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## Variation in substance use relapse episodes among adolescents: A longitudinal investigation

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### Abstract

Substance use disorders are chronically relapsing conditions and there is a need to evaluate whether relapse precursors are consistent across multiple relapses. We identified latent groups of relapse characteristics over time in alcohol and substance use disordered adolescents following an inpatient treatment episode. Youth (N = 124; mean age = 16 years; 56% male; 60% Caucasian) were interviewed while in treatment and biannually during the first year after treatment to gather contextual information about first and second relapse episodes. We identified two latent classes of relapse precursors labeled *Aversive-Social* (41% at initial relapse; 57% at subsequent relapse) and *Positive-Social* (59% at initial relapse; 43% at subsequent relapse). Classes were stable in structure over time; however, only 61% of those assigned to *Aversive-Social* and 39% assigned to *Positive-Social* classes at initial relapse remained there for the subsequent relapse. Findings highlight the dynamic nature of relapse for youth and have important clinical implications.

### Keywords

Adolescence; Relapse; Latent transition analysis

### 1. Introduction

Alcohol and other drug problems among teens remain a widespread public health concern, with 4.6% of 12- to 17-year-olds meeting criteria for a past year DSM-IV alcohol use disorder, and 4.3% for a non-alcohol substance use disorder in 2009 (Substance Abuse Mental Health Services Administration, 2010). For those teens who enter substance abuse treatment, relapse prevention remains a primary treatment goal, and as such, is an ongoing concern for researchers and clinicians. Studies have increasingly articulated that multiple relapses are a normative part of addiction recovery for those who are diagnosed with an alcohol or other drug disorder (AODD) in adolescence (e.g., Chassin, Flora, & King, 2004), and that evaluation of substance-related outcomes from treatment should consider that

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relapse as a dynamic, rather than static process (Stout, 2000; Wang, Winchell, McCormick, Nevius, & O'Neill, 2002). In a review of processes that underlie addiction relapse among adolescents, Chung and Maisto (2006) call for relapse to be considered a “clinically significant change point in course that can cue an individual to carefully consider one’s status in the recovery process (p. 157).” In order to better characterize the clinical course of addiction recovery, and for treatments to help improve outcomes for AODD teens, it is important to address whether the predictors of relapse are consistent across first and subsequent relapses.

Cognitive and behavioral models of addiction relapse have emphasized the importance of identifying situational precursors to relapse, which can be used in building coping skills to manage such “high risk” situations among AODD individuals (Brown & Ramo, 2006; Witkiewitz & Marlatt, 2004). The cluster of high risk situations (internal and/or external) that an individual faces after treatment, combined with a lack of adequate coping skills, low self-efficacy, and positive use expectancies interact to explain an initial use episode (or “lapse”). Individuals who have experienced a lapse would be more vulnerable to using again when faced with a similar set of high risk situations. In a longitudinal examination of situational antecedents to substance use among club-drug using young adults in New York City, Starks and colleagues (Starks, Golub, Kelly, & Parsons, 2010) identified three clusters of substance users based on their most common antecedents including *Situationally Restricted*, *Pleasure Driven*, and *Situationally Broad* clusters. Clusters were replicated 12 months after the initial examination in the same sample, supporting the cognitive behavioral model assumption that relapse precursors remain stable over time in young adults. Research identifying the most common relapse precipitants in adolescents has tended to examine only initial relapse episodes (Ramo & Brown, 2008; Shiffman, et al., 2007), leaving open the question of whether the situations that pose the highest risk for relapse early after treatment are the same as those in later periods. The present study is a first effort to articulate recurrent relapse contexts among AODD adolescents.

Prior research has characterized the most common situations that precipitate an initial relapse among adolescents. Social behavior, which peaks during adolescence across species (Varlinskaya & Spear, 2008), is a consistent dominant relapse precursor for adolescents (Anderson, Frissell, & Brown, 2007; Brown, Vik, & Creamer, 1989; Chung & Maisto, 2006; Cornelius, et al., 2003; Ramo, Anderson, Tate, & Brown, 2005; Ramo & Brown, 2008). Brown and colleagues (Brown, et al., 1989) demonstrated that most adolescents relapse in the presence of other people, are offered their first drink one or more times, and report experiencing direct or indirect social pressure to drink and/or use. In addition to social antecedents, AODD adolescents with comorbid psychiatric disorders such as depression, disruptive behavior disorders, and attention deficit-hyperactivity disorder tend to relapse when experiencing urges and temptations to use, and negative emotional states (Anderson, et al., 2007; Ramo, et al., 2005). Therefore direct or perceived social pressure exposure to peer use, and intrapersonal factors such as affective state and urges to use are critical precursors to relapse in adolescent samples overall.

Research studies are increasingly using latent-variable mixture modeling approaches to examine patterns of use in the addictive behaviors. Such approaches (e.g., latent class analysis [LCA], latent transition analysis [LTA]), seek to discover the underlying latent structure of discrete (categorical data), thereby identifying naturally-occurring mutually exclusive and exhaustive categories. Velicer and colleagues (1996) describe various applications of LTA to the study of relapse in adults, including comparing models of the stage of change process across time and examining the effects of a stage-based intervention for smoking cessation compared to a control condition. Ramo and Brown (2008) used LCA to examine patterns of situational precursors to relapse in both adolescents and adults. They

described two classes of relapse precursors in both age groups. Adult classes were one in which individuals primarily experienced urges and temptations to use coupled with a social situation (*Social & Urges* class), and those in which there was an internal negative emotion (e.g., sadness, anger), an external negative situation (fight with partner, peer), accompanied by urges and temptations to use (*Negative & Urges* class). Youth patterns were characterized by a *Social & Positive* class of those most likely to relapse in social situations coupled with positive emotional states (e.g., excitement), and a *Complex* class in which teens experienced a negative interaction, had a negative emotional state, had urges and temptations to use, and also found themselves in a social situation in which they had direct or indirect pressure to use. These findings indicated that social influence is a more common relapse precursor for adolescents than for adults in initial relapse episodes. An examination of multiple relapses after treatment would extend this research and determine whether this important developmental finding is consistent over time.

The present study used LTA to evaluate the situational antecedents of the first and a subsequent relapse episode in AODD adolescents after alcohol and/or drug treatment. We hypothesized that, consistent with results from Ramo and Brown (2008), two distinct relapse precursor classes would be evident and remain stable during the first year after treatment. Further, social influences, negative affect, and urges and temptations to use were expected to be pervasive across both relapse episodes (Brown, et al., 1989; Ramo, et al., 2005; Ramo & Brown, 2008).

## 2. Materials and methods

### 2.1 Participants

Participants for the present study were drawn from a longitudinal study of two cohorts of youth in substance abuse and mental health treatment (total N = 207), with sample characteristics and attrition rates described in detail previously (Tomlinson, Brown, & Abrantes, 2004). Youth age 13 to 18 who met DSM-III-R (American Psychiatric Association, 1987) criteria for alcohol and/or substance use disorder were recruited from seven adolescent inpatient alcohol and drug and psychiatric treatment programs in the San Diego area. Programs were two to six weeks long; abstinence focused, and included lectures, as well as group, individual and family therapy. Twelve step and cognitive-behavioral components were included in all programs (for details, see Brown, Myers, Mott, & Vik, 1994). Exclusion criteria for the parent study included: (1) residence more than 50 miles from the research facility, (2) lack of a parent to provide corroborative information, (3) inability to understand English, (4) a history of psychotic symptoms independent of substance use, and (5) history of brain trauma with loss of consciousness (> 2 minutes). The sample for the present study included only those youth who reported a distinct relapse episode in the first 6 months following treatment and another independent relapse between 6 and 12 months following treatment. Demographic and substance use characteristics of the final sample (n = 124) are presented in Table 1.

### 2.2 Procedure

The present study used data from a longitudinal study of youth treatment outcomes after substance abuse and mental health treatment (see for example, Tomlinson, et al., 2004). Consecutive admissions to seven San Diego area treatment facilities were screened and approached for study participation. Parents and teens signed University of California, San Diego Human Research Protections Program-approved consents and assents, respectively. Different research staff conducted teen and parent interviews to ensure privacy. The first assessment was conducted while teens were in treatment (after at least two weeks of abstinence). In-person structured interviews conducted privately in the participants' home or

research facility at 6 and 12-months after treatment discharge yielded detailed information about the first, and a subsequent independent relapse episode. Since adolescents in the present study all reported a history of alcohol abuse and typically abused multiple drugs, initial relapse was defined as the first use of alcohol, nonprescription drugs, or use of a prescription drug above recommended dose. Subsequent episodes were only considered relapses if there was a period of abstinence of at least two weeks before use. A random sample of 15% of subjects completed urine toxicology screens at the end of each assessment for corroboration of substance use reports.

### 2.3 Measures

**Adolescent characteristics**—The Structured Clinical Interview (Brown, et al., 1994) was administered independently to adolescents and parents by Bachelor- and Masters-level research staff. The interview evaluated sociodemographic characteristics, family history of AODD, adolescent motivation for drinking and drug abstinence, social pressure to drink or use, and exposure to substance abusing models.

**Relapse characteristics**—The Relapse Review (RR; Brown, et al., 1994), a structured interview based on the Contextual Cue Assessment (Marlatt & Gordon, 1985) modified for youth, was administered to each adolescent who acknowledged use during the assessment period. This measure has been used widely within our research group (Ramo & Brown, 2008). The first use of any amount of drugs or alcohol following treatment was considered the first episode based on research demonstrating that the initial use episode most often results in either a gradual or rapid return to use for adolescents (Brown, Tapert, Tate, & Abrantes, 2000). A subsequent relapse was assessed upon the occurrence of any use following a two-week period of sustained abstinence between six months and one year following treatment. There has been much debate about the definition of relapse (e.g., Chung & Maisto, 2006); however, epidemiological findings (Grant, et al., 2004) and treatment outcome studies (Brown, D’Amico, McCarthy, & Tapert, 2001) demonstrate that most relapsing youth use at least 8 days per month (averaging out to weekend use). Thus, in order to assess independent episodes in which teens were most likely motivated for abstinence rather than periods in which teens are unable to use due to environmental constraints (such as during the school week), and consistent with recommendations made for adults (Stout, 2000), use following two weeks of abstinence was used to define relapse.

The RR begins with a detailed, open-ended description of the relapse episode, and is followed by a series of structured questions regarding thoughts, feelings, actions, and setting before, during and after each use episode. Trained interviewers code applicability of each situational precursor based on Marlatt’s (1996) taxonomy and process characteristics from qualitative information. Each contextual precursor is coded present or absent for use in the analyses (i.e., multiple precursors may be present for a given use episode). Precursors used for the present study were: 1) negative intrapersonal situation (e.g., frustration, anger, anxiety, sadness); 2) negative physiological situation (e.g., experiencing pain, other health problems); 3) other intrapersonal situation (experiencing a positive emotional state, urge or temptation); 4) negative interpersonal situation (e.g., fight with parent or peer); and 5) social pressure situation (either in the presence or absence of a direct offer).

### 2.4 Analyses

LTA was used to examine the most likely patterns of relapse precursors longitudinally. Detailed statistical presentations of the general LTA framework are available in Humphreys and Janson (2000), and Reboussin et al. (1998). The analyses proceeded through the LTA process in several steps. First, LCA was employed to describe the common patterns of relapse contexts for AODD youth at both initial and subsequent relapse episodes. LCA is a

latent variable modeling technique that characterizes homogeneous populations within a larger sample who share common response patterns to categorical indicators (e.g., present/absent). Models of 1–4 classes were fit and standard criteria were used to compare the models. Model selection was based on goodness of model fit, parsimony, and adequacy of the model with respect to the research questions being posed. Four sets of criteria were used for selecting the optimal number of latent classes in factor mixture models as recommended by Muthén and Muthén (2000).

The first criterion was the Bootstrapped Parametric Likelihood Ratio Test (BLRT; McLachlan & Peel, 2000), a statistical test that extrapolates data to better represent the true distribution with smaller samples. This statistic tests for model improvement in each successive model over a model with one fewer class (Nylund, Asparouhov, & Muthén, 2007).

The second set of criteria was the Sample Size Adjusted Bayesian Information Criterion (saBIC; Sclove, 1987) and Akaike's information criterion (AIC; Akaike, 1973) statistics which balances two components: maximizing the likelihood and keeping the model parsimonious. A low saBIC or AIC value indicates a better model fit, and as such, the model with the lowest AIC and saBIC are generally preferred (Muthén & Muthén, 2000). Finally, the saBIC has specifically been used successfully with smaller samples (Lubke & Neale, 2006).

Third, the entropy value, while not a true measure of fit, was also considered. Ranging from 0 to 1, entropy is a measure of the clarity of classification. Although there is no clear cut point for the entropy value to ensure a minimum level of good classification, entropy values that are close to 1.0 indicate that a model has clearly identified individuals of different types and it can be a useful summary measure (Celeux & Soromenho, 1996; Muthén & Muthén, 2000; Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993).

A final criterion was the usefulness of the latent classes in practice. This is evaluated by the substantive interpretation of the classes in a given model, as well as the parameter estimates. For a given model, parameter estimates included (1) class membership or posterior probabilities and (2) class-specific conditional response probabilities (CRPs). With LCA, observations are classified into their most likely latent classes on the basis of the estimated posterior probabilities for the observations. High diagonal and low off diagonal values in the class classification table indicate good classification. CRPs reflect the probability that an individual within a particular class has relapsed in a particular situation. Based on the patterns of the estimated conditional probabilities, meaningful labels or definitions of the latent classes were made.

LTA was then used to examine the extent to which initial relapse patterns were comparable to subsequent relapse patterns. LTA is a longitudinal data analytic strategy, which assesses the probabilistic change in class membership over time with categorical latent variables (Chung, Park, & Lanza, 2005; Velicer, et al., 1996). This analysis extends LCA by assigning transition probabilities, which are conditional probabilities describing the probability of being in a given state at time =  $t$ , conditional on the state at time =  $t-1$ . We used LTA to model the stability of relapse situations from first relapse to subsequent relapse by testing various models based on the LCA solutions for first and subsequent relapse. Latent transition probabilities from the best-fitting model were then used to evaluate how individuals either relapsed in the same relapse class or changed classes over relapses. LCA and LTA were conducted with Mplus version 4.0 (Muthén & Muthén, 1998–2006), due to the availability of multiple model fit indices not available in other statistics platforms and the ease of employing randomized starting values.



### 3. Results

#### 3.1 Latent Class Model Selection

Relapse precursors were coded into five dichotomous variables (present/absent) for each individual at first and subsequent relapse. Proportions of youth experiencing each relapse precursor were evaluated across relapse episodes (Table 2). Compared to the first relapse episode, subsequent episodes had significantly lower endorsement of relapse in negative intrapersonal states and negative physiological states, and higher endorsement of interpersonal states.

Using LCA, models between 1 and 4 classes were fit for the first and subsequent relapse precursors, and model fit criteria are presented in Table 3. In both relapse episodes, relatively lower saBIC and AIC values, and significant BLRT values favored the 2- and 3-class solutions over the 1- and 4-class solutions. For the initial relapse, the saBIC and AIC values for the 2- and 3-class models were almost identical, and the significant BLRT value (12.56,  $p = .04$ ) only slightly favored the 3-class over the 2-class model. Entropy values were highest for the 4-class solution and lowest for the 2-class solution; but the model fit statistics were considered stronger drivers of best fitting-model in this case so only the parameter estimates of the 2- and 3-class solutions were evaluated for usefulness in practice. Conditional response probabilities (CRPs) for the 2- and 3-class models are presented in Tables 4 and 5, respectively. The 2-class model produced clearer discrimination of group membership (Table 4) relative to the 3-class model which had class membership probabilities closer to chance (Table 5). The 2-class model revealed two meaningful groups, whereas in the 3-class model, classes 1 and 2 were virtually indistinguishable from one another clinically (Table 5). This led to the choice of the 2-class model as the best-fitting model to describe the data from the initial relapse episodes.

At subsequent relapse, the saBIC, AIC and entropy values favored the 2-class model, while the BLRT indicated the 3-class model fit better than the 2-class model (Table 3). Comparing the CRPs across the 2-class and 3-class models, the 2-class model again produced clearer discrimination of group membership (Table 4), while the 3-class model had one class (Class 1) which had class membership probabilities closer to chance (Table 5). Taken together, the criteria indicated that the 2-class model again best fit the data.

#### 3.2 Latent Class Descriptions

The 2-class model defined two separate latent classes or profiles of relapse precursors (Table 4). One class represented those who were most likely to report relapse when experiencing a negative intrapersonal state, interpersonal frustration and anger, giving in to temptations in the presence of drug/alcohol cues, and coping with social pressure, and was thus labeled *Aversive-Social situations* (41% of individuals at initial relapse and 57% at subsequent relapse). The second class represented those who reported relapsing when experiencing a positive emotional state or “wanting to get high” and coping with social pressure and was thus labeled *Positive-Social* (59% of individuals at initial relapse and 43% of individuals at subsequent relapse).

An examination of subcategories of relapse precursors was conducted to further characterize the two most likely classes. Teens most likely to be in the *Positive-Social* class at either assessment reported a strong desire to “get high” (35.7% initial, 45.1% subsequent) and that they experienced social pressure (36.5% initial, 29.4% subsequent). Those assigned to the *Aversive-Social situations* class at either assessment most commonly endorsed a negative intrapersonal state (87.8% of initial sample, 82.4% at subsequent relapse), which was most often frustration and anger (26.5% of initial sample, 19.1% at subsequent relapse). This profile also included endorsement of giving into temptations in the presence of cues (44.9%

of initial sample, 30.9% at subsequent relapse) as well as social pressure (44.9% of initial sample, 26.5% at subsequent relapse).

### 3.3 Latent Transition Model Selection

We next fit a series of LTA models, with thresholds constrained to be invariant across time, evaluating model fit statistics, entropy, CRPs, and transition probabilities between classes. Although a 2-class solution was chosen to fit the first and subsequent relapse data best, it seemed fitting to test both 2- and 3-class solutions in the LTA to confirm these findings. Thus, transitional models with 2-class/2-class, 2-class/3-class, 3-class/2-class, and 3-class/3-class solutions were fit (Table 6). Based on lowest saBIC and AIC values, highest entropy value, and parsimony, the 2-class/2-class transitional model appeared to fit the data best.

### 3.4 Latent Transition Probabilities

Finally, to test the hypothesis that first relapse precursors predict subsequent relapse precursors, we examined the extent to which individuals in each initial relapse precursor class were in the same class for their subsequent relapse using the LTA. Latent transition probabilities for the 2-class/2-class model are presented in Figure 1. The *Aversive-Social situations* class was fairly stable over time, with 61% of youth assigned to this class at first relapse assigned to the same class at subsequent relapse, and 39% transitioned to the *Positive-Social* class. The *Positive-Social* class was less stable, with 39% of those assigned to this class at first relapse remaining there for the subsequent assessments, while 61% transitioned to the *Aversive-Social* class.

## 4. Discussion

The present study is the first to examine characteristics of multiple alcohol and drug relapses across time among youth following a treatment episode. Relapse precursors were found to have the same two primary patterns during both relapse episodes. One pattern consisted of adolescents reporting primarily social factors and wanting to get high as common relapse precursors (*Positive-Social* class), and the other was made up of teens who reported primarily negative personal factors and social pressure (*Aversive-Social situations* class). Class types were stable across the initial six months post treatment and 6- to 12-months post treatment when the subsequent relapse occurred; however almost half of adolescents relapsed in response to a different set of circumstances in their second relapse compared to their first use episode.

Relapse prevention treatment has traditionally emphasized assessment and feedback regarding specific types of situations that have posed the highest risk for relapse in a client's past (Ramo, Brown, & Myers, 2007). Given that many youth in the present study shifted relapse precursor classes from the first to subsequent relapse, findings suggest that clinicians should take a more general approach with youth, addressing the range of likely high risk situations for all teens before addressing the examples most salient for a particular client.

This study also suggests that for adolescents, there is a need to conceptualize negative internal (e.g., frustration, anger) and external (e.g., conflicts with parents, peers) situations as having similar or overlapping risk for relapse. This contrasts with prior research with adults which has highlighted differences between intrapersonal-environmental determinants and interpersonal determinants by categorizing relapse precursors as primarily internal or external (Marlatt, 1996). The present study indicates that in adolescents, negative internal and external factors appear to unfold together as a common set of precursors and clinicians should not consider these two relapse precursors as distinct. These findings parallel those found in studies of adolescents with AODDs and comorbid psychopathology demonstrating that relapse tends to occur in response to a combination of internal and external negative

states (Anderson, et al., 2007; Ramo & Brown, 2008). The present study is further evidence that relapse has both internal and external precursors that may play a different role for the individual across time. This highlights the importance of assessing the salient “high risk” situations fundamental to cognitive behavioral conceptualizations of relapse (Brown & Ramo, 2006; Marlatt & Donovan, 2005), but also in preparing for situations and personal experiences that may arise in the longer term.

The dominant clusters of relapse precursors found here suggest that for adolescents, social situational precursors dominate regardless of intrapersonal states (either positive, as in the Positive/Social class, or negative, as in the Aversive-Social class). This is consistent with developmentally focused models of substance use of adolescents and young adults, which suggest less discrimination among youth compared to adults and multiple or cumulative relapse determinants such as temptation and stress (Anderson, Ramo, & Brown, 2006; Christiansen, Goldman, & Brown, 1985). Clinicians should highlight social influence as one of the most high risk situations for all youth, and implement cognitive and behavioral strategies to help youth avoid and manage these situations (e.g., emphasize importance of non-using friends, strategies to remove oneself from unexpected situations of temptations, and to increase accuracy of risk assessments; Ramo, Myers, & Brown, 2007).

For this adolescent sample, nearly all participants reported social factors involved in their relapse, including giving in to social temptations and peer influence. Prior research has demonstrated social influences to be the most common precursors for adolescents during initial use following treatment (Brown, et al., 1989; Ramo, et al., 2005), and that most teens relapse in social situations when they were also seeking to enhance a positive emotional state (i.e., “get high;” Ramo & Brown, 2008). The current study expands this finding by demonstrating that over time, while the predominant groups of relapse precursors are likely to change for a given individual from one relapse to the next (i.e., teens move from one relapse class to another), social influences remain the most salient contextual features of teen return to use after treatment or a period of abstinence.

This study has limitations which must be acknowledged. First, there was a modest sample size. While latent variable techniques such as LCA/LTA generally required large sample sizes, these approaches have been used successfully with smaller sample sizes. For example, Bailey et al. (2007) used 76 dyads, Acosta et al. (2008) used 107 children, and Pears et al. (2009) used 117 children. Nonetheless, unstable class/profile solutions can result with modest sample sizes, and replication studies are needed to validate the specific classes found in the present study.

In addition, we did not consider the influence of some variables which are known to influence the relapse process (e.g., motivation, substances used during relapse). Future studies with larger samples should include these variables as potential covariates or predictors of relapse class membership and shifting of membership overtime. The present study was the first to examine multiple relapse episodes within individuals, and was therefore limited to participants who relapsed at least twice within one year following alcohol and drug treatment. We were thus not able to compare experiences of high risk situations between teens who relapsed more than once to those who relapsed once, and those who did not relapse after treatment. Future studies should examine this specific question.

The major profiles of the situational precursors to relapse, *Positive-Social* and *Aversive-Social situations*, differ by the additional influence of intrapersonal stress or interpersonal conflict as a precipitant to relapse. This could imply that substance use relapse risk for adolescents is cyclical, oscillating with levels of social pressure and personal influences. Relapse process variables such as coping, self-efficacy, and motivation for abstinence may



play an important role in differentiating members of these groups. Future research should explore process variables in relation to stability or change in relapse risk over time. This work highlights both the limited scope of precursors youth experience compared to that originally outlined for adults, and the dynamic nature of the relapse process as it unfolds over time.

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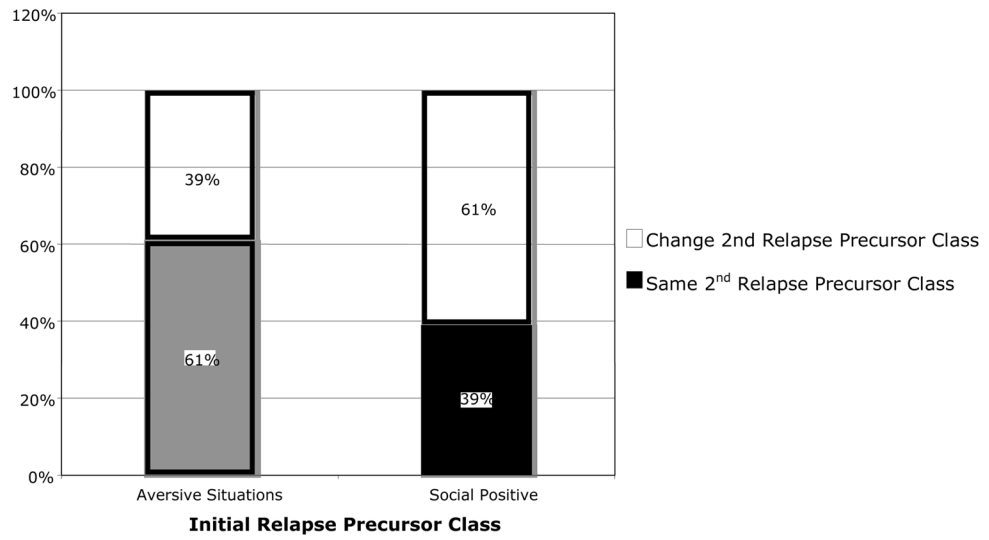
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**Figure 1.**  
Latent transition probabilities for 2-Class/2-Class solution

**Table 1****Background Characteristics of Alcohol/Drug Disordered Adolescents (N = 124)**

Age: M (SD)	16.07 (2.11)
Gender (% Male)	55.5
Years of School: M (SD)	9.23 (1.27)
	Range (6 to 11)
Hollingshead Index: M (SD)	31.11 (12.28)
	Range (11 to 65)
<u>Ethnicity (%)</u>	
Caucasian	59.7
More than one race	18.5
Hispanic	12.6
African American	5.9
Native American	0.8
Asian/Pacific Islander	0.8
Other	0.8
<u>Pretreatment Substance Involvement: Days/month, past 3 months: M (SD)</u>	
Alcohol	11.09 (12.81)
Marijuana	17.59 (12.36)
Stimulants	12.32 (12.47)
Other	1.35 (3.69)
<u>Pretreatment Drug of Choice (%)</u>	
Alcohol	7.0
Marijuana	43.0
Amphetamines	37.5
Barbituates	0.8
Hallucinogens	8.6
Cocaine	0.8
Poly-substance	0.8



**Table 2**

Proportion relapsed in each of five major relapse categories and corresponding minor relapse categories for first and subsequent relapse episodes (N = 124).

<b>Relapse Precursor</b>	<b>Initial Relapse (% yes)</b>	<b>Subsequent Relapse (% yes)</b>
<b>Negative Intrapersonal*</b>	<b>68.0</b>	<b>56.3</b>
Coping with frustration/anger	18.8	20.3
Coping with fear	0.8	1.6
Coping with depression	10.2	10.9
Coping with boredom	20.3	14.8
Concern about responsibility	6.2	1.6
Anxiety	9.4	4.7
Feeling like a failure	2.3	0.8
Other	0.0	1.6
<b>Negative Physiological States*</b>	<b>10.9</b>	<b>10.2</b>
Coping with pain, illness, injury, etc.	10.9	10.2
<b>Other Intrapersonal</b>	<b>91.4</b>	<b>89.1</b>
Get High	38.3	44.5
Test personal Control	8.6	3.9
Give into temptations in the presence of cues	43.0	35.9
Give into temptation in the absence of cues	1.6	3.9
Other	0.0	0.8
<b>Interpersonal*</b>	<b>33.6</b>	<b>35.2</b>
Coping with frustration/anger	15.6	14.1
Feeling criticized	3.1	3.9
Feeling rejected	1.6	4.7
Disappointment in a person (feeling let down)	1.6	2.3
Tense around others	4.7	5.5
Nervous/Uptight around the opposite sex	4.7	3.1
Other	2.3	1.6
<b>Social Pressure</b>	<b>72.7</b>	<b>71.9</b>
Coping with direct social pressure (offer)	50.0	44.5
Coping with indirect social pressure (cues, but no offer)	22.7	27.3

*Note.* Five major relapse categories are indicated in bold text. Chi-square analyses evaluated differences between percent endorsement of each relapse category between first and subsequent relapse.

\*  $p < .05$

**Table 3**

Latent Class Analysis of Situational Precursors to Initial and Subsequent Relapses, Indices of Model Fit 1-Class - 4-Class Models

	Initial Relapse				Subsequent Relapse			
	1-Class	2-Class	3-Class	4-Class	1-Class	2-Class	3-Class	4-Class
Number of free parameters	5	11	17	23	5	11	17	23
saBIC	606.95	582.27	579.61	583.18	650.41	620.56	623.08	628.38
AIC	608.70	586.12	585.56	591.23	652.12	624.32	628.89	636.24
Bootstrapped parametric likelihood	n/a	34.58	12.56	6.33	n/a	39.80	7.43	4.66
P	n/a	<.0001	0.04	0.12	n/a	<.0001	0.02	0.11
<b>entropy</b>	<b>n/a</b>	<b>.59</b>	<b>.69</b>	<b>.83</b>	<b>n/a</b>	<b>1.00</b>	<b>.92</b>	<b>.77</b>

saBIC = Sample Size Adjusted Bayesian Information Criterion; AIC = Akaike's Information Criterion

**Table 4**

Conditional response probabilities for the 2-class model: First and subsequent relapse

Situational precursor	Initial Relapse		Subsequent Relapse	
	Class 1 (n=50)*	Class 2 (n=73)	Class 1 (n=71)	Class 2 (n=53)
Negative Intrapersonal	0.94	0.45	1.00	0.00
Negative Physiological	0.23	0.00	0.17	0.04
Other Intrapersonal	0.87	1.00	.90	0.93
Negative Interpersonal	0.67	0.04	0.58	0.09
Social Pressure	0.78	0.71	0.72	0.72

\* Note. Sample sizes are based on most likely latent class membership, and one participant with incomplete data for initial relapse was not included in the corresponding LCA analysis.

**Table 5**

Conditional response probability for the 3-class model: First and subsequent relapse

Situational precursor	Initial Relapse			Subsequent Relapse		
	Class 1 (n=13)*	Class 2 (n=38)	Class 3 (n=73)	Class 1 (n=42)	Class 2 (n=28)	Class 3 (n=54)
Negative Intrapersonal	1.00	0.88	0.46	1.00	1.00	0.11
Negative Physiological	0.18	0.25	0.00	0.27	0.00	0.04
Other Intrapersonal	0.66	1.00	1.00	0.86	1.00	0.94
Negative Interpersonal	0.51	0.80	0.00	0.50	0.91	0.10
Social Pressure	0.37	1.00	0.71	0.57	1.00	0.71

\* Sample sizes are based on most likely latent class membership.

**Table 6**

Latent Transition Analysis of Situational Precursors to Initial and Subsequent Relapses, Indices of Model Fit

	2-Class/2-Class	2-Class/3-Class	3-Class/2-Class	3-Class/3-Class
Number of free parameters	13	24	24	45
saBIC	1151.97	1157.05	1156.73	1163.88
AIC	1156.94	1166.22	1165.90	1181.08
<b>entropy</b>	<b>.88</b>	<b>.69</b>	<b>.79</b>	<b>.71</b>

saBIC = Sample Size Adjusted Bayesian Information Criterion; AIC = Aikaike's Information Criterion