Published in final edited form as:

Eval Rev. 2008 February ; 32(1): 83–112. doi:10.1177/0193841X07307411.

Longitudinal HIV Risk Behavior among the Drug Abuse Treatment Outcome Studies (DATOS) Adult Sample

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Abstract

Longitudinal trajectories for HIV risk were examined over five years following treatment among 1,393 patients who participated in the nationwide Drug Abuse Treatment Outcome studies (DATOS). Both injection drug use and sexual risk behavior declined over time, with most of the decline occurring between intake and the first year follow-up. However, results of the application of growth mixture models for both sets of trajectories indicated a subgroup of individuals reverted to a high-risk behavior over time, with a higher level of risk at the 5-year follow-up than their original risk level at intake. Of clients who were engaged in regular injection drug use at intake, 76% continued to inject drug at a Moderate/stable or Increased rate over the 5-year follow-up.

Keywords

HIV; Risk Behavior; Injection Drug Use; Sexual Risk Behavior

In the U.S., the majority of individuals infected with HIV contracted the virus by engaging in either sexual behavior or drug use. Among drug injectors, failing to utilize hygienic needle use behaviors (such as cleaning with bleach before reuse and not sharing cookers or needles) is associated with HIV infection (Dasgupta et al. 1995; Neaigus et al. 1994). In addition, use of alcohol or drugs before sex is significantly related to unprotected sex (Hou and Basen-Engquist 1997), leaving substance abusers at high risk for HIV infection. Longitudinal studies of HIV risk behaviors can contribute to a better understanding of change or continuity over time and identification of contributing factors. Such knowledge may have implications for developing improved intervention strategies. Taking advantage of the nationwide Drug Abuse Treatment Outcome studies (DATOS), we examine trajectories over five years following treatment among a large sample of drug-abusing patients, focusing on their injection and sexual risks—the two major HIV risk behaviors among this population. We are particularly interested in identifying distinctive patterns of risk trajectories so that timing and/or individuals at greater risk can be targeted for intervention. Below we provide a brief literature review to provide the relevant context of our study.

Drug Treatment and Injection Drug Use

As far back as the early years of the HIV epidemic, injection drug users (IDUs) were identified as a group at risk for HIV infection through the sharing of needles and other drug paraphernalia (Marmor et al. 1984). Approximately 300,000 IDUs in the U.S. have been diagnosed with acquired immunodeficiency syndrome since 1980 (Centers for Disease Control and Prevention 2003). While treatment is not typically considered prevention, it has been proposed that the close association between injection drug use and HIV transmission suggests that drug treatment can be considered primary HIV prevention (e.g., Metzger, Navaline, and Woody 1998). In the past 20 years, several studies have documented significantly lower rates of drug use, drug-related risk behaviors, and HIV infections among drug users who remain in treatment programs (Metzger and Navaline 2003; Metzger et al. 1998). For example, early studies indicated that treated drug injectors reduced their drug injection behaviors following treatment, compared to untreated injection drug users (Ball et al. 1988). In a large study of out-of-drug-treatment users of injection drugs and/or crack ($N = 8,241$), entry into drug treatment corresponded to greater reductions in drug use frequency and high-risk injection practices compared to those who did not enter treatment (Hoffman et al. 1998). Specifically, treatment was associated with a decreased number of injections among heroin users, and a reduction in reuse of cookers, cottons, and/or rinse water, and decreases in needle sharing. Sharing needles has also been found to decrease among IDUs following drug treatment in other studies (e.g., Klee et al. 1991). More time in treatment has been associated with greater reductions in injection risk behaviors (Woods et al. 1999).

As has been noted in previous studies, drug use behaviors are more amenable to change than are sexual behaviors (Baker et al. 1993). Thus, the findings for drug treatment effects on sexual risk behaviors are not as definitive as findings for drug treatment effects on injection risk behaviors.

Drug Treatment and High-risk Sexual Behavior

A number of studies have investigated whether individuals who have attended a drug abuse treatment program lower their HIV risk behavior, but as noted above, results are far more disparate than investigations of drug treatment on injection drug use behaviors. For example, a number of studies investigating single treatment episodes have found that drug users in treatment typically report fewer sex partners and more condom use than drug users not in treatment (e.g., Camacho et al. 1996; Gossop et al. 2002; Watkins et al. 1992) and Shoptaw et al. (1988) found safer sex practices were more common among cocaine users who had completed a treatment episode compared to drop-outs. Among DATOS clients, short-term reduction (from intake to 3 or 6 months post treatment) of sex and needle-risk behaviors were found for individuals treated in outpatient methadone treatment and outpatient drug-free settings (Broome, Joe, and Simpson 1999). On the other hand, Latka et al. (2005) found that while women in drug treatment were less likely to become sexually active, except for those involved in three or more programs, drug treatment did not impact the consistent use of condoms among sexually active women. Hoffman et al. (1998) found that entry into drug treatment was associated with reduction in risky sexual behavior, but the reductions were less substantial and less consistent than those noted for drug use and injection risk behaviors. Furthermore, among IDUs involved in an outreach intervention on risk reduction, no relationship was found between treatment status and frequency of unprotected sex (Neaigus et al. 1990). Finally, three other studies found that drug treatment duration was unrelated to number of sex partners or condom use (Abdul-Quader et al. 1988; Schilling et al. 1991; Watkins et al. 1992). It should also be noted that only a limited number of interventions specifically focused on HIV prevention have been found to be effective in changing sexual risk behavior among drug users (van Empelen et al. 2003).

Longitudinal Patterns of HIV Risk over Time Among Treated Substance Abusers

While numerous studies have now investigated whether drug treatment in and of itself reduces HIV risk behaviors (i.e., injection drug use and sexual risk acts), there has been much less investigation of the longitudinal patterns of HIV risk behavior of patients who have been in drug treatment, and the characteristics associated with these patterns. The Drug Abuse Treatment Outcome Studies (DATOS), a prospective treatment outcome study sponsored by the National Institute on Drug Abuse (NIDA), provided the opportunity to assess the 5-year outcomes of HIV risk (injection drug use and sexual behavior) among a large sample of adults. Previous HIV risk related analysis of the DATOS data were conducted focused on: the relationship between lifetime treatment exposure and risky sex by drug users during the year before intake into DATOS (Longshore and Hsieh 1998), in which users with more lifetime treatment exposure had lower scores for risky sex; and on the effects of outpatient methadone treatment and outpatient drug free treatment on HIV risk behaviors (Broome et al. 1999). Broome et al. investigated client and treatment program characteristics as predictors of risk. Cocaine dependent users were found to reduce risky behaviors significantly from baseline to the third and sixth month of treatment, but antisocial clients did so only in outpatient methadone treatment (as opposed to outpatient drug-free modalities).

In the present study, the goal was to examine longitudinal trajectories over five years following treatment among patients who participated in DATOS, and the associated baseline characteristics and statuses at the five year follow-up (e.g., Hser et al. 2006). First, the trajectories of HIV risk behavior for injection drug use and for sexual risk behavior among the DATOS adult sample across intake, one-, and five-year follow-ups were examined. We applied growth mixture models to identify distinctive patterns of trajectories. Then the baseline characteristics and follow-up statuses associated with the different risk trajectories were determined, including: demographics, drug use, involvement in HIV risk reduction program, criminal justice contact, and mental health problems and treatment.

Method

Sample

The Drug Abuse Treatment Outcome Studies (DATOS) treatment population originally included a total of 10,010 patients admitted to 96 drug treatment programs from 1991 to 1993 in 11 cities in the United States. These programs were sampled purposively in an attempt to assure representative and naturalistic sources of data. (See Flynn et al. 1997 for a detailed description of the DATOS research design, and Simpson et al. 1999 and Etheridge et al. 1997 for descriptions of the type of treatment delivered to patients within each modality.) DATOS was the first national treatment study since the HIV/AIDS epidemic and collected information on HIV risk and other health issues (Hubbard et al. 2003).

A stratified sampling plan was used to select 4,229 of the original sample of 10,010 for a follow-up interview at 12 months after discharge. Altogether, 3,147 (74.4%) were located; 2,966 (70.1%) were interviewed, 64 (1.5%) had died, and 117 (2.8%) refused to be interviewed. To enable examination of the stability of outcomes and the relationship of 1-year and 5-year outcomes, the 5-year follow-up targeted the 2,966 patients who had completed the 1-year follow-up. Cases were excluded for both scientific and cost reasons: 619 cases in three cities were not followed due to small samples and the high cost of field work; 200 cases for whom there was no locator information were dropped; and 106 others who were institutionalized or out of the interview area were excluded. The remaining 2,041 patients from programs in eight cities (Chicago, Miami, Minneapolis, Newark, New York, Phoenix, Pittsburgh, and Portland)

formed the eligible sample of whom 1,618 were located (79%); 1,393 were interviewed (68%); 128 died (7%); and 65 refused (3%). Thus, of the patients targeted for 5-year follow-up data collection, 73% were interviewed.

To address the potential effects of bias due to attrition from follow up, Hubbard et al. (1997) compared respondents who were interviewed at 12-month follow-up with the complete sampling frame on eight key characteristics, including age, gender, ethnicity and previous treatment experience. No differences of greater than 5% were observed. Similar analyses were conducted at 5-year follow-up, indicating that no overall or systematic differences were observed between interviewed respondents and study participants who were not interviewed (Hubbard et al. 2003).

All participants provided informed consent; study procedures followed standard ethical guidelines for the participation of human subjects. At admission patients participated in a two-part intake interview, with sessions occurring approximately one week apart. The intake interviews were conducted between 1991 to 1993, and addressed sociodemographics, substance use history, illegal involvement, mental health, health, and sexual activities. Standard clinical instruments were used, such as the Diagnostic Interview Schedule (Robins et al. 1981), Composite International Diagnostic Interview, (Robins, Wing, and Helzer 1983), and the Symptom Checklist 90 (Derogatis, Lipman, and Covi 1973). Interviews required an average of 90 minutes to complete and were administered by research staff. Subjects were paid \$10 for each intake interview. Follow-up interviews were conducted at approximately one- and five-years following discharge from the DATOS treatment episode or date of last contact with program. These interviews averaged two hours to complete and patients were compensated \$15 for their time. Interview content focused primarily on drug use and other behaviors during the 1- and 5-year post-treatment periods. At the 5-year follow-up, each person interviewed was asked to provide a urine and hair specimen for drug testing. An additional compensation of \$10 was provided for those samples.

Measures

Study measures used in DATOS included standardized instruments, and items and modules drawn from other instruments that had been used in previous research (described in Hubbard et al. 2003; Broome et al. 1999; and Flynn et al. 1997). The present study examined multiple measures at intake, one-year follow-up, and five-year follow-up of injection and sexual risk behaviors associated with HIV risk, sociodemographic characteristics, substance use, mental health status, criminal behavior, treatment for substance use and mental health problems, and HIV-related services. The analysis included the intake period (predictors) and the 5-year outcomes. The following self-reported measures were used in this study.

Injection risk in the past 12 months

Injection risk was assessed using a computed scale with higher scores indicating greater risk: specifically, 0 indicated no injection drug use; 1 indicated injection drug use without using a needle, syringe or “works” that had been previously used by someone else; 2 indicated use of needles that had been used previously, although not by persons considered at elevated risk for HIV infection (i.e., a stranger/person you have not know very long; a prostitute, a person known or suspected of being HIV+ and/or a man known or suspected of being homosexual or bisexual); and 3 indicated use of needles that had been used previously by persons considered at elevated risk for HIV infection. While the scale is ordinal, it was treated in this exploratory analysis as interval-level rather than categorical because of empirical estimation limitations with categorical models (see Analysis section).

Sexual risk behaviors in the past 12 months

Similarly, sexual risk behaviors were examined as a four-level variable, with higher scores equaling higher risk. No sexual activity or always using a condom was scored as zero; sexual activity with one partner and not always using a condom was scored as a 1; sexual activity with multiple partners and occasional condom use was scored as a 2; and sexual activity with multiple partners and no condom use was scored as a 3.

Sociodemographic/background variables

Variables examined at DATOS treatment intake included gender, race age, marital status, education, and employment. At five-year follow up, marital status, employment, and whether female respondents were pregnant in the past 12 months were examined.

Substance use in the past 12 months

These measures included: primary drug used, number of drugs used weekly, and frequency of drug use (i.e., monthly, weekly, daily) at treatment intake. Heavy alcohol use (defined as having five or more drinks at one sitting) was examined at treatment intake and five-year follow up. Frequency (i.e., monthly, weekly, daily) of marijuana, cocaine, heroin or other drug use (e.g., amphetamines, sedatives, hallucinogens) was examined at five-year follow up.

Mental health status

Separate dichotomous variables examined whether respondents reported experiencing significant symptoms of depression or anxiety for periods of two weeks or more, or were prescribed medication for mental health problems in the past 12 months at the 5-year follow-up. Whether suicidal thoughts or attempts were reported in the period between the end of the DATOS treatment and the 5-year follow up interview was also examined.

Legal status

Any arrests and drug-related arrests in the past 12 months at five-year follow up were examined, as were the number of days incarcerated during the period between the end of the DATOS treatment and the 5-year follow up interview.

Drug and alcohol treatment

At DATOS treatment intake, type of treatment, age at first drug treatment, and number of prior drug treatment episodes were examined. Measures of whether respondents reported receiving outpatient or inpatient/residential alcohol or drug treatment during the period between the end of the DATOS treatment and the 5-year follow up interview were examined.

HIV/AIDS-related services

Whether any treatment services related to HIV infection, AIDS, or risk reduction were received in the past 12 months at the five-year follow up, and specific services targeted at reducing risk of needle use, sexual transmission and increasing general knowledge related to HIV were examined.

Analysis

Analyses examined longitudinal patterns of needle injection risk and sexual behavior risk over five years after DATOS treatment enrollment and then compared subjects' characteristics (e.g., demographics, drug use, treatment, criminal activities, and HIV-related services) among subgroups with different longitudinal patterns. First, the longitudinal data (3 observations over time) were analyzed using growth mixture modeling (Muthen 2004; Muthen and Muthen 2000; Muthen and Shedden 1999; Nagin 1999, 2005). These models, estimated using Mplus

6.0, identify latent classes represented by different growth or change trajectories over time (e.g., intercepts and slopes), while allowing individual differences in growth trajectories both between and within latent classes (Muthen and Muthen 2004). Results allow subjects to be partitioned into latent classes determined by differences in their trajectory patterns. Analyses were conducted separately for needle injection risk and sexual behavior; in each analysis, three observations of the risk behaviors over the five-year period were included. Because of the limited number of observations over time available for pattern identification, the complexity of the model to be estimated was limited. Preliminary analyses explored estimation assuming an ordinal logistic model, as well as inclusion of quadratic trend parameters to more accurately reflect observed patterns over time. Reliable estimation could not be achieved, even after imposing many additional constraints (which served to simplify models, but for which there was little empirical support). Thus, we proceeded using a simple and easily interpretable linear normal model. This model captures the general trends in risk behaviors from baseline to 5-year follow-up even if it cannot estimate fluctuations (curvature) in these trends over time. Specific estimated models included intercept and slope, as well as their error variances and covariances, as random effects. Goodness of model fit was evaluated by Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and sample-size-adjusted BIC.

The second part of analyses investigated differences among the estimated trajectory groups. Comparisons were made on subjects' characteristics at intake interview and outcome status from the five-year interview. Major outcome variables included employment, alcohol/drug use, treatment history, mental health status, criminal justice status, and HIV/AIDS services. Differences among the groups were tested using chi-square for categorical variables and ANOVA or multivariate analysis (SAS Proc GLM) for continuous variables. Sensitivity analyses considered whether controlling for DATOS treatment modality affected comparisons of groups on 5-year follow-up variables; since results were similar to original simpler analyses without such control, sensitivity analysis results are not presented.

Separate analyses were conducted for injection risk behavior and sexual risk behavior. While the two scales were slightly correlated ($r = .09$) at intake, they were not significantly correlated at 1- and 5-year follow-ups ($r = .04$ and $.05$), suggesting a non-redundancy of the two measures.

Results

The first section of the results describes the sample. Then results relating to trajectories are described first for injection risk behaviors, then for sexual risk. Within each of these sections, we describe the modeled trajectory groupings, then we describe how these trajectory groupings differ in terms of (intake) characteristics that might predict patterns over time and (outcome) characteristics at 5-year follow-up.

Sample Description

The sample used in this analysis includes all DATOS participants with data at treatment intake (baseline) and 1-year and 5-year follow-up interviews ($N = 1,393$). This sample was 63% male, 37% female; 46% Black, 9% Hispanic, 43% non-Hispanic White, and 2% other race/ethnicity. The average age was 34.0 years at intake. At intake, 33% were married or living as married; 23% were separated, divorced, or widowed; and 44% never married. Twenty-nine percent had less than a high school education; 42% a high school diploma; and 29% had some education past high school.

Table 1 shows average levels of risk behaviors across the three time points. At intake approximately 1/3 reported injection risk behavior, with most of the risk behavior including injection but not needle sharing. Sexual risk behaviors were substantially more prevalent, with nearly 3/4 reporting at least some sexual risk behavior preceding intake. Considering the sample

as a whole, both types of risk behavior declined over time, with most of that decline occurring between intake and the one-year follow-up.

Injection Drug Use Risk Trajectories

Trajectory Patterns—For needle injection risk, growth mixture modeling identified four trajectory groups: a group with consistently low risk (labeled “Low/stable,” 79.0% of the sample), one with risk remaining relatively stable over time at a moderately high level (“Moderate/stable,” 12.6%), one with high risk at intake but decreasing over time (“High/decreased,” 5.0%), and one generally in the high range with increases by the 5-year follow-up (“High/increased,” 3.4%). Average observed risk levels for clients in the trajectory groups appear in Figure 1. Technical details of estimation appear in Table 2. The four-group model was selected because of its optimal fit statistics with substantial improvement over 2- and 3-group models (BIC = 6,817, 4,345, and 4,005 for 2-, 3-, and 4-group models, respectively; other fit statistics followed a similar pattern), with trajectory groups maintaining reasonable size and interpretability (Nagin 2005). Note that a 5-group model showed very little improvement in fit over the selected 4-group model; and interpretation of a 5-group model was limited because of small group sizes and non-convergence of estimation. Trajectory groups differed significantly on observed injection risk score at each observation point (ANOVA group main effect significant at $p < .001$ for each time point).

Intake Characteristics—Client demographic characteristics at intake differed significantly across the trajectory groups in terms of race, age, marital status, and employment (see Table 3). The Low/stable trajectory group had the smallest proportion of Whites (38% compared to 56% – 71% for other trajectory groups), largest proportion of Blacks (50% compared to 21% – 34%), highest proportion of never married clients (47% compared to 34% – 38%), highest proportion working at intake interview (33% compared to 17% – 24%), and least likely to be involved in drug-related activity (e.g., selling drugs; 11% compared to 27% – 32%). The Moderate/stable group was on average the oldest at the intake interview (37 years compared to 33 – 35 years for other groups). The High/decreased and High/increased groups were similar to each other in their large (compared to other groups) percentages of Whites (71% and 69%) and of those working (18% and 17%). Specifically, the High/increased group was most likely to be married or living as married (48%). Trajectory groups did not differ significantly on gender composition or education.

Injection risk trajectory groups differed significantly on their reported drug use during the 12-months before the intake interview. As would be expected, the percentage reporting heroin use was high among the groups with moderate to high injection risk (63% – 73% compared with 25% for the Low/stable group) as was the percentage reporting daily use of primary drug (77% – 80% compared to 51% for the Low/stable group) and percentage reporting use of two or more drugs weekly (76% – 83% compared to 56% of Low/stable group). The Low/stable group was characterized by higher rates of cocaine use (45% compared to 15% – 21% for other trajectory groups). Heavy alcohol use was highest for the High/decreased group (38%).

The Low/stable group was least likely to have been sampled from outpatient methadone maintenance treatment (20% compared with 58% – 78% for other trajectory groups). This is consistent with their lower rates of primary heroin use and/or daily substance use. While there was no significant difference among trajectory groups in the age at first drug treatment, the Low/stable group had the lowest average number of prior drug treatment episodes (1.7), followed by the Moderate/stable and High/decreased at 3.7 and 3.8, respectively, and the High/increased at 8.3. There was no significant difference among trajectory groups on criminal justice status.

Five-year Follow-up Characteristics—The trajectory groups found to be most different from each other in many characteristics at intake, Low/stable and High/increased, maintained many of these differences on characteristics at the 5-year follow-up (see Table 4). In terms of demographics, the Low/stable group had the highest percentage of clients working (56%) while the High/increased group had the lowest (25%); however, there was not a significant difference in average income.

In terms of substance use in the 12 months preceding the 5-year follow-up, the High/decreased group had changed behavior since intake, becoming more similar to the Low/stable group than the other groups, with large percentages no longer using alcohol (42% and 48% for Low/stable and High/decreased, respectively), marijuana (68% and 75%), cocaine (70% and 80%), heroin (87% and 91%), or other drugs (93% in both groups). As reflected in the trajectory levels, the High/increased group had highest rates of substance use at the 5-year follow-up: 27% with heavy alcohol use, 25% with daily use of cocaine, and 54% with daily use of heroin.

Concordant with lower substance use, the Low/stable and High/decreased groups had the lowest rates of mental health and most criminal justice problems: depression in the preceding 12 months (43% and 48% for Low/stable and High/decreased, respectively, compared to 63% and 81% for Moderate/stable and High/increased), anxiety (15% and 22% compared to 28% and 42%), use of medication for mental health problems (18% and 28% compared to 30% and 48%), suicidal ideation (12% and 19% compared to 20% and 31%), arrests (15% in both groups compared to 33% and 35%), and drug-related arrests (7% and 9% compared to 15% and 21%). Note, however, that the High/decreased group also had the highest number of days incarcerated at 34 days. Concordant with higher substance abuse, the High/increased group had the highest rates for mental health and criminal justice problems. This group also had highest rates of residential (40%) and outpatient (31%) drug treatment during the period following DATOS treatment. This group also had the highest rate of receipt of HIV/AIDS-related services of any kind (60%) or services specifically related to needle-risk reduction (27%), sexual risk reduction (35%), or HIV knowledge (50%) in the 12 months preceding the 5-year follow-up interview.

The current study limited its examination of trajectory group differences primarily to selected predictors (beginning of observation period) and outcomes (end of five years), leaving to future studies the influence of the DATOS treatment episode and its characteristics and the myriad of events and behaviors during the full interim of the five-year trajectory period. However, as a basis for considering such future study, we examined trajectory group differences on short vs. long-term retention in DATOS treatment (90 days for long-term residential and outpatient drug-free, 21 days for short-term inpatient, and one year for methadone [Simpson et al. 1999]). The Low/stable group had the highest percentage (70%) who met the retention criteria, followed by the Moderate/stable (60%), High/decreased (58%), and High/increased (52%) (chi square = 14.26, df = 3, $p = .003$). A sensitivity analysis explored whether trajectory group differences in outcome measures were affected by controlling for DATOS treatment retention; inclusion of retention as a covariate did not substantially change results from those without such control (as shown in Table 4).

Sexual Risk Trajectories

Trajectory Patterns—For sexual behavior risk, three trajectory groups were identified, all with moderate to high risk levels at intake (see Figure 2): a group with decreased risk over time (“Decreased,” 34.7%), a stable group (“Stable,” 45.0%), and a group with increased risk by 5-year follow-up (“Increased,” 20.3%). Technical results from estimation are shown in Table 2. The three-group model was selected based on lowest fit value. For example, the BIC for two, three, and four groups were 10,398, 9,677, and 9,696, respectively; other fit criteria followed the same pattern. Trajectory groups differed significantly on sexual risk at each observation point (ANOVA group main effects $p < .001$ at each time).

There was not a significant redundancy between increasing patterns of injection and sexual risk behaviors. Less than 1% of the sample experienced an increasing pattern for both types of risk behaviors, not significantly different from expected values given the numbers with increased injection risk and with increased sexual risk (chi square = 0.29, df = 1). Within any of the injection risk trajectory groups, there was variability in sex risk trajectories; for example, of those with low/stable injection risk, 46% were in the average sex risk group, 35% showing decreasing sex risk, and 20% increasing sex risk (not statistically different from expected values).

Intake Characteristics—As can be seen in Table 5, the Increased group had the highest percentage of males (70% compared to 61% and 62% for the Decreased or Stable sexual risk trajectory groups), lowest percentage of Whites (36% compared to 42% and 48%) and highest percentage of Blacks (55% compared to 45% and 42%), and highest percentage of never married clients (51% compared to 49% and 37%). The Stable group had the highest percentage of clients married or living as married (39% compared to 27% for Decreased and 28% for Increased groups) or working (36% compared to 24% and 29%). Substance use during the 12 months prior to intake did not differ significantly among the sexual risk trajectory groups, nor did criminal justice status, or prior treatment characteristics.

Five-Year Follow-up Characteristics—Whereas the Stable group had the highest proportion of married or working clients at intake, this had shifted to the Decreased group by the 5-year follow-up, with 56% married/living as married compared to 17% and 22% for Stable and Increased groups, and 60% working compared to 40% or 53% (see Table 6). Average income did not differ significantly among trajectory groups. The Stable group had the lowest percentage pregnant in the 12 months preceding the 5-year follow-up (4% vs. 7% for the Increased and 13% for the Decreased groups).

The Increased sexual risk trajectory group had highest levels of heavy alcohol use (18% compared to 13% and 10%), as well as any use of alcohol (72% compared to 62% and 52%), marijuana (42% compared to 32% and 31%), cocaine (53% compared to 29% or 33%), and heroin (30% compared to 23% and 27%). For all drugs except heroin the Increased group also had slightly higher rates of daily use. The Increased group also had highest rates of most mental health problems and arrests: depression (54% for Increased compared to 45% for both Decreased and Stable groups), anxiety (23% compared to 16% and 17%), suicidal ideation (20% compared to 12% and 15%), and arrests in 12 months prior to the 5-year follow-up (25% compared to 16% and 17%). Note that drug related arrests did not differ significantly. The stable group had the highest percentage reporting prescribed medication for mental health problems (24% compared to 18% for Decreased and 22% for Increased).

The Increased trajectory group also had the highest percentages reporting additional residential alcohol treatment (16% compared to 7%), residential drug treatment (32% compared to 17% and 16%), or outpatient drug treatment since DATOS treatment (19% compared to 13% and 12%). This group also had the highest percentages reporting receipt of any HIV/AIDS-related services in the 12 months prior to the 5-year follow-up (38% compared to 24% and 31%); this pattern also held for specific risk reduction services.

The sex risk trajectory groups did not differ significantly on retention in the DATOS treatment episode (66% – 68% meeting the retention criteria; chi square = 0.28, df = 2, $p = 0.870$).

Discussion

Both types of risk behavior— injection drug use and sexual risk behavior--declined over time, with most of the decline occurring between intake and the first year follow-up. Thus, drug

treatment did appear to assist in reducing HIV risk for both of these behaviors in the first year following treatment. However, for both sets of trajectories, we see a subgroup of individuals who revert to a high-risk pattern of behavior over time. In fact, the high/increased group demonstrating a higher level of risk 5 years out than their original risk level at intake, and the moderate/stable group demonstrating approximately the same level of risk. Controlling for treatment retention did not affect the global findings at 5 year outcomes discussed here, although future studies could explore in depth treatment effects (and characteristics of treatment such as modality) on long-term outcomes at five years.

Injection Drug Use Trajectories

Approximately one-third of the sample (33%) reported injecting at intake, with only 5% reported injecting and sharing needles with other high-risk individuals. As would be expected, among the injection drug use risk trajectory patterns, the majority of the DATOS population ($n = 1,100$) fell into the low stable group for whom there was no or very little injection risk behavior at intake. This group also was most functional at intake in terms of other characteristics, such as being employed and less likely to be involved in drug related activity. It is the two other groups that are of most interest. The moderate stable and high increased groups, for the majority of them heroin was their primary drug, are the two groups in most need of continued treatment and/or more intense treatment. The most problematic group, the High/increased group, had the highest rates of substance use at the 5-year follow-up, and this subgroup also evidenced heavy alcohol use. In both the Moderate/stable and the High/increased subgroups, two other factors seemed to contribute highly by the five-year follow-up in this group to increased injection drug use risk by the 5-year follow-up: (1) mental health problems (including depression, anxiety, and medication for mental health problems); and (2) arrests. This is consistent with other long-term outcome findings. For example, among a cocaine-dependent sample, Hser et al. (2006) found that individuals achieving stable recovery reported fewer psychiatric symptoms, and less criminal involvement and unemployment.

Surprisingly, some subject characteristics that might be anticipated to be associated with continued injection drug use were not. No significant differences were found for legal/criminal justice status at either intake or at the 5-year follow-up. In addition, age at first drug treatment and education were not associated with injection risk group.

Though IDUs may understand the risk for HIV associated with injection practices, it has been shown that many continue to engage in high-risk injection drug use behaviors. In addition, a number of studies have found that many IDUs continue to engage in high-risk sexual behavior even after completing drug treatment programs and even after making changes to reduce injection risk behaviors (Bryan et al. 2000; Helal et al. 1995; Stephens et al. 1993). In a sample of injection drug users, Shah et al. (2006) found that of 936 who had ceased injection, three-quarters resumed injection drug use, with a median time to relapse of 1 year. This is very similar to the current study finding showing that of clients who were engaged in regular injection drug use at intake, 76% continued to use at a Moderate/stable or Increased rate at the 5-year follow-up.

For the subgroup of injection drug users who cannot stop injecting even after intensive drug treatment program attendance, using sterile needles and syringes remains the most effective approach for limiting HIV transmission, thus, IDUs need access to interventions and sterile injection equipment. Moreover, integrated treatment approaches that combine drug treatment and more general life-skills training may be needed. For example, life skill job training and community outreach for employment may be a key factor in assisting the moderate stable and high/increased subgroups, as higher employment was associated with less injection drug use.

Sexual Risk Behavior

The majority of the sample was engaged in some high-risk sexual behavior at intake. It should be noted that all of the three trajectory groups showed some decrease initially in high-risk sexual behavior following treatment (at the one-year follow-up). However, longitudinally, only approximately one-third of the sample (35%) maintained this initial decrease (the Decreased group). For that group, treatment may have had a longitudinal effect either directly or indirectly. However, for the majority of the sample, involvement in high-risk sexual behavior continued, either staying approximately constant (the Stable group) or escalating (the Increased group).

The Increased group is the population of most concern from public health and cost effectiveness perspectives. As might be expected, at treatment intake the Increased group had the highest percentage of never-married individuals. Three factors seemed to contribute the most to increased sexual risk by the five-year follow-up in this group: (1) higher levels of heavy alcohol use, as well as any use of alcohol, marijuana, cocaine, and heroin; (2) mental health problems; and (3) arrests. This group appears to be the most dysfunctional, from a psychosocial perspective, and therefore appears to be a very vulnerable population at risk for multiple problems, including sexual risk behavior that can lead to sexually transmitted infections. Moreover, and discouragingly, this group also had the highest percentage of individuals who had received more residential and outpatient drug treatment since intake, as well as more specific HIV/AIDS-related services in the year prior to the five-year follow-up, but these interventions did not result in behavior change by the 5-year follow-up. New treatment approaches may be needed for these recalcitrant subgroups, for whom standard drug treatment does not appear to be sufficient to assist them in reducing or abstaining from drug use, and possibly as a concurrent result does not result in decreased high-risk sexual behavior.

Study limitations and implications

The study findings need to be interpreted within the context of study limitations. First, we only have three data points, which limits our growth mixture modeling approach to simple linear models. Nevertheless, our modeling results were able to distinguish several groups of distinctive trajectory patterns. Second, this was a secondary analysis, and thus many variables (e.g., age at sexual initiation; # of lifetime partners; whether sexual coercion when subject was underage had ever occurred) that would have been of interest to study in terms of characteristics associated with trajectory patterns were not available in the data set. In addition, HIV prevention in the drug treatment program was not standardized, and detailed data on whether and exactly what HIV prevention messages might have been given in the varied drug treatment programs in DATOS is not available. Future analyses should reconsider the model formulation (e.g., ordinal logistic and/or to include quadratic or higher polynomial terms) as more detailed data on risk behaviors over time and/or higher risk prevalence samples become available.

Despite of these study limitations, our study findings have some important implications. In looking at patterns over time, there was not a significant redundancy between increasing injection and sexual risk behaviors. Thus, analyzing the trajectory patterns separately for these two behaviors is justified. These findings also suggest that it is important to provide longitudinal data and outcomes of both injection and sexual risks among these populations to assist in treatment plans for these individuals at greater risk for HIV infection. Such information is also needed for the development of drug treatment programs that can further incorporate HIV prevention intervention. Most importantly, this study has implications for new approaches to drug treatment and HIV prevention among the highest risk groups. The subgroups that maintain high-risk levels over 5-year periods, are those of highest public health concern, and indicate a need for a different approach to treatment. Further studies among those who were able to reduce their HIV risk behaviors in terms of timing, turning points, or critical events and

process that contribute to such changes can provide insight for developing improved intervention strategies for reducing HIV risk behaviors.

Acknowledgements

This research was supported by Grant #P30 DA016383 from the National Institute of Drug Abuse to the last author.

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Figure 1.
Trajectory of Needle Injection Risk

Figure 2.
Trajectory of Sexual Risk

Table 1

Injection and sexual risk behaviors in the past 12 months at each study time point (N = 1,393)

	Intake	Year 1 Follow-up	Year 5 Follow-up
Injection Risk Behavior	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Never injected	916 (66.6%)	1148 (82.4%)	1169 (83.9%)
Injected/did not share needles	265 (19.3%)	148 (10.6%)	176 (12.6%)
Injected/shared needles; did not share with high-risk persons ^a	120 (8.7%)	75 (5.4%)	30 (2.2%)
Injected/shared needles with high-risk persons ^a	74 (5.4%)	22 (1.6%)	18 (1.3%)
Sexual Risk Behavior	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
No sex/always use condom	356 (26.2%)	435 (32.0%)	473 (35.1%)
1 partner/occasional or no condom use	513 (37.8%)	642 (47.3%)	598 (44.4%)
2+ partners/occasional condom use	303 (22.3%)	194 (14.3%)	188 (14.0%)
2+ partners/no condom use	185 (13.6%)	87 (6.4%)	89 (6.6%)
Composite Indicators ^b	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Injection risk ^c	0.53 (0.86)	0.26 (0.62)	0.21 (0.53)
Sexual risk ^d	1.23 (0.99)	0.95 (0.85)	0.92 (0.87)

^a Stranger/person you have not known very long; a prostitute; a person suspected of being HIV+; a man who was homosexual or bisexual.

^b 0–4 scale (lower to higher risk); see text for scoring description.

^c Overall decline across three observations: slope = -0.04 , $p < .01$, from one-group linear growth model; simple paired t-test comparisons of baseline to Years 1 and 5 follow-ups were significant at $p < .001$, Year 1 to Year 5 follow-up $p = .002$ not significant $p = .517$ for sex risk

^d Overall decline across three observations: slope = -0.04 , $p < .01$, from one-group linear growth model; simple paired t-test comparisons of baseline to Years 1 and 5 follow-ups were significant at $p < .001$, Year 1 to Year 5 not significant $p = .517$.

Table 2
Linear Growth Mixture Models Estimation Results: Injection Risk (n = 1,393) and Sexual Risk (n = 1,390)

	Injection Risk			Sexual Risk		
	Low/ stable	Moderate/ stable	High/ decreased	High/ increased	Decreased	Stable
Means						
Intercept	0.13**	0.96**	1.95**	1.14**	0.95**	1.16**
Slope	-0.03**	0.01	-0.39**	0.25**	-0.17**	-0.03**
Variance						
Intercept		0.008			0.23**	
Slope		0.002			0.01	
Covariance						
Intercept slope		-0.002			-0.04**	
% of individuals in each						
class (estimated)			75.8	48.0	486.9	616.8
% of individuals in each			(5.4%)	(3.4%)	(35.0%)	(44.9%)
class (observed)			69	48	483	625
Goodness of fit			(5.0%)	(3.4%)	(34.7%)	(45.0%)
Log H ₀						
Akaike (AIC)		-1940.7			-4786.7	
Bayesian (BIC)		3915.5			9601.3	
Adjusted BIC		4004.5			9674.7	
Entropy		3950.5			9630.2	
		0.981			0.972	

* $p < .05$.

** $p < .01$

Table 3
Participant characteristics at intake interview by injection risk group (N = 1,393)

	Low/stable (N = 1,100)	Moderate/stable (N = 176)	High/decreased (N = 69)	High/increased (N = 48)
Sociodemographic/background characteristics				
Gender (%)				
Male	63.9	61.4	62.3	54.2
Female	36.1	38.6	37.7	45.8
Race (%) **				
White	38.4	56.3	71.0	68.8
Black	50.2	33.5	21.7	20.8
Hispanic	9.1	8.5	7.3	10.4
Other	2.4	1.7	0	0
Age, <i>M (SD)</i> **	33.4 (7.7)	37.1 (7.7)	35.1 (6.8)	33.8 (5.6)
Marital status (%) **				
Married/Living as married	31.7	35.4	33.3	47.9
Separated/divorced/widowed	21.7	30.9	30.4	14.6
Never married	46.7	33.7	36.2	37.5
Education (%)				
Less than high school	29.4	30.1	29.0	25.0
High school degree	40.2	44.9	44.9	58.3
Some college or more	30.5	25.0	26.1	16.7
Employment (%) **				
Working	33.2	23.5	18.4	17.0
Seeking	12.2	11.2	7.7	8.5
Homemaker/retired/disabled	16.5	22.4	20.0	17.0
Institutionalized	16.3	7.1	4.6	12.8
Income from drug-related activity	11.3	27.1	32.3	29.8
Other	10.6	8.8	16.9	14.9
Substance use past 12 months				
Heavy alcohol use (%) **	33.5	21.6	37.7	27.1
Primary drug (%) **				
Alcohol	13.0	1.2	4.4	6.3
Cocaine	45.0	17.9	14.5	20.8
Heroin/Narcotics	24.8	76.3	72.5	62.5
Marijuana	4.9	0.6	1.5	2.1
None	8.8	1.7	1.5	2.1
Other	3.5	2.3	5.8	6.3
Frequency of primary drug use (%) **				
No primary drug	8.8	1.7	1.5	2.1
No use	5.2	2.8	1.5	4.3
Monthly use	9.2	5.1	8.7	6.4
Weekly use	26.0	10.8	11.6	10.6
Daily use	50.8	79.6	76.8	76.6
Poly-substance use (number of drugs used weekly) (%) **				
0	14.4	3.4	4.4	8.3
1	29.7	20.5	13.0	10.4
2+	55.9	76.1	82.6	81.3
Number drugs used weekly, <i>M (SD)</i> **	1.7 (1.1)	2.4 (1.2)	2.4 (1.2)	2.3 (1.1)
Legal/Criminal Justice Status				
On probation, parole or case pending (%)	43.3	41.5	44.9	41.7
Drug Treatment				
Age at 1st drug treatment, <i>M (SD)</i>	27.6 (7.0)	28.1 (7.3)	27.2 (8.0)	24.7 (5.4)
Number of prior drug treatment episodes, <i>M (SD)</i> **	1.7 (2.8)	3.7 (4.2)	3.8 (5.4)	8.3 (13.4)
DATOS Treatment Modality **				
Long-term residential	26.8	10.2	14.5	16.7
Short-term inpatient	22.6	3.4	10.1	10.4
Outpatient methadone maintenance	20.2	77.9	65.2	58.3
Outpatient drug free	30.4	8.5	10.2	14.6

* $p < .05$.

** $p < .01$

Table 4
Status at year 5 follow-up by injection risk group (N=1,393)

	Low/stable (N = 1,100)	Moderate/stable (N = 176)	High/decreased (N = 69)	High/increased (N = 48)
Sociodemographic/background characteristics				
Marital status (%)				
Married/Living as married	36.4	29.6	31.9	35.4
Separated/divorced/widowed	26.1	33.5	34.8	31.3
Never married	37.5	36.9	33.3	33.3
Employment (%) **				
Working	56.4	30.7	43.5	25.0
Seeking	9.1	9.1	8.7	6.3
Homemaker/retired/disabled	23.1	38.1	30.4	31.3
Institutionalized	5.9	8.0	10.1	12.5
Income from drug-related activity	0.6	4.0	0	4.2
Other	5.0	10.2	7.3	20.8
Income, <i>M (SD)</i>	14,377 (23,971)	13,383 (24,614)	9,412 (11,631)	12,632 (19,290)
Pregnant in past 12 months (%)	9.2 (N = 392)	7.4 (N = 68)	4.0 (N = 25)	4.4 (N = 23)
Substance Use in the past 12 months (%)				
Heavy alcohol use *	12.5	12.5	15.9	27.1
Alcohol use **				
No use	42.4	22.7	47.8	20.8
Monthly use	28.6	41.5	29.0	43.7
Weekly use	21.8	26.1	13.0	18.8
Daily	7.3	9.7	10.1	16.7
Marijuana use **				
No use	68.4	54.6	75.4	47.9
Monthly use	16.5	25.0	13.0	35.4
Weekly use	9.1	11.9	5.8	12.5
Daily	6.1	8.5	5.8	4.2
Cocaine use **				
No use	70.0	34.7	79.7	22.9
Monthly use	12.6	27.8	13.0	35.4
Weekly use	10.0	20.5	2.9	16.7
Daily	7.4	17.1	4.4	25.0
Heroin use **				
No use	86.5	8.0	91.3	12.5
Monthly use	6.1	32.4	5.8	18.7
Weekly use	2.8	19.9	2.9	14.6
Daily	4.6	39.8	0	54.2
Other drug use **				
No use	92.5	76.1	92.7	50.0
Monthly use	4.6	13.1	7.3	27.1
Weekly use	0.8	5.7	0	10.4
Daily	2.1	5.1	0	12.5
Mental health status (%)				
Depression in past 12 months **	42.5	63.1	47.8	81.3
Anxiety in past 12 months **	15.0	27.8	21.7	41.7
Prescribed medication for mental health problem in past 12 months **	18.1	30.1	28.3	47.8
Suicide thoughts/attempts since last interview **	12.4	19.9	18.8	31.3
Legal/criminal justice status				
Arrest in past 12 months (%) **	15.4	32.9	14.5	35.4
Arrest in past 12 months, <i>M (SD)</i> **	0.3 (1.9)	0.6 (1.2)	0.2 (0.6)	1.3 (3.0)
Drug related arrest in past 12 months (%) **	6.6	15.3	8.7	20.8
Drug related arrest in past 12 months, <i>M (SD)</i> **	0.1 (0.4)	0.3 (0.7)	0.1 (0.5)	0.5 (1.4)
Days incarcerated after DATOS treatment, <i>M (SD)</i>	20.0 (64.4)	21.3 (60.4)	33.7 (68.6)	27.1 (49.3)
Received treatment after DATOS treatment (%)				
Residential/inpatient alcohol treatment	9.1	7.4	10.1	10.4
Outpatient alcohol treatment	6.7	4.6	8.7	14.6
Residential/inpatient drug treatment **	18.8	21.1	17.4	39.6
Outpatient drug treatment **	12.1	14.3	21.7	31.3
Methadone treatment **	7.8	40.6	23.2	47.9
Received HIV/AIDS-related services in past 12 months (%)				
Any services **	24.3	46.0	43.5	60.4
Services related to reducing risk of needle use **	7.2	22.2	24.6	27.1
Services related to reducing risk of sexual transmission **	10.6	21.6	26.1	35.4

	Low/stable (N = 1,100)	Moderate/stable (N = 176)	High/decreased (N = 69)	High/increased (N = 48)
Services related to general knowledge of HIV infection ^{**}	20.9	38.6	39.1	50.0

*
 $p < .05$.

**
 $p < .01$

Table 5
Participant characteristics at intake interview by sexual risk group (N = 1,390)

	Decreased (N = 483)	Stable (N = 625)	Increased (N = 282)
Sociodemographic/background characteristics			
Gender (%) [*]			
Male	60.5	62.2	69.9
Female	39.5	37.8	30.1
Race (%) ^{**}			
White	41.6	47.8	35.8
Black	45.3	41.6	55.3
Hispanic	11.2	8.6	6.0
Other	1.9	1.9	2.8
Age, <i>M (SD)</i> ^{**}	34.8 (8.1)	33.9 (7.5)	32.8 (7.4)
Marital status (%) ^{**}			
Married/Living as married	27.2	39.2	28.0
Separated/divorced/widowed	23.5	23.8	20.6
Never married	49.3	37.0	51.4
Education (%)			
Less than high school	29.8	29.0	29.1
High school degree	40.6	42.2	42.2
Some college or more	29.6	28.8	28.7
Employment (%) ^{**}			
Working	24.0	36.4	29.4
Seeking	12.4	10.0	14.3
Homemaker/retired/disabled	20.3	17.4	12.1
Institutionalized	16.1	12.3	16.5
Income from drug-related activity	15.9	13.3	17.3
Other	11.4	10.5	10.3
Substance use past 12 months/drug treatment			
Heavy alcohol use (%)	29.0	32.3	36.2
Primary drug (%)			
Alcohol	9.4	10.7	13.1
Cocaine	37.7	38.9	42.6
Heroin/Narcotics	37.3	35.6	30.6
Marijuana	3.8	4.6	3.6
None	8.3	6.3	7.3
Other	3.4	3.9	2.9
Frequency of primary drug use (%)			
No primary drug	8.3	6.3	7.2
No use	5.8	4.9	4.3
Monthly use	10.7	8.7	8.2
Weekly use	21.1	27.3	24.1
Daily use	62.5	59.2	63.4
Poly-substance use (number of drugs used weekly) (%)			
0	12.6	12.0	12.1
1	26.9	28.6	24.1
2+	60.5	59.4	63.9
Number of drug used weekly, <i>M (SD)</i>	1.8 (1.2)	1.8 (1.1)	1.9 (1.1)
Legal/Criminal Justice Status			
On probation, parole or case pending (%)	44.3	40.5	47.0
Drug Treatment			
Age at 1st drug treatment, <i>M (SD)</i>	28.2 (7.6)	27.2 (6.8)	27.0 (6.8)
Number of prior drug treatment episodes, <i>M (SD)</i>	2.3 (4.3)	2.2 (4.3)	2.3 (3.8)
DATOS Treatment Modality			
Long-term residential	23.4	21.1	30.1
Short-term inpatient	17.4	20.3	19.2
Outpatient methadone maintenance	32.3	31.9	27.3
Outpatient drug free	26.9	26.7	23.4

* $p < .05$.

** $p < .01$

Table 6
Status at year 5 follow-up by sexual risk group (N = 1,390)

	Decreased (N = 483)	Stable (N = 625)	Increased (N = 282)
Sociodemographic /background characteristics			
Marital status (%)**			
Married/living as married	55.8	16.6	21.7
Separated/divorced/widow	21.4	32.5	33.5
Never married	22.7	50.9	44.8
Employment (%)**			
Working	59.5	40.0	53.2
Seeking	7.5	9.9	10.6
Homemaker/retired	24.0	31.3	19.5
Institutionalized	3.0	9.9	8.5
Income from drug-related activity	0.8	1.0	1.8
Other	5.1	7.9	6.4
Income, <i>M (SD)</i> **	16,951 (28,162)	10,209 (19,049)	13,677 (17,134)
Pregnant in past 12 months (%)**	(N = 233) 12.5	(N = 190) 3.7	(N = 83) 7.2
Substance use in the past 12 months (%)			
Heavy alcohol use**	12.8	10.4	18.4
Alcohol use**			
No use	37.8	48.2	28.4
Monthly use	34.1	26.1	30.9
Weekly use	21.8	17.8	29.1
Daily	6.4	7.9	11.7
Marijuana use*			
No use	67.8	69.2	57.5
Monthly use	17.8	15.5	23.1
Weekly use	8.8	8.7	12.1
Daily	5.6	6.6	7.5
Cocaine use**			
No use	70.6	66.7	46.5
Monthly use	13.4	14.7	20.9
Weekly use	9.1	10.6	17.0
Daily	6.9	8.1	15.6
Heroin use*			
No use	76.6	73.4	70.1
Monthly use	10.7	8.3	10.7
Weekly use	3.7	6.2	7.8
Daily	9.0	12.0	11.4
Other drug use			
No use	89.6	90.5	85.1
Monthly use	6.4	5.6	8.9
Weekly use	1.0	2.1	2.8
Daily	3.0	1.9	3.2
Mental health status (%)			
Depression in the past 12 months*	44.5	45.2	53.6
Anxiety in the past 12 months*	15.7	17.4	23.1
Prescribed medication for mental health problem in past 12 months*	18.2	24.4	22.0
Suicide thoughts/attempts since last interview**	11.7	14.5	19.9
Legal/criminal justice status			
Arrest in the past 12 months (%)**	16.3	17.0	24.5
Arrest in the past 12 months, <i>M (SD)</i> **	0.3 (1.2)	0.3 (0.7)	0.8 (3.5)
Drug related arrest in the past 12 months (%)	7.8	7.9	10.3
Drug related arrest in the past 12 months, <i>M (SD)</i> *	0.1 (0.6)	0.1 (0.4)	0.2 (0.6)
Days incarcerated after DATOS treatment, <i>M (SD)</i> *	13.5 (46.4)	30.5 (83.5)	21.9 (55.3)
Received treatment after DATOS treatment (%)			
Residential/inpatient alcohol treatment**	7.4	6.8	16.4
Outpatient alcohol treatment	7.5	5.0	8.2
Residential/inpatient drug treatment**	17.0	16.2	31.7
Outpatient drug treatment*	12.7	11.8	18.5
Methadone treatment	14.5	15.1	11.4
Received HIV/AIDS-related services in past 12 months (%)			
Any services**	24.2	31.3	37.9
Services related to reducing risk of needle use*	8.6	11.2	14.2
Services related to reducing risk of sexual transmission**	10.6	14.5	18.4
Services related to general knowledge of HIV infection**	21.4	26.3	30.9

*
 $p < .05$.

**
 $p < .01$