantial changes were observed from baseline to follow-up for all variables except for legal income, having multiple sex partners, having sex with a crack smoker, and having sex without a condom. The percentage of participants with a positive morphine UA declined (from 100% to 76%), the average number of injections per month decreased by almost half (from 98 to 51), more participants were legally employed (48% at follow-up compared to 33% at baseline) and fewer had illegal income (42% at baseline and 23% at follow-up), fewer participants shared needles or paraphernalia (36% and 61% at baseline compared to 20% and 40% at follow-up), and fewer participants engaged in sex with IDU partners (35% compared to 46% at baseline) or exchanged sex for drugs or money 6% at follow-up compared to 19% at baseline).

Prediction models were developed for the eight outcome variables that demonstrated significant, positive change from baseline to follow-up. Independent variables (demographics, treatment, and intervention variables) were tested in univariate analyses (chi-square, t-tests, and correlations) with each of the eight outcome variables. Independent variables that had significant univariate associations ($p < 0.10$) with the outcome variables were then entered into either a logistic or least squares regression model to determine the most significant variables contributing to each of the outcomes. Results are shown in Table 3. Odds ratios, 95% confidence intervals and p -values are given for independent predictors for the logistic regressions; beta weights and p -values are given for the least squares regression (for times injected).

3.1 Drug Use

Predictor variables that were significantly associated with testing negative for morphine at follow-up included being White, having more days in treatment in the six months prior to

follow-up, being in treatment in the 30 days prior to follow-up, and having more significant counselor contacts. When these variables were entered into a logistic regression, more days in treatment was significantly associated with having a negative UA for morphine. Those who had a negative UA averaged 127 days in treatment compared to 60 days for those with a positive UA for morphine (OR = 1.02).

Injecting heroin fewer times in the last month was associated at the univariate level with more days in treatment in the last six months and being in treatment during the 30 days prior to the 6-month follow-up. More days in treatment in the last 6 months was significantly associated with fewer times injecting in the least squares regression, and being in treatment in the 30 days prior to the follow-up just failed to reach statistical significance ($p = 0.055$). Participants who were in treatment in the last 30 days injected an average of 37 times in the 30 days prior to follow-up and those not in treatment injected an average of 84 times in the prior 30 days. Participants who spent more days in treatment in the prior six months also injected fewer times in the past 30 days.

3.2 Productivity

Variables that were significantly associated with employment at follow-up included being employed at baseline, being male, White, and receiving the contingency management intervention. Of these, being employed at baseline was the only significant predictor in the logistic regression (OR = 4.60). Of those employed at follow-up, about half were employed at baseline; of those not employed at follow-up, only 17% were employed at baseline.

3.3 Criminal Behavior

Not reporting any illegal income at follow-up was significantly related to not having illegal income at baseline, being female, African American, older age, having more days in treatment in the last six months, but having fewer counselor contacts. In the logistic regression, not having illegal income at baseline (OR = 0.15) significantly associated with not having illegal income at follow-up. Of participants who had no illegal income at follow-up, 69% did not have illegal income at baseline; 23% of participants who had illegal income at follow-up did not have illegal income at baseline.

3.4 HIV Needle Risk Behaviors

Not using a syringe after someone else had used it at follow-up was significantly related to using dirty needles at baseline, being older, and having more days in treatment during the last six months. Of these, dirty needle use (OR = 0.17) and more days in treatment (OR = 1.01) were statistically significant in the logistic regression. Of participants who did not share needles at follow-up, 72% did not share needles at baseline compared to 32% of participants who did share needles at follow-up. Participants not sharing needles at follow-up were in treatment an average of 81 days in the past six months compared to 59 days for participants who shared needles in the 30 days prior to follow-up.

Not sharing paraphernalia at follow-up was significantly related to sharing at baseline, being White, not being Hispanic, and having more days in treatment in the past six months. Sharing needles at baseline and more days in treatment were significantly related to not sharing paraphernalia in the logistic regression. Of participants who did not share paraphernalia at follow-up, 54% did not share at baseline compared to 16% who shared at follow-up (OR = 0.10). Those who did not share paraphernalia at follow-up averaged 86 days in treatment in the past six months compared to an average of 65 days in treatment for those who did share paraphernalia at follow-up.

3.5 HIV Sex Risk Behaviors

Two sex risk variables had significant reductions from baseline to follow-up. Not having sex with an IDU partner at follow-up was associated with not having sex with an IDU at baseline, being male, and being older. Of these, only the baseline measure of having sex with an IDU ($OR = 0.06$) was significantly associated with not having sex with an IDU at follow-up in the logistic regression. Of participants who did not have sex with an IDU at follow-up, 76% did not have sex with an IDU at baseline; 14% who had sex with an IDU at follow-up did not have sex with an IDU at baseline.

Not exchanging sex for drugs or money at follow-up was associated with not exchanging sex for drugs or money at baseline and with being male. However, in the logistic regression, only the baseline measure was statistically significant ($OR = 0.03$). Of participants who did not exchange sex for drugs or money at follow-up, 85% did not exchange sex for drugs or money at baseline; of participants who did exchange sex for drugs or money at follow-up, only 11% did not do so at baseline.

4. Discussion

The results of this study further emphasize the need for opiate injectors to remain in methadone maintenance treatment in order to assist in reducing risk and improving life outcomes. As prior research and this study have shown, participants in MMT do reduce their drug use and risk behavior (Millson et al 2007; Teesson et al 2006; Corsi et al 2002). Sharing needles and paraphernalia are high risk behaviors that IDUs engage in that may transmit not only HIV but also HCV, which is more virulent than HIV and therefore more transmissible with even just one sharing episode. The fact that HIV risk behavior declined for MMT participants is encouraging and has not been shown widely in other research. This should induce public health officials to adapt MMT as one more strategy for improving outcomes for IDUs and reducing HIV transmission. Additionally, the finding that more time in treatment reduces HIV risk behavior is novel and provides a rationale for focusing on retention in treatment to affect not only drug use outcomes but also public health risk outcomes as well. We also show that for MMT participants in this study, we see improved productivity and less illegal income, which may indicate reduced criminality. Again, this indicates the importance of IDUs in gaining treatment which can improve many aspects of their lives, including disease risk. Street-recruited, out-of-treatment opiate users, such as the ones in this study, have been less well-studied and are also more difficult to reach and induce behavior change, thus making this study remarkable in its outcomes among this hard to reach population.

This research supports the idea that the more time that an opiate IDU spends in treatment will yield better overall results. For example, the results here indicate that spending more days in treatment in the last 6 months prior to the interview predicts no drug use, less injection, no dirty needle use and not sharing paraphernalia. These behaviors are interrelated in that if one is not using drugs, then there will be fewer risk episodes. This study also indicates that just being in treatment, regardless of how long, at the time of follow up can predict less drug use as measured by times injected heroin. Another interesting result was that Hispanics were more likely than other race/ethnic groups to share paraphernalia at follow-up. Over half of Hispanics (56%) shared paraphernalia at follow-up compared to 32% of Whites and 43% of African Americans. This result should be further examined and may indicate the need for a specialized intervention for different communities that target specific risks that are being taken.

There are limitations to this study. The use of self-report on drug use behaviors may reduce reliability, however the use of an audio-computer assisted interview (audio-CASI) reduces that bias by providing privacy to the respondent. Research has shown that the audio-CASI improves reliability in other studies among IDUs. The use of self-administered interviews has been found

to minimize social desirability and encourage more accurate reporting of HIV risk behaviors (Newman et al., 2002; Perlis et al., 2004). Research, and our own experience with ACASI, has also shown that drug users are comfortable using computers for interviewing and possess the requisite skills to complete the interview with a touch screen and audio enhancement (Mills et al., 1996, Des Jarlais et al., 1999). An additional limitation is that all of the respondents were recruited from a single metropolitan area, which may limit generalizability.

We are still battling the dual epidemics of drug use and HIV in this country, thus research on how to improve people's lives is essential. In this study, we showed that MMT is an important tool for researchers and public health professionals to reduce HIV risk and finding ways to improve the livelihood of those with an opiate addiction. This finding has not been widely studied in prior research and underscores the importance of MMT for many improved outcomes. This study may also indicate a special need in the Hispanic population for reducing risk through sharing of paraphernalia, which may be unique to that population due to lack of education or support or other infrastructure. Additionally, while MMT has been shown in prior research to be effective for reducing drug use, there is still a resistance to entering MMT among opiate users. This means that continued research in this area may lead to increased funding for programs that can engage people in treatment and keep them there which will then lower their HIV risk behaviors as well. In order to continue to reduce risk and disease transmission, as well as improve the overall quality of life for IDUs, we must continue to emphasize the effectiveness of MMT and other programs and find innovative ways to get these individuals linked up with them.

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Table 1

Baseline Descriptive Variables (N=160)

Baseline Descriptive Variable	% or mean (SD)
Male gender (%)	65.6
Ethnicity (%)	
White	47.8
Hispanic	20.1
African American	21.4
Native American	5.0
Other	5.7
Mean age	39.2 (11.2)
Mean times injected drugs in prior month	116.2 (102.0)
Mean number of years injecting	19.2 (12.0)
Ever been in drug treatment before (%)	83.1

Table 2
Changes in Outcome Variables between Baseline and Follow-up Interviews

Variables (current or past month)	Baseline	Follow-up	P-value
Drug Use			
Morphine UA (%)	100.0	76.3	n/a **
Times injected heroin *	98.3 (70.7)	51.2 (60.3)	<.001
Productivity			
Employed (%)	32.5	47.5	<.001
Legal income *	277.2 (516.0)	405.7 (709.5)	.156
Criminal Behavior			
Illegal income (%)	41.5	23.0	<.001
Needle risk behaviors			
Used dirty needles (%)	36.0	20.3	<.001
Shared paraphernalia (%)	61.3	40.0	<.001
Sex risk behaviors			
Multiple partners	9.5	6.3	.251
Sex with IDU	45.6	35.4	.005
Sex with crack smoker	22.6	17.6	.088
Sex for drugs or money	19.4	5.6	<.001
Sex without a condom	49.1	41.5	.077

* Log transformation used in analyses because of high standard deviations

** Statistical test could not be conducted because baseline measure had no variance.

Table 3
Multivariate Models of Associations with Positive Outcomes

Outcome Variables	OR or β Weight	95% C.I.	p-value
Negative Morphine UA			
White	OR=2.15	0.87–5.29	0.098
More days in treatment (last 6 months)	OR=1.02	1.01–1.03	<0.001
In treatment in month prior to follow-up	OR=2.92	0.58–14.63	0.194
More significant counselor contacts	OR=0.91	0.82–1.01	0.073
Decreased # times injected heroin *			
More days in treatment (last 6 months)	β =0.48		<0.001
In treatment in month prior to follow-up	β =0.14		0.055
Employed at follow-up			
Employed at baseline	OR=4.60	2.17–9.74	<0.001
Female	OR=0.50	0.24–1.05	0.068
White	OR=1.62	0.82–3.23	0.168
Contingency management intervention	OR=1.89	0.94–3.78	0.073
No Illegal Income at follow-up			
Illegal income at baseline	OR=0.15	0.06–0.37	<0.001
Female	OR=2.27	0.81–6.34	0.117
African American	OR=3.31	0.73–15.03	0.121
Age	OR=1.01	0.97–1.06	0.571
More days in treatment (last 6 months)	OR=1.01	1.00–1.02	0.062
More significant counselor contacts	OR=0.94	0.88–1.01	0.075
No Dirty Needle use at follow-up			
Dirty needle use at baseline	OR=0.17	0.07–0.40	<0.001
Age	OR=1.03	0.99–1.07	0.211
More days in treatment (last 6 months)	OR=1.01	1.00–1.02	0.023
No Sharing Paraphernalia at follow-up			
Sharing paraphernalia at baseline	OR=0.10	0.04–0.26	<0.001
White	OR=2.15	0.89–5.19	0.090
Hispanic	OR=0.57	0.20–1.63	0.296
More days in treatment (last 6 months)	OR=1.01	1.00–1.01	0.017
No sex with IDU			
Sex with IDU at baseline	OR=0.06	0.03–0.15	<0.001
Female	OR=0.61	0.26–1.42	0.249
Age	OR=1.02	0.98–1.06	0.391
No Sex for drugs or money			
Sex for drugs or money at baseline	OR=0.03	0.00–0.28	0.002
Female	OR=0.34	0.06–1.93	0.221

* Based on least squares regression. Beta weights above 0 indicate positive relationship.