

Article

## Pathways in the relapse—treatment—recovery cycle over 3 years

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### Abstract

For many individuals, substance use leads to a chronic cycle of relapse, treatment reentry, and recovery, often lasting for decades. This study replicates earlier work, documents the transition patterns within the cycle during a 3-year period, and identifies variables that predict these transitions. Data are from 1,326 adults recruited from sequential admissions to 12 substance abuse treatment facilities in Chicago, IL, between 1996 and 1998. Participants were predominantly female (60%) and African American (88%) adults. Participants were interviewed at intake, and at 6, 24, and 36 months post-intake follow-up rates ranged from 94% to 98% per wave. At each observation, participants' current status in the cycle was classified as (1) in the community using, (2) incarcerated, (3) in treatment, or (4) in the community *not* using. The transitional probabilities and correlates of pathways between these states were estimated. Over 83% of the participants transitioned from one point in the cycle to another during the 3 years (including 36% two times, 14% three times). For the people in the community, about half remained in the same status (either using or abstinent) and just under half transitioned. The majority of people whose beginning status was incarceration or in-treatment also transitioned by the end of the observation period. While there was some overlap, predictors typically varied by pathway and direction (e.g., *using* to *not using* vs. *not using* to *using*). These results help demonstrate the need to adopt a chronic vs. acute care model for substance use. While exploratory and observational, several of the predictors are time-dependent and identify promising targets for interventions designed to shorten the cycle and increase the long-term effectiveness of treatment. © 2005 Elsevier Inc. All rights reserved.

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### 1. Introduction—The chronic and cyclical nature of addiction: relapse, treatment reentry, and recovery

Although most people who use substances eventually abstain or manage their use without the aid of either professionally directed treatment or self-help groups (Burman, 1997; Cunningham, 1999; Humphreys, Moos, & Finney, 1995; Sobell, Ellingstad, & Sobell, 2000; Toneatto, Sobell, Sobell, & Rubel, 1999; Watson & Sher, 1998), over the past several decades a growing body of evidence suggests that a subset of substance users suffers from what appears to be a more chronic condition whereby they cycle through periods of relapse, treatment reentry, recovery, and

incarceration, often lasting several years (Anglin, Hser, & Grella, 1997; Anglin, Hser, Grella, Longshore, & Prendergast, 2001; Hser, Anglin, Grella, Longshore, & Prendergast, 1997; White, 1996). Moreover, of the people with lifetime dependence who eventually achieved a state of sustained recovery, the majority did so after participating in treatment—ranging by substance from cannabis (43%) to cocaine (61%), alcohol (81%), and heroin (92%; Cunningham, Koski-Jannes, & Toneatto, 1999; Cunningham, Lin, Ross, & Walsh, 2000).

Despite the fact that longitudinal studies have repeatedly demonstrated that substance abuse treatment is associated with major reductions in substance use, other studies demonstrated that after discharge, relapse and eventual readmission are also common, particularly when addiction is accompanied by one or more psychiatric problems (Godley, Godley, Dennis, Funk, & Passetti, 2002; Lash, Petersen, O'Connor, & Lehmann, 2001; McKay et al., 1997; McKay et al., 1998). Further evidence of this cycle of relapse,

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treatment reentry, and recovery is provided through statistics for people admitted to the U.S. public treatment system in 1999, in which 60% were reentering treatment, including 23% for the second time, 13% for the third time, 7% for the fourth time, 4% for the fifth time, and 13% for six or more times (Office of Applied Studies, 2000). Retrospective and prospective treatment studies report that most participants initiate three to four episodes of treatment over multiple years before reaching a stable state of abstinence.

The pioneering work of Hser and colleagues using event-history analysis clearly showed that individuals move along different pathways, transitioning between various points in the addiction treatment career cycle, e.g., using in the community, treatment, incarceration, abstinence in the community, and death (Anglin et al., 1997; Hser, Hoffman, Grella, & Anglin, 2001; Hser et al., 1997). A next step in understanding more about the various pathways in this cycle is to learn more about the frequency with which individuals transition from one point in the cycle to another. This is important because cumulative rates alone fail to inform us about movement at the individual level. For example, a stable rate of 40% of the people *being in the community using* 2 years in a row does not tell us if this is the same 40%, a totally different set of people, or a mix of continuing and new people. Knowing more about the frequency of transitions for individuals can guide interventions designed to shorten the cycle between relapse, treatment, and recovery. For example, Scott and Dennis (2003) developed and tested a recovery management model that incorporates *quarterly* monitoring of these transitions. Knowing more about the frequency and length of time between these transitions could guide the frequency with which monitoring and aftercare are provided.

Another important line of inquiry for developing interventions focuses on identifying the variables that predict the different pathways or types of transitions. A number of long-term studies have investigated changes in substance use following treatment (see review by McKay & Weiss, 2001). Some of the factors related to reductions in use include psychiatric status, substance use severity, treatment progress, 12-step involvement, motivation, family/social environment, and fewer post-treatment problems in other associated areas (Bischof, Rumpf, Hapke, Meyer, & John, 2001; Jin, Rourke, Patterson, Taylor, & Grant, 1998; Koski-Jannes & Turner, 1999; McKay & Weiss, 2001; Ouimette, Moos, & Finney, 1998). However, most of this research has focused on factors related to relapse and only at a single follow-up time point. The stability of these predictors across time and their interrelationship is not well understood. Moreover, identifying the predictors for transitions from one point in the cycle to another (e.g., abstinence to relapse) does not inform us about movement on the same pathway but in the opposite direction (e.g., relapse to abstinence) or other pathways (e.g., relapse to treatment).

This first goal of this paper is to replicate prior work demonstrating that individuals move along various path-

ways in the addiction-recovery cycle. The second goal is to begin exploring the rates at which these individuals transition along one pathway to another. The third goal is to identify variables that predict the various types of pathways or transitions in the cycle. While the cycle includes pathways involving death and incarceration, this paper focuses only on the pathways that involve relapse, treatment, and abstinence. Pathways involving death and incarceration will be addressed in later papers.

## 2. Methods

### 2.1. Data source

As part of the original Chicago Target Cities study (Scott, Muck, & Foss, 2000; Scott, Foss, & Sherman, 2003a, 2003b), a sample of 1,326 participants was recruited between 1996 and 1998 from sequential admissions to 12 substance abuse treatment facilities operated by 10 agencies on Chicago's west side and from the central intake unit serving these programs. Data was collected at four points over a 3-year period and organized into three transition periods: (a) intake to 6 months, (b) 6 to 24 months, and (c) 24 to 36 months. Follow-up interviews were completed with 98% of the participants at 6 months, 94% at 24 months, and 94% at 36 months, excluding deceased participants (see Scott, Foss, & Dennis, 2003, for more detailed methods).

The analyses used in this study (see section 2.5, Analytic methods) excluded only those deceased at 36 months ( $n=34$ ), reducing the sample to 1,292 (97%). The data was divided into pathway subsets based on the starting point of each transition period: (a) *in the community using*, also referred to as *relapse*, (b) *in treatment*, (c) *in the community not using*, also referred to as *abstinence*, and (d) *incarcerated*. These data were then collapsed in an effort to obtain stable estimates of transition probabilities over time. The prediction analyses were restricted to transitions where at the beginning of the period the person was either *in the community using* or *in the community not using*. The goal of these subgroup analyses was to identify predictors that distinguish between participants who transitioned from these two points in the cycle to either the opposite status or to treatment at the end of the period. Low base rates over the 3-year period limited the number of observations and power needed to examine the remaining two subgroups (those starting from treatment; those starting from incarceration). Whether or not these smaller subgroups are examined does not impact the current subgroup analysis because (by definition) they were not in the other subgroups.

### 2.2. Instruments and measures

#### 2.2.1. Augmented Addiction Severity Index (A-ASI)

The primary study instrument was based on the Addiction Severity Index (ASI), fifth ed. (McLellan, et al.,

1992), which was enhanced to form the Augmented ASI by adding more detailed questions/scales in each section (Scott, Dennis, Godley, & Foss, 1995). The internal consistency of the ASI composite scores (CS) was typically 0.7 or better, and test-retest reliabilities were generally between 0.7 and 0.9, which are comparable or better than values reported in other published studies (see Scott, Foss, & Dennis, 2003, for more details).

### 2.2.2. Measures

The dependent variable for this study was based on the point in the cycle (relapse, treatment, recovery, incarceration) where the participant ended the observation period. At intake and at each follow-up wave, the participants were classified into one of four mutually exclusive categories. A participant was classified as *incarcerated* if during the 30 days prior to the interview the person had spent 15 or more days in jail, prison, or was otherwise incarcerated. A participant was classified as *in treatment* if the person was receiving inpatient or outpatient substance abuse treatment at the time of the interview and was not classified as incarcerated. A participant who was not incarcerated or in treatment and was using substances was classified as *in the community using (relapse)* if during the prior 30 days the participant reported any illegal substance use, intoxication, or reported experiencing any days of alcohol- or drug-related problems. Finally, if there was no use of an illegal drug, intoxication, or days with drug- or alcohol-related problems in the prior 30 days, a participant was classified as being *in the community not using (abstinent)*. In a subsample of 77 people, the 2-day test-retest reliability of this classification scheme was high ( $Kappa = .69$ ).

A combination of variables related to abstinence, relapse, and treatment entry were identified in the literature (see, e.g., Bischof et al., 2001; McKay & Weiss, 2001; Scott, Foss, & Dennis, 2003). The predictor variables were conceptually divided into two types: (a) static and (b) time-dependent variables. Static variables are those that do not vary over time or were fixed at the time of the intake interview. The static variables include (a) gender, (b) age of first illegal drug use (including amphetamines and methamphetamines, barbiturates and other sedatives, crack and other forms of cocaine, PCP and other hallucinogens, heroin, street methadone and other opiates, inhalants, marijuana and other forms of cannabis) or alcohol to intoxication (5+ drinks or feeling drunk), (c) number of arrests lifetime at intake, (d) number of prior substance abuse treatments at intake, and (e) number of months of incarceration. The time-dependent variables varied over time and were measured either at the starting point of the transition period or during the transition interval. Time-dependent variables include (a) the General Mental Distress Index (GMDI), (b) ASI Legal Composite Score at the beginning of the period, (c) self-reported current homelessness at the beginning of the period, (d) number of friends who are clean and sober (rated as 0 = none, 1 = a few, 2 = some, 3 = most, 4 = all) at the beginning of the period,

(e) weeks in treatment during the period, (f) number of 12-step sessions attended during the period, and (g) a dummy variable for the length of the transition period (6 or 12 vs. 18 months). The GMDI (Dennis et al., 1995; Dennis, 1999) is based on factor and item response analyses of the Hopkin's Symptom Checklist 90 (Dennis, Scott, Lennox, Funk, & McDermeit, in press; Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974) and is a symptom count of internal sources of distress (somatic, depressive, and anxiety-related disorders) with a high internal consistency ( $\alpha = .9$ ) in this sample and the prior literature (see Scott, Foss, & Dennis, 2003).

### 2.3. Treatment system

Participants were recruited from Illinois's Treatment Service Delivery Network 4, which draws over half of its participants from Chicago's west side and provides access to all levels of care. From 1996 to 1997 a stratified sample of 1,326 participants were recruited from 22 treatment units (10 outpatient drug-free programs, five intensive outpatient drug-free programs, three methadone maintenance programs, two short-term inpatient programs, one long-term inpatient program, and one halfway house) operated by 10 agencies in these communities/networks. Eighty-four percent of the participants were in treatment at some point in the study, 55% had multiple episodes of care, and 29% went to both residential and outpatient levels of care. Thus here we have focused on "any" treatment and not divided people by specific episodes or level of care.

### 2.4. Participant characteristics

The study participants were predominantly female (59.6%). Their racial/ethnic distribution was African American (87.6%), Hispanic (7.0%), white (4.8%), and other (0.5%). The average age was 34.2 years at the time of the intake assessment. Two thirds of the participants (65.2%) were never married, and half (51.1%) never received a high school degree or GED. About one third (32.1%) reported being homeless at intake. At intake, 82% of the participants had used tobacco in the previous 6 months (all subsequent discussion of substance use excludes tobacco). The average age of first use of an illegal drug or alcohol to intoxication was 16.8 years of age, with an average of 14.4 years of regular use (frequent use, e.g. weekly or a pattern of use for 6 or more months out of the year) of one or more of the following substances: amphetamines or methamphetamines, barbiturates or other sedatives, crack or other forms of cocaine, PCP or other hallucinogens, heroin, street methadone or other opiates, inhalants, marijuana or other forms of cannabis, or alcohol to intoxication (5+ drinks or feeling drunk). Of the 82% who had used cocaine in their lifetime, the average years of regular use was 8, and 42% (35% of all participants) were using it weekly or more often at intake. Of the 68% who had used alcohol to intoxication

in their lifetime, the average years of regular use was 12, and 30% (21% of all) were using it weekly or more often at intake. Of the 54% who had used heroin in their lifetime, the average years of regular use was 9, and 57% (31% of all users) were using it weekly or more often at intake. Of the 73% who had used marijuana in their lifetime, the average years of regular use was 8, and 11% (8% of all) were using it weekly or more often at intake. Among the 49.1% who reported a month or more of abstinence (post regular use) from their substance(s) of abuse (i.e., substance that they had used regularly, that caused problems, or for which they had received treatment for their use), the average length of their last period of abstinence was 10.4 months. The majority (64.4%) had received substance abuse treatment prior to the intake assessment for this study, with an average of 2.5 prior episodes and 26.2% having 3 or more prior treatment events. Participants self-reported symptoms on the GMDI and A-ASI suggesting a range of other problems, including major depression disorders (36.7%), generalized anxiety disorder (36.6%), lifetime arrests (76.6%), lifetime convictions (49.9%), and currently being on probation or parole (24.9%). Among those who had ever been incarcerated, 38.8% spent an average of 30 months of their life incarcerated. Close to half (50.6%) reported having been in some kind of controlled environment (e.g., residential treatment, hospital, jail, prison) during the 6 months before study intake.

### 2.5. Analytic methods

Repeated measures multinomial logistic regression was conducted using the point in the cycle where participants ended the transition period (intake to 6 months, 6 to 24 months, and 24 to 36 months) as the outcome measure. Separate analyses were conducted depending on whether the starting point of the transition period was *in the community using* or *in the community not using*. The model was fit using a full-information maximum likelihood, mixed-effects multinomial logistic regression procedure (MIXNO; Hedeker, 1998, 1999). A random intercept term was used to account for individual differences in average response probabilities over time. The maximum likelihood has been shown to be the best estimation method, both under conditions of model misspecification and non-normality (Olsson, Foss, Troye, & Howell, 2000), and for handling missing data (Enders & Bandalos, 2001). The full-information maximum likelihood uses all outcome data available for an individual by assuming that any missing outcome data is missing at random and can be ignored without bias. Given the high follow-up rates in this study, the effect of missing data is small and the assumption of missing at random deemed tenable. However, if any one of the predictor variables was missing for an outcome, all data for that outcome would have been deleted from the analysis. This can result in a significant loss of data even when the overall amount of missing data is small. In this study, whenever the follow-up

interviews were conducted, there were very little missing data among the predictor variables (i.e., typically less than 1%); therefore, it was decided to replace these missing data with imputed values using a hot-deck imputation procedure (Schafer, 1989). This was done by grouping participants based on their gender, age, and the level of care to which they were referred at intake. Missing values were then replaced with values selected at random, with replacement, from the corresponding group. This keeps both the mean and variance unbiased.

This analytic model is related to a first-order Markov Model with predictor variables; however, instead of modeling all the transitions simultaneously using starting status as a predictor variable, we decided to analyze specific transitions conditioned on the starting status. This approach eliminated the need for a large number of interaction terms (starting status by each predictor variable) because the optimal set of predictors depended on the starting status. In addition, the present model controls for within subject variability rather than treat repeated observations as independent (e.g., Bonney, 1986).

## 3. Results

### 3.1. Characterizing the pathways in the addiction-recovery cycle

To examine the various pathways that participants moved through over 3 years, at each observation point participants were classified into one of four points in the addiction-recovery cycle (in the community using, incarcerated, in treatment, and in the community not using). Consistent with the earlier literature, the percent of individuals at each point in the cycle changed from intake to 36 months: going from 80% to 39.6% for *in the community using*, 3.6% to 8.9% for *incarcerated*, 15.5% to 10.3% for *in treatment*, and 8.3% at intake to 41.2% for *in the community not using*.

This status was then compared with the person's status at the next follow-up wave. The transition probabilities—that is, the probability of each ending point in the path conditioned on the starting point of the participant—are reported in Table 1. The rows reflect starting points (for each period) and the columns reflect ending points in the path. Along the block diagonal (in boldface) are the probabilities of remaining in the starting status. The final row of each set is the “average” probability across observations of transitioning along each pathway.

A couple of significant patterns emerge from the data and are noted in Table 1. For the two largest groups (*in the community using*—starting status of 60.1% of all the transitions—and *in the community not using*—starting status of 25.5% of all the transitions), over half continued in the same status with the probability of remaining in this status increasing over time (see probabilities in the boldface diagonal values of Table 1). Thus for those *in the*



Table 1  
Probabilities of continuation (***bold italics***) and transition in recovery status

Starting status	Transition Periods		Ending status			
	Starting <sup>a</sup>	Ending	In the community and using	Incarcerated	In treatment	In the community and not using
In the community and using	Intake (80.3%)	6 months	<b>.514</b>	.045	.163	.279
	6 months (49.4%)	24 months	<b>.523</b>	.104	.080	.294
	24 Month (41.6%)	36 months	<b>.576</b>	.059	.099	.266
	[Average across periods (60.1%)]		[.530]	[.064]	[.126]	[.280]
Incarcerated	Intake (3.6%)	6 months	.370	<b>.174</b>	.065	.391
	6 months (5.2%)	24 months	.262	<b>.446</b>	.077	.215
	24 months (10.6%)	36 months	.302	<b>.395</b>	.093	.209
	[Average across periods (6.4%)]		[.304]	[.367]	[.083]	[.246]
In treatment <sup>b</sup>	6 months (15.5%)	24 months	.295	.047	<b>.181</b>	.477
	24 months (8.7%)	36 months	.330	.028	<b>.264</b>	.377
	[Average across periods (8.0%)]		[.308]	[.040]	[.211]	[.441]
	Intake (8.3%)	6 months	.340	.076	.085	.500
In the community and not using	6 months (29.9%)	24 months	.328	.081	.054	<b>.538</b>
	24 months (39.0%)	36 months	.245	.051	.074	<b>.631</b>
	[Average across periods (25.5%)]		[.288]	[.065]	[.067]	[.580]

<sup>a</sup> The percentage of participants at each starting period with the corresponding starting status (Intake  $N=1,276$ ; 6 months  $N=1,246$ ; 24 months  $N=1,216$ ).

<sup>b</sup> By design there were no participants in treatment at Intake.

community using at one time point, 51.4% to 57.6% were also in the community using at the next time point; for those in the community not using (abstinent) at one time point, 50.0% to 63.1% were in the community not using at the next observation time. Incarceration and treatment were more transitory points in the cycle, with over half of the people transitioning to a different point in the cycle.

Across all conditions and waves, 83.3% of the people transitioned from one point in the cycle to another one or more times (including 35.6% two times and 14.4% three times). Almost half of the participants transitioned between each wave: 49.9% between intake and the 6-month follow-up, 53.0% between 6 and 24 months, and 44.9% between 24 and 36 months. Thus transitioning from one point to another in the addiction-recovery cycle was common.

### 3.2. Predicting pathways in the cycle

The second goal of this study was to identify factors that predict the pathways from (a) being in the community using to being in the community not using, (b) being in the community not using to being in the community using, (c) being in the community using to treatment, and (d) being in the community not using to treatment. A key question is whether the same set of variables predicts the different pathways in the cycle. Within each subgroup, transitions were predicted using a mixed-effects multinomial logistic regression with the MIXNO program (Hedeker, 1998, 1999). In each analysis the reference group was the participants staying at the same point in the cycle (i.e. in the same subgroup). Autocorrelations within individuals were controlled over time by including a random intercept term. The analyses were done using each person's starting point. For those starting in the community using we compared

participants who did not transition with those who (a) transitioned to in the community not using and then with those who (b) transitioned to treatment. For those starting in the community not using, we compared those who did not transition with those who (a) transitioned to in the community using and then with those who (b) transitioned to treatment. The same set of predictors was examined in each analysis; however, only the significant predictors are presented in the tables.

Reported in Tables 2 and 3 are the odds ratios for each predictor. An odds ratio greater than 1 indicates that participants with high scores on the predictor were more likely to transition to the comparison point in the cycle than remain in the current status. Odds ratios below 1 indicated that persons with high scores on the predictor were more likely to remain in the current status than to transition. For continuous predictor variables, the odds ratios were based on the change in odds when the predictor variable increased one *SD* (based on the variance at intake—except for the variables “time in treatment” and “number of 12-step sessions attended,” which were based on the variance at 6 months). For dichotomous predictor variables (e.g., gender) the odds ratio was based on comparing one level of the variable (male) to the other (female). For the rating of friends involved in drugs or alcohol (a polychotomous variable) the odds ratio is based on the difference between adjacent categories.

#### 3.2.1. Pathways between relapse and recovery

Table 2 includes the six factors that predicted the pathway from in the community using (relapse) to in the community not using (abstinent). Relative to those who continued using, those who made the transition to abstinence: (a) were older when they first used drugs or alcohol

Table 2  
Odds ratios of transitioning between using and being abstinent while living in the community

Predictor	Mean <sup>a</sup>	SD <sup>a</sup>	From using to abstinence	From abstinence to using
Static (from study intake)				
Gender (female)	–	–	–	0.58***
Age of first use/intoxication	16.8	5.39	1.12**	–
Number of arrests, lifetime	7.27	13.72	–	0.86**
Number of prior treatments	1.60	2.18	–	1.21***
Time Dependent <sup>b</sup>				
General mental distress	5.53	5.55	0.88**	–
ASI Legal CS	0.14	0.21	0.84***	0.84***
Homeless	–	–	1.27*	1.64*
Amount of friends who are clean and sober (none, a few, some, most, all)	–	–	1.23***	0.82***
Weeks in treatment	8.93	8.84	1.14**	–
Number of 12-step sessions	53.05	77.63	–	0.55***
Long Period of Transition <sup>c</sup>	–	–	1.26*	1.41**

<sup>a</sup> The mean and standard deviation (*SD*) at intake of continuous variables. The odds ratios are based on a one *SD* increase in the predictor. For categorical variables the odds ratio represents the difference between adjacent categories.

<sup>b</sup> Time-dependent variables in that the predictor was a measure of the status at the start of the transition period or what occurred during the period.

<sup>c</sup> Transition period from 6 to 24 months (18 months elapsed) vs. other transition periods (6 to 12 months in duration).

\*  $p < 0.1$ .

\*\*  $p < 0.5$ .

\*\*\*  $p < 0.01$ .

to intoxication, (b) reported fewer symptoms of mental distress, (c) had fewer legal problems, (d) were more likely to be homeless, (e) had more non-using friends, and (f) spent more time in treatment during the follow-up period. The odds of this type of transition were also higher (1.26) for the longest transition period observed (from 6 to 24 months).

Table 2 includes the eight factors that predicted the pathway from *abstinence* to *relapse*. Relative to those who continued *abstinence*, individuals who relapsed back into being *in the community using* were more likely (a) to be males, (b) to have fewer arrests in their lifetime, (c) to have more prior treatments at intake, (d) to have fewer legal problems, (e) to be homeless, (f) to have fewer friends who are clean and sober, and (g) to have attended fewer 12-step sessions in the 6 months prior to the transition period. The odds of this transition were also higher (1.41) for the longest period observed (6 to 24 months) vs. the two shorter periods (0 to 6 months or 24 to 36 months).

Of the 11 variables in this table, one predicts these pathways in a consistent direction (sober friends were

associated with transition to and staying in abstinence), three predict transitions in either direction (ASI legal composite score, homelessness, and period duration), and the remaining seven factors were unique to the type/direction of the pathway.

### 3.2.2. Pathways to treatment

For those starting *in the community using*, Table 3 shows the four variables that predict transitions to *treatment*. Relative to those who continued using, those who transitioned to treatment were more likely to (a) be female, (b) have more months of incarceration in their lifetime prior to intake, (c) be homeless, and (d) have participated in more weeks of treatment during the transition period. For those starting the period *not using*, Table 3 shows the three factors that predict who transitioned to *treatment*. Relative to those who continued to be abstinent, those who transitioned to treatment were more likely to (a) have more legal problems, (b) be homeless, and (c) have attended more 12-step sessions in the last 6 months of the period. Of the six factors in this table, one predicts transitions in a consistent direction toward treatment for both pathways (homelessness), and the remaining five factors were unique to the type/direction of the path.

### 3.3. Other potential factors

The literature suggests that several other variables might help predict the above transitions. To check for spurious findings and/or model misspecification, we verified that over a dozen other variables frequently cited in the literature did not contribute (i.e., were not significant) to the existing models. In addition to the variables above, we tested intake

Table 3  
Odds Ratios for transitioning to treatment by starting status

Predictor	Mean <sup>a</sup>	SD <sup>a</sup>	From using to treatment	From abstinence to treatment
Static (From study intake)				
Gender (female)	–	–	1.98***	–
Months incarcerated lifetime	11.59	32.43	1.20*	–
Time Dependent <sup>b</sup>				
ASI Legal CS	0.14	0.21	–	1.46**
Homeless	–	–	2.53***	3.59***
Weeks in treatment	8.93	8.84	1.65***	–
Number of 12-step sessions	53.05	77.63	–	1.49***

<sup>a</sup> The mean and standard deviation (*SD*) at intake of continuous variables. The odds ratios are based on a one *SD* increase in the predictor. For categorical variables the odds ratio represents the difference between adjacent categories.

<sup>b</sup> Time dependent variables in that the predictor was a measure of the status at the start of the transition period or what occurred during the period.

\*  $p < .1$ .

\*\*  $p < .5$ .

\*\*\*  $p < .01$ .

variables including age, race, number of children, public-aid status, medical status, involvement with the criminal-justice system (e.g., probation, parole), treatment mandates, years of regular substance use and dependence, as well as their status at the beginning of each period in terms of current substance use, illegal activity, health problems, emotional health status, employment activity, and family/social environment (e.g., living with a substance user, interpersonal conflict). None of these variables were significant with the existing variables in the model; nor did any of them replace the reported variables when tested with step-wise regression.

## 4. Discussion

### 4.1. The chronic cyclical nature of addiction

Using a large, clinically heterogeneous sample, the findings from this study replicated and expanded upon prior work (Anglin et al., 1997; Hser et al., 1997, 2001) that focused on the chronic and cyclical nature of addiction and treatment. In this study, data were used to learn more about the pathways between relapse, treatment reentry, and recovery (in 12-month intervals) over a 3-year period.

While there are indications of stability between consecutive waves, the data also revealed a significant number of transitions between points in the addiction, treatment, recovery cycle during the 3-year period. Between intake and the 6-month follow-up, 49.9% of participants moved from one point in the cycle to another; between 6 and 24 months, 53.0% transitioned; and between 24 and 36 months, 44.9% moved to a different point in the cycle. Moreover, while the percentage of the sample at each point in the cycle appears relatively stable at the group level (e.g., between 30% and 40% of participants were abstinent at any one follow-up wave), only 10.6% of those abstinent at 6 months continued to be abstinent at 24 and 36 months, revealing that although the rates are stable for the points in the cycle, different people are included. Likewise, those who were in the community using did not remain at this point in the cycle; only 16.2% of participants remained here. These results clearly demonstrate that for some, substance abuse is a chronic condition that involves movement along the various pathways in the cycle over years.

### 4.2. Dominant patterns

These analyses also revealed the existence of certain dominant patterns or pathways. For example, there was a steady increase in the overall rate of *being in the community abstinent*, as well as an increase in the rate of once abstinent continuing to remain abstinent. At each follow-up wave the rates of abstinence increased: 29.9% at 6 months, 39.0% at 24 months, and 41.2% at 36 months. Among those abstinent at one time point, the rate of abstinence at the next observation increased from half to almost two thirds (see

boldface values in the lower right-hand corner of Table 1). The other pattern revealed by these analyses was that the most likely status at the next observation was the current status of the participant—those using at one time point were most likely to report use at the next time point, those abstinent were most likely to continue their abstinence the next time we observed them, and so forth (the boldface diagonal values in Table 1). However, one important exception to this pattern was observed when individuals who were in treatment were more likely to have transitioned to *being in the community abstinent* than remain in treatment at the next observation.

### 4.3. Predicting pathways

The second goal of this study was to identify variables that predicted transitions from one point in the cycle to another; that is, those variables that predict status at the following wave conditioned on the starting status. A number of variables were related to transitions within the cycle across the 3-year period. However, these preliminary findings suggest that the optimal set of variables used to predict the various transitions in this cycle differ by pathway. Namely, the variables that predict relapse (gender, number of arrests, number of prior treatments, ASI Legal CS, homeless status, number of sober friends, number of 12-step sessions attended) differ from the variables that predict transitions to abstinence (age of first use, general mental distress, ASI Legal CS, homeless status, number of sober friends, number of weeks of treatment). Identifying predictor variables can help guide the development of treatment approaches that can sustain recovery and/or facilitate movement down one pathway over another (e.g., transitions from negative points in the cycle to positive ones).

The analyses also produced another critical finding regarding treatment: predictor variables for transitioning to treatment depended on the status at the start of each wave (using vs. not using). As shown in Table 3, when the pathway involved starting *in the community using* and transitioning to *treatment*, predictor variables included gender, number of months of lifetime incarceration, homeless status, and number of weeks of treatment. In contrast, when the pathway involved transitioning from *not using* to *treatment*, the predictors included the ASI Legal composite score, homeless status, and the number of 12-step sessions attended during the last 6 months of the period. The only overlap in these two sets of predictors was homeless status. In both transitions, being homeless increased the odds of returning to treatment.

Two of these factors appear to predict general “instability” rather than the direction of the transition per se. Homeless participants were more likely to transition no matter what their starting status, especially when transitioning into treatment. This suggests that these participants may be using substance abuse treatment as a path out of homelessness in addition to being a road to abstinence. On the other hand, participants were less likely to transition when they had

current legal problems, which possibly commanded their full attention. The mechanisms through which these or other variables affect general stability will require a focused investigation that is beyond the scope of this paper.

Another finding seen in both Tables 2 and 3 is that the majority of the predictor variables were time dependent. This suggests that the transition process is time dependent insofar as the factors that distinguish between individuals that transition involve the person's environment and behaviors just prior to the transition. Understanding and impacting this process and the pathway to sustained recovery will require frequent monitoring and timely interventions (Scott & Dennis, 2003).

#### 4.4. Limitations

While this data set served to document various pathways in the cycle of relapse, treatment reentry, and abstinence, it is likely that during the period between observations, some portion of the sample experienced additional transitions that were not documented, resulting in the estimated frequency of transitions reported here as an underestimate. Data on short transition periods (e.g., weekly, monthly, quarterly) could further our understanding of the frequency and stability of transitions in the cycle. Knowing the frequency with which individuals transition from one point in the cycle could help inform the frequency with which participants should be monitored in a recovery-management model, the optimal length and intervals during which aftercare might be provided, and optimal time-frames for interventions designed to shorten the cycle between relapse and recovery.

In this study we attempted to identify stable predictors of recovery status, those variables that predict status at the following wave conditioned on the starting status. We selected potential predictor variables from various domains and found that a number of variables were related to transitions across a 3-year period. However, this is an observational study and, as such, cannot establish causation. While we conducted secondary analysis to rule out over a dozen other variables frequently cited in the literature as potential predictors, there is always a risk of model misspecification when making prediction. Because this study started 10 years ago, the variables available for the analyses were limited by the original assessment instrument and do not include standardized measures of several concepts that we believe need to be addressed in future studies (e.g., substance use disorder diagnosis, co-occurring diagnoses, recovery environment, motivation). Nevertheless, these preliminary findings provide a starting point for further research.

#### 4.5. Conclusion and next steps

The results from this study provide additional support that addiction is a chronic condition often involving several transitions between relapse, treatment reentry, and recovery. This growing body of evidence clearly indicates the need for

a shift in the treatment system, the ways in which treatment professionals are trained, the expectations that clients and families have about their condition and treatment, and the way in which treatment is currently financed. Historically, substance use disorders have been treated within an acute care framework that led treatment professionals, clients, and their families to believe that a one-time treatment would "fix" the problem. Because relapse was labeled as a "failure" instead of part of the process, many claimed that treatment didn't work, while treatment professionals often blamed the clients. To move forward, the field will need to grasp the true understanding of addiction as a chronic condition, what that means for treatment and clients, and what it will require to finance it.

These findings also identified sets of variables that predict movement from one point in the cycle to another. Importantly, these preliminary findings suggest that the optimal set of variables predicting relapse may in fact differ from those predicting recovery. Moreover, the variables that predict the transitions to treatment depended on the beginning status (*using* vs. *not using*). In addition, homeless status was the only variable that predicted transitions across four pathways, which suggests that it is a critical variable when looking at ways of facilitating movement down one pathway and preventing movement down other pathways. An understanding of the factors influencing transitions in the recovery cycle will help focus assessment and monitoring of the assets and liabilities a person has for recovery and help individualize treatment, aftercare, and monitoring plans to address these factors. These results add to the existing body of literature that clearly demonstrates the need to address not only substance use disorders but the multiple co-occurring conditions that accompany them to maximize the success of treatment. In summary, improved documentation and understanding of the chronic and cyclical (relapse, treatment reentry, and recovery) nature of addiction is essential to improving existing treatments, developing new treatment approaches, finding ways to maximize movement down positive pathways, and prohibit movement down others, as well as restructuring the financing of treatment.

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