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Patterns of Drug Use and Expectations in Methadone Patients

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Abstract

Expectations about future behavior have been shown to have a positive relationship with subsequent behavior. For patients in drug treatment, recovery should manifest changes in drug use and in cognitive perceptions of being able to refrain from use. The present study identified latent patterns of the longitudinal relationship between drug use expectation and illegal drug use during treatment. Latent variable mixture modeling identified three patterns of change over successive 3-month intervals during treatment: Improvers (48%), Decliners (33%), and Continuing Users (19%). The sample consisted of 497 patients in community-based outpatient methadone treatment. The utility of the latent patterns was shown through their relationship to treatment engagement, where Continuing Users had lower counseling rapport and time in treatment. These latent patterns also differed on drug use measures at follow-up. Additional analyses of expectations with measures of opioid use, cocaine use, or criminality yielded similar latent patterns. Expectations about future drug use were found to be a useful measure of cognitive change corresponding to drug use change. Its potential as a brief treatment management tool is noted.

Keywords

Drug use expectations; Follow-up outcomes; Latent class analyses; Longitudinal assessments; Methadone drug use

Introduction

In drug abuse treatment, progress is commonly measured by the patient's drug use and to some extent by indicators of their treatment engagement, including session attendance and their rapport or alliance with their counselors. Considering the implicit role of treatment directed toward cognitive changes in the individual (e.g., counseling, cognitive behavioral interventions, relapse prevention, motivation interviewing, etc.), it would be anticipated that progress in rehabilitation should manifest itself in a correspondence between the patient's report of being able to refrain from drug use in the future and subsequent drug use behavior. In fact, some attention has been given to patient perceptions regarding risk of relapse (e.g., Walton, Blow, & Booth, 2000) and to recovery-oriented perceptions (e.g., De Leon, Melnick, Cao, & Wexler, 2006) with promising results in predicting recovery criteria. A concept that has received more theoretical consideration is that of "expectancy" in relation to treatment

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progress and outcome. Notably, attention has been given to perceptions of self-efficacy in resisting drug use, with this concept being initially described by Bandura in his social learning theory of behavioral change (Bandura, 1977,1978). Drug use expectations of being able to refrain from drug use (beliefs about use behavior), which is a counterpart to self-efficacy, may likewise be a useful predictor of outcome based upon the hypothesized relationships among outcome expectation, self-efficacy, and behavioral outcome.

As indicated by Bandura in his self-efficacy theory, expectancy consists of both efficacy expectancy and outcome expectancy, and the two should have a close behavioral relationship (Bandura, 1986). Indeed, as noted by Solomon and Annis (1990), a number of studies have found that these concepts are highly intercorrelated and also correlated with behavioral outcomes (Barling & Abel, 1983;Barling & Beattie, 1983;Lee, 1984a,1984b). Nevertheless, when considered together, efficacy expectancy seems to be the better predictor of outcomes.

Generally, efficacy has received considerably more research as a predictor of outcome among drug users than has outcome expectations. For example, higher levels of self-efficacy are associated with less drinking in the alcoholic population (Long, Hollin, & Williams, 1998), particularly among male-only samples (Burling, Reilly, Moltzen, & Ziff, 1989;McKay, Maisto, & O'Farrell, 1993;Rychtarik, Prue, Rapp, & King, 1992). In studies of drug users, relationships between heightened self-efficacy and lower levels of drug use have been consistently replicated, and a number of studies have found increased self-efficacy during treatment is related to reduction in drug use, with the magnitude of this relationship strengthened as time in treatment increased (Rounds-Bryant, Flynn, & Craighead, 1997). Both pre-treatment (Stephens, Wertz, & Roffman, 1993) and end of treatment self-efficacy (Stephens, Wertz, & Roffman, 1995) were found to predict posttreatment drug use in a study of adult marijuana users.

Based on the large body of self-efficacy research, and the high correlation between the two concepts (Solomon & Annis, 1990), efficacy has come to be regarded as the preferred indicator from expectancy research. Nevertheless, some theorists consider outcome expectations to be an important and often overlooked predictor of behavioral outcome (Eastman & Marzillier, 1984;Kazdin, 1978;Rosenthal, 1978;Teasdale, 1978). Examples include greater self-efficacy and outcome expectancy scores being related to declines in drug use, injection frequency, and increases in safer needle use practices (Celentano, Cohn, Davis, & Vlahov, 2002), and more confidence in abstaining from opioid use predicting progress towards recovery (Gossop, Green, Phillips, & Bradley, 1990). Although efficacy might be a better statistical predictor, outcome expectations could have greater practical utility for drug treatment counselors. This is because information concerning expected drug use and cravings can be assessed routinely in treatment as part of the counseling procedure or as part of a routine status report.

Most of the research on expectations, particularly self-efficacy, has approached it as a static rather than a dynamic concept, and generally patterns of drug use in relation to corresponding patterns of efficacy or expectations over time have been ignored. As noted by Maibach and colleagues (Maibach, Flora, & Nass, 1991), an important limitation in the health and self-efficacy literature is the failure to recognize how self-efficacy changes over time, and they recommended that more attention should focus on this change. This is addressed in the present research. More specifically, existing longitudinal data collected during methadone outpatient treatment (at 3-month intervals) were examined with respect to drug use expectations (about being able to refrain from drugs) and drug use while in treatment.

The importance of examining patterns of treatment response was recognized by Morral and his colleagues, who used cluster analysis of urine test results during treatment to identify profiles that corresponded to clinical observation of "improving," "stable-good," and "stable-

poor” patients (Morrall, Iguchi, Belding, & Lamb, 1997). The present research expands on the concept by including a cognitive component (expectation) in addition to the behavioral component (drug use) – both collected longitudinally – in identifying the treatment progress response patterns. That is, the study deals with the dynamic relationship between a cognitive and a behavioral component in assessing patient rehabilitation. The current research therefore helps address not only the dearth of information on how a measure of outcome expectancy changes over time, but on how it changes in relation to a measure of behavior.

It was hypothesized that higher expectations (more likely to be able to refrain from use) would be associated with a pattern of increasing abstinence or reduced drug use for a majority of the sample based on the positive relationship between increasing efficacy and reduced drug use noted in the literature. However, it is expected that other patterns should also emerge reflecting the substantial drug usage rates sometimes reported during methadone treatment. The predictive utility of the patterns of expectations and drug use is shown by examining their relationships to drug use at a follow-up interview 18 months after intake to methadone treatment. Additional information is provided on the patterns by showing mean differences on patient measures and measures of treatment process. However, the number of these measures was limited, with some possibly pertinent information on psychiatric and medical status (such as HIV status, hepatitis, and social and family networks) being unavailable for analysis.

Method

Sample

The sample included 497 patients admitted to a private, for-profit outpatient methadone treatment (OMT) clinic in Texas between September 1995 and August 1997. Patients received no-fee services for a year of their participation in the research. After a year, patients could elect to remain in the treatment agency by paying for their services. Eighteen months after the start of treatment, each patient was eligible for a follow-up interview. Of the 451 who were located (91%), 309 patients (62%) completed the follow-up interview, 8 refused (1.6%), 4 were unable to complete the interview for medical reasons (1%), 13 were dead (2.6%), and 115 were in prison and inaccessible (23%).

Of the 497 patients in the admission sample, 69% were male, 66% were Hispanic (21% White/11% Black), average age was 39, 65% had either completed high school or possessed a GED, and a third were married or living as married (25% never married and 42% were separated, divorced, or widowed). Major sources of financial support before treatment included illegal activities (37%), family or friends (29%), job (19%), and unemployment benefits, welfare, or other (14%). A majority (57%) had a legal status at intake (probation, parole, awaiting trial, outstanding warrant, or case pending). About a third (36%) of the sample had a dual cocaine/opioid dependency, and 29% had an alcohol/opioid dependency. In addition to their daily methadone dose, individual counseling was provided. Patients averaged 17.7 counseling sessions, with a range of zero to 58. Two-thirds had over 12 sessions. Only a small percentage of the patients attended self-help treatment while receiving methadone. About 10% attended AA for alcohol problems in the first 3 months and about 14% attended other self-help groups for drug problems in the first 3 months, with the percentages declining thereafter.

Procedures

All procedures and materials used in the research were approved by the TCU Institutional Review Board. Written consent was obtained from all subjects after proposed treatment strategies and data collection procedures were explained. The follow-up interview procedure included voluntary participation, written informed consent, and request for a voluntary urine specimen. Interviewees were paid a nominal fee for the interview (\$20) and an additional

nominal fee for the urine specimen (\$5). Each individual had potentially 6 data collection points. Measurement was at admission to treatment and the next four occurred every 3 months (for up to a year) while in treatment. The sixth potential data point was the follow-up, which was at least 6 months beyond the last during treatment measurement.

Measures

Drug use expectations—A brief scale created for the research consisting of 4 items assessed drug use expectations about opioid and cocaine use over time. Questions asked about the patient's likelihood of using drugs in the next few months. These included how likely will you "feel the need to use drugs," "have heroin/opioid relapses," "have cocaine use relapses," and "have problems quitting drug use." A 5-point Likert rating scale was used (0 = not at all, 1 = slightly, 2 = moderately, 3 = considerably, 4 = extremely) for each question. Each of the items was reversed scored and then averaged to obtain the drug use expectation measure. A low score reflects low expectations about being able to refrain from use while a high score indicates high expectations for being able to refrain. Although a very short scale, these four questions cover three domains: (1) control of behavior (the two relapse questions), (2) cravings (feel the need to use), and (3) general belief about recovery (problems quitting). The coefficient alpha reliability of this scale was consistently high from the intake interview to Month 12 during treatment (alphas were .81, .81, .82, .82, and .79, respectively).

Illegal drug use—This was a composite measure representing frequency of all illegal drug use, including heroin, street methadone, other opiates, speedball, cocaine, crack, methamphetamine, uppers, barbiturates, other sedatives, tranquilizers, inhalants, hallucinogens, marijuana, and other drugs. Drug usage was measured using a 9-point scale (where 0 = none, 1 = 1–3 times, 2 = 1 time per month, 3 = 2–3 times per month, 4 = once a week, 5 = 2–6 times per week, 6 = once a day, 7 = 2–3 times per day, 8 = over 3 times per day). This composite mapped the frequency reported for each drug into a single response scale using a scheme based on combining the maximum drug frequency for any of the 15 drug groups and the summed drug score obtained by adding frequencies across all 15 drugs. This procedure was patterned after that used for a measure of total drug frequency combining multiple drugs (Joe & Simpson, 1993).

Alcohol—Measures of DSM-IV Alcohol Dependence and DSM-IV Alcohol Abuse at treatment intake were examined to address whether alcohol was associated with the response patterns.

Demographics—Age, gender, and race-ethnicity were included as demographic characteristics in comparing the patterns. Age was scored in years, gender was scored 1 for male and 0 for female, and ethnicity (white, black, and Hispanic) was represented by as dichotomies. Similarly, for marital status, the three classifications were never married, married or living as married, and widowed, separated, or divorced. The category for never married served as the reference category. Major financial support was represented by three dichotomies in the analysis: job, family or friends, and illegal activity (including prostitution). Legal status was a dichotomy representing no legal status versus any type of legal status at intake (i.e., probation, parole, awaiting charge, trial, or sentence, outstanding warrant, case pending, or other).

Psychological characteristics—Three psychological measures were used as predictors based upon their relationships to outcomes. These were self-esteem, depression, and psychological problems. Self-esteem has been shown to be related to drug treatment outcome (e.g., Berry & Sipps, 1991) and is often an integral concept in drug prevention interventions that address efficacy. Being able to remain abstinent conceivably might raise self-esteem. The

measure of self-esteem used is the TCU scale of this construct and it has been shown to have an alpha reliability in the upper .70's (e.g., Joe, Broome, Rowan-Szal, & Simpson, 2002). Depression, which has been found to be a positive force for treatment participation and retention (e.g., Broome, Flynn, & Simpson, 1999; Joe, Simpson, & Broome, 1999), was measured by the TCU Depression scale and also has an alpha reliability in the upper .70's (e.g., Joe et al., 2002). An indicator of psychological problems describing more pathological behaviors (hallucinations, significant anxiety or tension, difficulty in understanding, concentrating, and remembering, difficulty in controlling violent behavior, and serious depression) was also used because of its relationship to treatment participation (Joe, Brown, & Simpson, 1995). It has a coefficient alpha reliability of .72.

Motivation—Motivation for treatment has been found to be a consistent predictor of retention in treatment and treatment engagement measures (e.g., Joe et al., 1999; Simpson & Joe, 1993; Simpson, Joe, Rowan-Szal, & Greener, 1997). The study used two scales as indicators: desire for help and treatment readiness. Both have alpha reliability coefficients in the low 70's (Simpson & Joe, 1993; Simpson et al., 1997) and were measured by 7-point Likert response formats.

Time in Treatment—Time in treatment was calculated as the number of days in treatment from intake to termination date if prior to a year or to a year in treatment. This measure was used in the analyses to assess whether the latent classes differed with respect to time spent in treatment during the episode covered by the study. Patients were provided with free treatment for a year for participation in the research.

Session attendance—Quarterly session attendance was defined by the number of counseling sessions attended during the quarters ending in months 3, 6, 9, and 12. In these four quarters, the frequency of attendance ranged from 0 to 17, 0–16, 0–16, and 0–14, respectively.

Methadone dose—The methadone philosophy of the treatment program was to use a dose deemed sufficient for the patient's heroin use. Methadone dose was the average dose over each of the four quarters ending in months 3, 6, 9, and 12. The averages and corresponding standard deviations for each of the quarters were 65.5 mg (sd = 24), 77.5 mg (sd = 34), 79.7 mg (sd = 39), and 74 mg (sd = 42), respectively. The corresponding ranges were 18–178 mg, 1–390 mg, 7.3–390 mg, and 5.7–390 mg, respectively. The averages for the first two quarters are used in describing the patterns.

Rapport between counselor and patient: Measures of therapeutic relationship

There were two measures of rapport between counselor and patient, one from the counselor's perspective and one from the patient's. The measure of *rapport by the counselor* was measured by counselor ratings of their interactions with each patient at 3-months intervals during treatment. This scale consisted of five items ("easy to talk to," "warm and caring," "honest and sincere," "not hostile nor aggressive," "not in denial about problems") and had a coefficient alpha reliability of .79, .81, .83, and .81 for months 3, 6, 9, and 12, respectively. Each of the items was rated on a 7-point Likert scale (1 = strongly disagree, ..., 4 = not sure, ..., 7 = strongly agree). In addition to scale scores at month 3, 6, and 9 being used as individual measures in discriminating among the latent classes, the scale scores were averaged over the patient's stay in the treatment episode, up to 12 months, to provide a summary measure.

The measure of *rapport by the patient* was measured by patient ratings of their interactions with their counselor at 3-months intervals during treatment. This scale consisted of twelve items (e.g., "easy to talk to," "understanding," "respects you and opinions," "sensitive to situation and problems," "trust your counselor," "counselor views your problems and situations

realistically”). As with the rapport by the counselor scale, each of the items of the rapport by the patient scale was rated on the same 7-point Likert response scale (1 = strongly disagree, ..., 4 = not sure, ..., 7 = strongly agree). Similarly, in addition to scale scores at month 3, 6, and 9 being used as individual measures in discriminating among the latent classes, the scale scores were averaged over the patient’s stay in the treatment episode, up to 12 months, to provide a summary measure.

Follow-up measures—Six criteria were used to represent follow-up outcomes. Four of these involved self-reported weekly drug use in the 6 months prior to the follow-up interview, including weekly heroin use, weekly illegal opioid use (heroin, illegal methadone, other opioids, and speedball), weekly cocaine use, and weekly illegal drug use. A voluntary urine specimen was also requested at follow-up, and it was analyzed for heroin metabolites. This comprised the fifth follow-up outcome. Because a substantial percentage of the sample was in prison (23%), prison status at follow-up was used as the sixth follow-up outcome. (Note, however, that patients could be imprisoned for pretreatment offenses, so that a prison term does not necessarily indicate a treatment failure.)

Analysis

In the during-treatment portion of the longitudinal design, each individual had potentially five assessment points. These repeated measurements of expectations and opioid use were analyzed using a joint latent variable growth mixture model analysis through the MPLUS software (B. Muthén & Muthén, 2000). The object of this analysis was to determine whether there were subgroups characterized by different patterns of change on expectations and drug use. This was accomplished by finding the smallest number of latent groups that adequately described the associations between the repeated measurements of expectations and illegal drug use over the course of treatment. The analysis was then repeated separately with opioid use and with cocaine use in relationship to the expectation measure to gauge the generalizability of the findings.

The growth portion of the model was estimated in the following way. Loadings of the intercept factor were fixed at one and loadings of the slope factor were fixed at 0, 1, 2, 3, and 4 to define linear growth with equidistant time points. The intercept and growth parameters were estimated as correlated in the model for each latent group. Results from the analysis also provided estimates of the longitudinal pattern of means on expectations and drug use for each latent group and the proportion of the total sample that is represented by that change pattern.

In addressing which background variables discriminated among the groups as well as whether the groups differed on during treatment process measures, the following procedure was used. Differences in characteristics of the latent groups were assessed by estimating two models – one in which the means were equal and one in which there were no constraints on the means for the groups. The significance of the mean differences for each characteristic was assessed by a chi-square difference test in the two models, with the degrees of freedom equal to the difference in the number of free parameters estimated; that is, $\chi^2(\text{number of free parameters difference}) = [-2 (\text{Log likelihood } H_1 - H_0)]$.

The MPLUS software was also used in testing the hypothesis that the patterns of drug use expectation and drug use were predictive of future drug use behavior. This was accomplished using a growth mixture model with a categorical “distal” outcome. The outcomes selected were weekly heroin use, weekly opioid use, and prison status for the patterns developed from the opioid analysis and weekly cocaine use and prison status for the patterns developed from the cocaine analysis. In these analyses, the distal outcome is regressed on the categorical latent variable (patterns) using logistic regression. Significant differences between patterns were tested by assessing odds ratios in a pairwise manner.

An advantage of this analysis over cluster analysis of the longitudinal data is its approach to addressing attrition, a common problem with longitudinal data. Usually in cluster analysis, individuals without complete data on the variables would have to be deleted or data imputed for them. An advantage of using the MPLUS software is the availability of an estimation approach that uses information from all cases (complete or incomplete), and therefore assumes only that missingness is unrelated to the values that are missing. Formally, missingness may be related to characteristics that are measured for the incomplete cases, but once these characteristics are taken into account, there is no bias between individuals with and without missing responses (Little & Rubin, 1987; Rubin, 1976).

Decisions about the number of latent classes were based on the Bayesian Information Criterion (BIC), adjusted for sample size (BIC), the Akaike Information Criterion (AIC), and an entropy index (see L. K. Muthén & Muthén, 1998). The adjusted BIC balances fit against the number of parameters used, and it favors simpler models that achieve close fit. Smaller values of the BIC, adjusted BIC, and AIC are preferred. Entropy summarizes the classification quality of the model, indicating the degree to which individuals conform to one (and only one) of the identified groups. It ranges from 0 to 1, with larger values reflecting cleaner classification.

Results

Latent Variable Mixture Model: Expectations and Illegal Drug Use

In identifying the number of latent classes that best fit the data from the joint latent variable growth mixture model analysis of longitudinal drug use expectations and illegal drug use, a comparison between the model fit statistics for a two latent class solution (Log-likelihood = -5372.61, AIC = 10803.22, BIC = 10925.27, Adjusted BIC = 10833.23, Entropy = .72) and the three latent class solution (Log-likelihood = -4495.78, AIC = 9057.56, BIC = 9196.44, Adjusted BIC = 9091.70, Entropy = .57) deemed the three latent class solution to be an appropriate solution for the data. For the two group solution, one group representing 30% of the sample had profiles that suggested consistently low expectations for refraining from drug use and fairly high drug use during treatment, while the second group comprised of the remaining 70% had fairly positive expectations about refraining from drug use and moderate drug use throughout treatment. The three group solution had better fit statistics, and it essentially splits the large group into two groups that appeared to be meaningful. The three group solution is presented in Table 1. The drug use expectations and illegal drug use profiles characterizing the first latent class represented 48% of the total sample, and from the estimates of the initial status and quarterly change, this latent class can be described as having fairly high drug use expectations (initial status = 3.33, on a scale where the maximum is 4) that continued to increase during treatment (quarterly change = .06, $t = 2.49$, $p < .02$), and very low illegal use during treatment that continued to decrease from intake (quarterly change = -.36, $t = -2.59$, $p < .01$). The first latent class is labeled “Improvers.” The second latent class is characterized by decreasing drug use expectations over the course of treatment (quarterly change = -.16, $t = -3.84$, $p < .0001$) and a corresponding increase in illegal use (quarterly change = .54, $t = 4.27$, $p < .0001$) and represents 33% of the total sample and is labeled “Decliners.” The third latent class comprised the remaining 19% of the sample, characterized by continuing high drug use and low expectations and was labeled “Continuing Users.”

Characteristics of Latent Classes

A comparison of the three classes identified in the illegal drug use analysis in terms of demographic characteristics, alcohol disorders, psychological attributes, motivation for treatment, and treatment process measures are presented in Table 2. These results show that the major variable domain distinguishing these groups was treatment process, particularly time in treatment [$\chi^2(2) = 116.62$, $p < .0001$] and counseling rapport between counselor and patient

from the counselor perspective [$\chi^2(2) = 50.78, p < .0001$]. The Continuing Users had a much shorter tenure (98.0 days) when compared with the other two groups, which had tenures over 330 days. The relationships were significant for the overall measure of counseling rapport as reported by the counselor [$\chi^2(2) = 50.78, p < .0001$], as well as for those measurements at month 3 [$\chi^2(2) = 28.66, p < .0001$], month 6 [$\chi^2(2) = 14.88, p < .001$], and month 9 [$\chi^2(2) = 33.80, p < .0001$]. For the overall average, the Improver group had the highest average (5.3) and the Continuing Users the lowest (4.4). The latent class means followed a similar pattern for each of the measurements at months 3, 6, and 9.

The overall measure of rapport from the patient perspective was also significant [$\chi^2(2) = 12.54, p < .01$]. The measurement at month 3 [$\chi^2(2) = 5.57, p < .10$] was not significant, but it was at month 6 [$\chi^2(2) = 9.16, p < .02$] and month 9 [$\chi^2(2) = 13.24, p < .01$]. The group having the highest mean was Improvers, with Decliners next, and Continuing Users the lowest. This order was maintained in each of the rapport measures in Table 2 and is the same as that observed for rapport from the counselor perspective. The groups were also different with respect to methadone dose in the first quarter of treatment [$\chi^2(2) = 9.46, p < .05$], with the Continuing Users having the highest average (74 mg) and the Decliners the lowest (62 mg), but not the second. Although not shown in the table, the Continuing Users received a significantly higher dose in the third quarter [$\chi^2(2) = 7.06, p < .05$], but not the fourth quarter [$\chi^2(2) = .73, p < .95$]. There was also a significant difference on psychological problems [$\chi^2(2) = 6.20, p < .05$], with the Continuing Users having the highest average. There were no differences with respect to demographics, alcohol disorders, motivation for treatment, and counseling session attendance. Only a small percentage of the sample attended self-help meetings while in methadone treatment (AA 10% and NA 14%), and the attendance rates were not significantly different by group.

Prediction of Follow-up Drug Use and Prison Status from Latent Classes

To provide evidence of the longer-term utility of the patterns of change in drug use expectations and drug use, the classes of patients identified in the latent variable mixture model analysis of illegal drug use were used to predict weekly heroin use, weekly opioid use, positive urine specimens for heroin metabolites, and prison status at the follow-up interview in a set of general mixture models with distal outcomes analyses. The results of these analyses of follow-up outcomes are presented in Table 3. It shows that the groups defined by during-treatment expectations and drug use trends differed markedly in their follow-up outcomes. The percentage of weekly heroin use at follow-up were 35.8%, 52.9%, and 72.1% for the Improvers, Decliners, and Continuing Users classes, respectively. Compared to the Improvers, the Continuing Users were over 4 times ($OR = 4.64$) as likely to be using weekly. The other comparisons for heroin use were not significant. The analysis of any opioid use at follow-up showed only small increases over the percentages noted for heroin use. These were 40.5%, 58.1%, and 75.1% for Improvers, Decliners, and Continuing Users, respectively. The comparisons between classes on opioid use also repeated the findings noted for heroin use.

Similarly, weekly cocaine use and weekly illegal drug use at follow-up were significantly predicted by the three patterns. The percentage of weekly cocaine use by the classes of Improvers, Decliners, and Continuing Users were 8.1%, 23.1%, and 43.5%, respectively. Compared to Improvers, the Decliners were about 3 times ($OR = 3.44$) as likely to be using weekly, and the Continuing Users were about 9 times ($OR = 8.77$) as likely to be using weekly. The Decliners were not significantly different from Continuing Users. On weekly illegal drug use, the percentages were 46.7% for Improvers, 79.9% for Decliners, and 83.1% for Continuing Users. The odds ratios showed significant discrimination between Continuing Users versus Improvers ($OR = 5.63$) and Decliners versus Improvers ($OR = 4.55$). Positive urinalysis test results were found to differ for Improvers (49.9%), Decliners (66.0%), and Continuing Users

(74.4%). Compared to Improvers, the Decliners were nearly 3 times as likely to have positive urines. With respect to prison status, there were no differences among the groups.

The groups were examined with regard to the percentage who were in treatment and in self-help after their free year of methadone treatment at the treatment site. Two treatment measures were examined: any drug treatment and any methadone treatment. Both self-help meetings of for alcohol problems (AA) and for drug problems (NA, CA, AA, etc.) were considered. For any drug treatment, the percentages were 52.4%, 49.9%, and 49.6% for Improvers, Decliners, and Continuing Users, respectively. For any methadone treatment, the corresponding percentages were 47.7%, 40.6%, and 37.1%. The groups were not significantly different with respect to any drug treatment [$\chi^2(2) = .10, p < .95$]. Although there was a 10% difference between Improvers and Continuing Users, the percentages among the three groups were not significantly different on any methadone treatment [$\chi^2(2) = 1.56, p < .50$]. On AA attendance for alcohol problems [$\chi^2(2) = 2.25, p < .50$], the percentages were 15%, 8.5%, and 18.9% for Improvers, Decliners, and Continuing Users, respectively. For self-help attendance for drug problems [$\chi^2(2) = 1.94, p < .50$], the percentages for Improvers, Decliners, and Continuing Users were 21.4%, 21.0%, and 32.6%, respectively.

Other Latent Variable Mixture Model Analysis of Repeated Measurements

Opioid use and cocaine use were also analyzed in relation to drug use expectations. Those analyses yielded similar results, with patterns of Improvers, Decliners and Continuing Users. However, the estimated percentages in these categories differed, with the percentages being 71%, 21%, and 8%, for Improvers, Decliners, and Continuing Users, respectively. The corresponding percentages were 65%, 20%, and 15% in the cocaine analysis.

Pattern Identification Issues

In that it might be useful to know how early in the patients' treatment these patterns of drug use behavior and expectations might be identifiable, the analysis was done on 9 months of data. These results yielded very similar patterns (Log-likelihood = -3763.58, AIC = 7589.17, BIC = 7719.63, Adjusted BIC = 7621.24, Entropy = .61), with 49% in the Improvers, 31% in the Decliners, and 20% in the Continuing Users groups. However, it was not possible to examine a shorter period of time since a minimum of three time points were needed for fitting the patterns.

Latent variable Models Based on Single Measures

The usefulness of modeling drug use and expectations jointly was seen further when additional analyses examined each measure separately in latent class analyses. For drug use, a two latent class solution was found to be satisfactory, with approximately half (48% vs. 52%) in each group. The first group had a profile (2.31, 1.80, 1.10, 1.11 for months 3, 6, 9, 12, respectively) that was similar to the drug use profile for the Improvers while the second group had a profile (3.96, 4.27, 4.51, 5.13) that was similar to the Continuing Users. For the analyses based only on expectations, a two-group solution was also found to be adequate for the data. The first group (71%) had means that were similar to the Improvers through month 3, but between Improvers and Decliners for the remaining 3 time periods (3.47, 3.47, 3.38, 3.36, 3.22 for intake, months 3, 6, 9, and 12 respectively). The second group (29%) had means similar to the Continuing Users, but slightly higher (2.36, 2.42, 2.51, 2.66, 2.71).

Discussion

In this study of drug use expectations and drug use during treatment, the longitudinal association between these two measures was investigated using growth mixture modeling. As shown previously (De Leon et al., 2006; Walton et al., 2000), the findings point to the potential

of using the patients' personal ratings data in better understanding their progress in treatment and that a cognitive component is an important part of the rehabilitation process. It showed patterns of consistency between drug use expectations and patterns of drug use. That additional information can be gained by examining these measures jointly was seen when results from latent class analyses performed on each measure separately were examined.

Approximately half of our sample was classified as Improvers, one third as Decliners, and one fifth as Continuing Users. The dominant longitudinal pattern – the Improvers (increasing expectations about being able to refrain and decreasing drug use) – corresponds to the negative correlation that has been reported often in the literature. The Decliners had declining drug use expectations and increasing illegal drug use, while the Continuing Users had continued low expectations and high illegal drug use throughout treatment. These patterns of drug use and expectations suggest that counseling can benefit by addressing patient expectations about their concerns with future relapse. Furthermore, the utility of the patterns was demonstrated by showing them to be related to measures of treatment process and to subsequent drug use behaviors.

Although about a third of the sample had problems with cocaine and alcohol in addition to opioids, the groups did not differ with respect to pretreatment alcohol dependence nor alcohol abuse. Additionally, cocaine use was analyzed in relation to expectations and found to yield similar groups of Improvers, Decliners, and Continuing Users.

The classes of Decliners and Continuing Users suggest that different interventions might be worth considering in their treatment plans. If Decliners can be identified early in treatment, before their drug use relapses become very frequent, relapse prevention interventions might be useful in halting their increasing drug use and declining expectations (e.g., Knight, Simpson, & Dansereau, 1994; McAuliffe & Ch'ien, 1986). The smaller group, the Continuing Users, might benefit from other forms of intervention – possibly motivational (Miller & Rollnick, 1991) – because their opioid use never decreased very much from their intake levels. Intervening with additional treatment would appear to be of importance in light of the fact that the trends of expectations and drug use observed during treatment are highly predictive of follow-up drug use and prison status. Moreover, the interrelatedness of expectations and drug use underscores the importance of psychological and cognitive components in the recovery process. The current study provides additional support for focusing efforts at improving the process aspects of treatment because of the findings that what happens during treatment has effects on outcomes at follow-up (Joe, Simpson, Dansereau, & Rowan-Szal, 2001).

The present study also provides evidence of the potential of using growth mixture modeling to investigate patient trajectories in treatment, as other research has shown its usefulness in identifying developmental trajectories of alcohol (Tucker, Orlando, & Ellickson, 2003) and marijuana use (Ellickson, Martino, & Collins, 2004). The value of identifying patterns of patients who differ in their behavioral treatment response has been expounded upon previously (e.g., Morral et al., 1997), particularly differentiating the poor responders from the improving and stable good patients based upon their drug use, as operationalized by negative urines. In the current research, the concept was expanded to include cognitive changes occurring in relation to a behavioral treatment response. This is viewed as a significant extension because of the importance placed on counseling in drug treatment, as well as the cognitive-based interventions that are often used in treatment.

Using illegal drug use and expectations, 48% were classified as Improvers, 33% as Decliners, and 19% as Continuing Users. The analysis gives evidence for the percentages of patients who are in recovery. If the criterion is only illegal opioids (the focus of methadone treatment), then a large majority of the patients appear to be in recovery (71% Improvers, 21% Decliners, and

8% Continuing Users). However, if all illegal drugs were used as the criterion, then only about half would be considered to be improving (48%). The difference between the two sets of figures suggests that a substantial percentage of the methadone patients were using illegal substances other than opioids.

In addressing the variables that distinguished the latent classes, the major differentiators were the treatment process variables. These included time in treatment and counseling rapport from both the counselor and patient perspectives, although for the latter, the differences were smaller. A few other variables that discriminated had smaller impact than these two treatment process measures. The utility of the recovery patterns in the current research suggest that the area of expectations might be viable as an indicator of treatment progress in addition to that of counseling rapport, whose usefulness has been demonstrated in modeling treatment process (e.g., Simpson & Joe, 2004) and in predicting follow-up outcomes (e.g., Joe et al., 2001). Even though rapport was a strong discriminator of the groups, expectations might be a useful separate indicator of treatment progress. Conceptually, cognitive changes in dealing with drug use issues and problems, particularly relapse possibilities, demonstrate an important link in modeling drug use behavior change. A patient could change cognitively with respect to stopping drug use and yet have low counselor-patient rapport. Considering the emphasis placed on cognitive changes in the patients by the drug treatment, it seems reasonable that these changes also be measured and used in treatment evaluations. Both time in treatment (e.g., Simpson, 1979; 1981) and counseling rapport (Joe et al., 2001; Simpson, 2004; Simpson & Joe, 2004) have broad literature support for their importance as indicators of treatment effectiveness. Rapport from both the counselor and patient perspectives, whether considered at various times in treatment or as a summary indicator over the course of treatment, was found to be highly discriminating among the groups, with the Improvers having the highest average.

The utility of these patterns of drug users based on their drug use and expectations during treatment was substantiated further by showing that they predicted subsequent drug use at post-treatment follow-up. The results suggest that patterns of behavior are highly predictive of these outcomes. The Improver group was significantly less likely than the other groups to be using heroin, all illegal opioids, cocaine, and illegal drug use on a weekly basis at follow-up. The usage rates at follow-up for opioids reiterated the need not only to identify the Decliners and Continuing Users, but also to find some way to intervene effectively in their behavioral patterns, since large majorities of these groups were using illegal opioids weekly at follow-up as indicated by positive urines. Furthermore, an analysis based on 9 months of data rather than 12 showed essentially the same results and thus future research might address how early in treatment patients on different trajectories can be identified since they have implications for subsequent behaviors. Although a large percentage of the sample returned to a drug treatment after leaving the year of free methadone treatment (given for participation in the research project), the groups were not significantly different on returning to any treatment or on returning to any methadone treatment.

The results of this study may be limited by the characteristics of the research sample. It was based on daily heroin users, who were admissions to an outpatient methadone treatment program located in the southwest, with a majority of the patients being male, Hispanic, and over 35 (the average age was 39). Although it is expected that similar latent classes would be observed in other treatment samples, their relative proportions would likely differ depending upon characteristics of the sample and type of treatment. Alcohol dependence was not found to be a predictor, but other discriminators of the latent classes also need further study, including additional information on psychiatric and medical status that might be pertinent such as HIV status, hepatitis, and social and family networks. Additionally, alternate measures of self-efficacy could be investigated based on the importance of this construct to drug use. An important limitation on the follow-up analyses is that only 62% of the sample at intake were

available to address this part of the study. However, as noted in the methods, imprisonment was the major reason for missing data and imprisonment status was included as an outcome (which did not differ significantly among the three groups). Also, the analyses described here permit the inclusion of incomplete cases (such as those without follow-up interview), which helps to avoid bias and loss of statistical power that would otherwise result. Another potential limitation on interpreting the treatment history of these methadone patients is that the follow-up measures were collected only 18 months following treatment intake and about half (51%) by that time had returned to treatment (43% had returned to methadone treatment). Because the index methadone treatment episode of this study provided a year of free treatment, enrollment and return to subsequent treatment may have been limited by the patient's financial situation. A later follow-up interview would extend evidence over time for the predictive utility of the patterns.

Overall, the results show that drug use expectations are indicative of the cognitive aspects related to recovery. One implication is that treatment programs might use brief patient measures in treatment planning; monitoring drug use expectations may improve treatment effectiveness by identifying where specialized interventions might be used for patients who are particularly at risk. The results also demonstrate some of the dynamic interrelationships between patient readiness, engagement, and recovery steps (both cognitive and behavioral) involved in recovery from drug dependence. Conceptually, this study also expands our knowledge about the link between psychological factors and behavioral outcomes in treatment as proposed in the TCU Treatment Model (Simpson, 2004).

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References

- Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 1977;84(2):191–215. [PubMed: 847061]
- Bandura A. Self-efficacy: Toward a unifying theory of behavioral change. *Advances in Behaviour Research and Therapy* 1978;1:237–269.
- Bandura, A. *Social foundations of thought and action*. Englewood Cliffs, NJ: Prentice-Hall; 1986.
- Barling J, Abel M. Self-efficacy beliefs and tennis performance. *Cognitive Therapy and Research* 1983;7:265–272.
- Barling J, Beattie R. Self-efficacy beliefs and sales performance. *Journal of Organizational Behavior Management* 1983;5:41–51.
- Berry GW, Sippes GJ. Interactive effects of counselor-client similarity and client self-esteem on termination type and number of sessions. *Journal of Counseling Psychology* 1991;38(2):120–125.
- Broome KM, Flynn PM, Simpson DD. Psychiatric comorbidity measures as predictors of retention in drug abuse treatment programs. *Health Services Research* 1999;34(3):791–806. [PubMed: 10445903]
- Burling TA, Reilly PM, Moltzen JO, Ziff DC. Self-efficacy and relapse among inpatient drug and alcohol abusers: A predictor of outcome. *Journal of Studies on Alcohol* 1989;50(4):354–360. [PubMed: 2787877]
- Celentano DD, Cohn S, Davis RO, Vlahov D. Self-efficacy estimates for drug use practices predict risk reduction among injection drug users. *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 2002;79(2):245–256. [PubMed: 12023500]
- De Leon G, Melnick G, Cao Y, Wexler HK. Recovery-oriented perceptions as predictors of reincarceration. *Journal of Substance Abuse Treatment* 2006;31:87–89. [PubMed: 16814014]
- Eastman C, Marzillier JS. Theoretical and methodological difficulties in Bandura's self-efficacy theory. *Cognitive Therapy and Research* 1984;8:213–229.

- Ellickson PL, Martino SC, Collins RL. Marijuana use from adolescence to young adulthood: Multiple developmental trajectories and their associated outcomes. *Health Psychology* 2004;23(3):299–307. [PubMed: 15099171]
- Gossop M, Green L, Phillips G, Bradley B. Factors predicting outcome among opiate addicts after treatment. *British Journal of Clinical Psychology* 1990;29:209–216. [PubMed: 2364199]
- Joe GW, Broome KM, Rowan-Szal GA, Simpson DD. Measuring patient attributes and engagement in treatment. *Journal of Substance Abuse Treatment* 2002;22(4):183–196. [PubMed: 12072163]
- Joe GW, Brown BS, Simpson DD. Psychological problems and client engagement in treatment. *Journal of Nervous and Mental Disease* 1995;183(11):704–710. [PubMed: 7595433]
- Joe, GW.; Simpson, DD. National AIDS Research Consortium. Needle use risks: Composite measures and comparisons. In: Brown, BS.; Beschner, GM., editors. *Handbook on risk of AIDS: Injection drug users and sexual partners*. Westport, CT: Greenwood Press; 1993. p. 137–154.
- Joe GW, Simpson DD, Broome KM. Retention and patient engagement models for different treatment modalities in DATOS. *Drug and Alcohol Dependence* 1999;57(2):113–125. [PubMed: 10617096]
- Joe GW, Simpson DD, Dansereau DF, Rowan-Szal GA. Relationships between counseling rapport and drug abuse treatment outcomes. *Psychiatric Services* 2001;52(9):1223–1229. [PubMed: 11533397]
- Kazdin AE. Conceptual and assessment issues raised by self-efficacy theory. *Advances in Behaviour Research and Therapy* 1978;1:177–185.
- Knight K, Simpson DD, Dansereau DF. Knowledge mapping: A psychoeducational tool in drug abuse relapse prevention training. *Journal of Offender Rehabilitation* 1994;20(34):187–205.
- Lee C. Accuracy of efficacy and outcome expectations in predicting performance in a simulated assertiveness task. *Cognitive Therapy and Research* 1984a;8:37–48.
- Lee C. Efficacy expectations and outcome expectations as predictors of performance in a snake-handling task. *Cognitive Therapy and Research* 1984b;8:509–516.
- Little, RA.; Rubin, DB. *Statistical analysis with missing data*. New York: Wiley & Sons; 1987.
- Long CG, Hollin CR, Williams MJ. Self-efficacy, outcome expectations, and fantasies as predictors of alcoholics' posttreatment drinking. *Substance Use & Misuse* 1998;33(12):2383–2402. [PubMed: 9781821]
- Maibach E, Flora JA, Nass C. Changes in self-efficacy and health behavior in response to a minimal contact community health campaign. *Health Communication* 1991;3(1):1–15.
- McAuliffe WE, Ch'ien JMN. Recovery training and self help: A relapse-prevention program for treated opiate addicts. *Journal of Substance Abuse Treatment* 1986;3(1):9–20. [PubMed: 3016290]
- McKay JR, Maisto SA, O'Farrell TJ. End-of-treatment self-efficacy, aftercare, and drinking outcomes of alcoholic men. *Alcoholism: Clinical and Experimental Research* 1993;17(5):1078–1083.
- Miller, WR.; Rollnick, S. *Motivational interviewing: Preparing people to change addictive behavior*. New York: Guilford Press; 1991.
- Morral AR, Iguchi MY, Belding MA, Lamb RJ. Natural classes of treatment response. *Journal of Consulting and Clinical Psychology* 1997;65(4):673–685. [PubMed: 9256569]
- Muthén B, Muthén LK. Integrating person-centered and variable-centered analyses: Growth mixture modeling with latent trajectory classes. *Alcoholism: Clinical and Experimental Research* 2000;24(6):882–891.
- Muthén, LK.; Muthén, BO. *Mplus user's guide*. Los Angeles: Authors; 1998.
- Rosenthal TL. Bandura's self-efficacy theory: Thought is father to the deed. *Advances in Behaviour Research and Therapy* 1978;1:203–209.
- Rounds-Bryant JL, Flynn PM, Craighead LW. Relationship between self-efficacy perceptions and in-treatment drug use among regular cocaine users. *American Journal of Drug and Alcohol Abuse* 1997;23(3):383–395. [PubMed: 9261487]
- Rubin DB. Inference and missing data. *Biometrika* 1976;63:581–592.
- Rychtarik RG, Prue DM, Rapp SR, King AC. Self-efficacy, aftercare, and relapse in a treatment program for alcoholics. *Journal of Studies on Alcohol* 1992;53(5):435–440. [PubMed: 1405635]
- Simpson DD. The relation of time spent in drug abuse treatment to posttreatment outcomes. *American Journal of Psychiatry* 1979;136(11):1449–1453. [PubMed: 495799]

- Simpson DD. Treatment for drug abuse: Follow-up outcomes and length of time spent. *Archives of General Psychiatry* 1981;38(8):875–880. [PubMed: 7259424]
- Simpson DD. A conceptual framework for drug treatment process and outcomes. *Journal of Substance Abuse Treatment* 2004;27(2):99–121. [PubMed: 15450644]
- Simpson DD, Joe GW. Motivation as a predictor of early dropout from drug abuse treatment. *Psychotherapy* 1993;30(2):357–368.
- Simpson DD, Joe GW. A longitudinal evaluation of treatment engagement and recovery stages. *Journal of Substance Abuse Treatment* 2004;27(2):89–97. [PubMed: 15450643]
- Simpson DD, Joe GW, Rowan-Szal GA, Greener JM. Drug abuse treatment process components that improve retention. *Journal of Substance Abuse Treatment* 1997;14(6):565–572. [PubMed: 9437628]
- Solomon KE, Annis HM. Outcome and efficacy expectancy in the prediction of post-treatment drinking behaviour. *British Journal of Addiction* 1990;85:659–665. [PubMed: 2354283]
- Stephens RS, Wertz JS, Roffman RA. Predictors of marijuana treatment outcomes: The role of self. *Journal of Substance Abuse* 1993;5:341–353. [PubMed: 8186669]
- Stephens RS, Wertz JS, Roffman RA. Self-efficacy and marijuana cessation: A construct validity analysis. *Journal of Consulting and Clinical Psychology* 1995;63(6):1022–1031. [PubMed: 8543705]
- Teasdale JD. Self-efficacy: Towards a unifying theory of behavioral change? *Advances in Behaviour Research and Therapy* 1978;1:211–215.
- Tucker JS, Orlando M, Ellickson PL. Patterns and correlates of binge drinking trajectories from early adolescence to young adulthood. *Health Psychology* 2003;22(1):79–87. [PubMed: 12558205]
- Walton MA, Blow FC, Booth BM. A comparison of substance abuse patients' and counselors' perceptions of relapse risk: Relationship to actual relapse. *Journal of Substance Abuse Treatment* 2000;19(2):161–169. [PubMed: 10963927]

Table 1
Patterns of change in drug use expectations (DUE) and illegal drug use (N = 497)

Percent of Sample	Patterns					
	Increase DUE w/Drug Decrease(Improvers)		Decrease DUE w/Drug Increase(Decliners)		Decrease DUE w/Drug Steadily High (Continuing Users)	
	48		33		19	
Time	DUE	Drug Use	DUE	Drug Use	DUE	Drug Use
Intake	3.29		3.41		2.37	
Month 3	3.40	2.19	3.35	3.64	2.27	4.86
Month 6	3.49	1.73	3.10	4.02	2.23	5.06
Month 9	3.56	1.10	3.02	4.51	2.22	4.72
Month 12	3.48	1.20	2.83	5.15	2.29	5.10
Growth Model Estimates						
Intercept (initial status)	3.33	2.45	3.45	3.05	2.32	4.87
Growth factor (quarterly change)	.06*	-.36**	-.16****	.54***	-.04(ns)	.06 (ns)
Correlations between Intercepts		-.65***		-.65***		-.65***
Growth factors		-.05*		-.05*		-.05***

* $p < .05$,
** $p < .01$,
*** $p < .001$,
**** $p < .0001$

Log-likelihood = -4495.78, Number of free parameters = 33
AIC = 9057.56, BIC = 9196.44, Adjusted BIC = 9091.70, Entropy = .57

Table 2
Characteristics and process for patterns of change based on drug use expectations and illegal drug use (N = 497)

Characteristics	Patterns					Chi-square Difference Test, df = 2
	Total	Improvers	Decliners	Continuing Users	H ₀ : no constraints on means	
Demographic						
Age (yrs)	38.4	39.4	36.8	39.0	-6352.70	2.83
Male (%)	69.0	66.4	66.9	79.3	-4815.81	3.74
Race (5)					-4947.53	5.44 [†]
White	21.3	20.4	18.6	31.6		
Hispanic	67.2	70.4	70.4	53.4		
Black	10.9	9.2	11.0	15.0		
Psychological Depression						
Depression	3.83	3.89	3.64	4.02	-5297.71	3.32
Anxiety	4.32	4.39	4.06	4.56	-5316.38	5.41 [†]
Psychological Problem						
Motivation	1.00	.96	.93	1.22	-5056.01	6.20 [*]
Desire for Help						
Treatment Readiness	6.06	6.13	5.97	6.02	-5032.04	2.52
Alcohol						
Alcohol Dependence (%)	28	30	25	31	-4804.58	1.04
Alcohol Abuse(%)	14	11	16	19	-4671.67	3.04
Treatment Process						
Time in treatment	266.30	339.74	338.93	98.01	-7532.75	116.62 ^{****}
Counseling Rapport by counselor	4.95	5.29	4.80	4.43	-4973.58	50.78 ^{****}
Rapport: 3 months	5.02	5.28	4.96	4.50	-5025.00	28.66 ^{****}
Rapport: 6 months	4.76	5.00	4.64	4.36	-5007.60	14.88 ^{****}
Rapport: 9 months	4.87	5.24	4.70	4.27	-4892.81	33.80 ^{****}
Counseling Rapport by patient						
Rapport: 3 months	5.45	5.55	5.46	5.17	-4873.58	12.54 ^{**}
Rapport: 6 months	5.53	5.62	5.49	5.35	-4914.60	5.57 [†]
Rapport: 9 months	5.43	5.55	5.47	5.07	-4887.09	9.16 [*]
Sessions: 1st quarter						
Sessions: 1st quarter	5.41	5.57	5.47	4.88	-4830.48	13.24 ^{**}
Sessions: 2nd quarter						
Sessions: 2nd quarter	7.62	7.71	7.55	7.53	-5780.06	.14
Methadone dose:						
Methadone dose:	5.87	6.25	5.28	5.98	-5546.90	4.19
1st quarter						
1st quarter	63.54	64.62	61.99	73.99	-6774.28	9.46 ^{**}
Methadone dose:						
Methadone dose:	77.39	77.44	73.40	84.44	-6590.03	3.65

[†] p < .10,

* p < .05,

** p < .01,

*** p < .001,

**** p < .0001

Table 3

Weekly use, positive urine, and prison status at follow-up for during treatment patterns of change in drug use expectations (DUE) and drug use

Follow-up Outcome	%	95% CI	Test of Patterns from Illegal Drug Analysis	OR	95% CI
Heroin Use					
Pattern of Change					
Improvers	35.8	(26.4%, 45.2%)	Continuing vs. Improvers	4.64	(2.01, 10.75)*
Decliners	52.9	(39.9%, 65.6%)	Continuing vs. Decliners	2.31	(.89, 5.98)
Continuing Users	72.1	(57.8%, 86.4%)	Decliners vs. Improvers	2.01	(.97, 4.17)
Illegal Opioid Use					
Pattern of Change					
Improvers	40.5	(30.9%, 50.1%)	Continuing vs. Improvers	4.42	(1.91, 10.25)*
Decliners	58.1	(45.6%, 70.6%)	Continuing vs. Decliners	2.17	(.83, 5.68)
Continuing Users	75.1	(61.6%, 88.6%)	Decliners vs. Improvers	2.04	(.99, 4.20)
Illegal Cocaine Use					
Pattern of Change					
Improvers	8.1	(2.4%, 13.8%)	Continuing vs. Improvers	8.77	(3.19, 24.14)*
Decliners	23.1	(12.5%, 33.7%)	Continuing vs. Decliners	2.55	(.97, 6.74)*
Continuing Users	43.5	(27.6%, 59.4%)	Decliners vs. Improvers	3.44	(1.18, 10.0)
Illegal Drug Use					
Pattern of Change					
Improvers	46.7	(37.3%, 56.1%)	Continuing vs. Improvers	5.63	(2.17, 14.58)*
Decliners	79.9	(68.9%, 90.9%)	Continuing vs. Decliners	1.24	(.37, 4.13)
Continuing Users	83.1	(70.9%, 95.3%)	Decliners vs. Improvers	4.55	(1.93, 10.64)*
Positive Opioid Urine					
Pattern of Change					
Improvers	49.9	(40.3%, 59.5%)	Continuing vs. Improvers	2.92	(1.213, 7.06)*
Decliners	66.0	(53.3%, 78.7%)	Continuing vs. Decliners	1.50	(.54, 4.19)
Continuing Users	74.4	(59.7%, 89.1%)	Decliners vs. Improvers	1.95	(.90, 4.24)
Prison Incarceration Rate					
Pattern of Change					
Improvers	18.9	(12.0%, 25.8%)	Continuing vs. Improvers	1.13	(.50, 2.55)
Decliners	30.3	(20.7%, 39.9%)	Continuing vs. Decliners	.60	(.25, 1.44)
Continuing Users	20.8	(10.0%, 31.6%)	Decliners vs. Improvers	1.86	(.89, 3.91)

*
p < .05