UNIVERSITY OF CALIFORNIA, SAN DIEGO

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Characteristics of Substance Use Situations for Adolescents with Comorbid Disorders: A Comparison of Adult and Adolescent Classification Systems

A dissertation submitted in partial satisfaction of the

Requirements for the degree of Doctor in Philosophy

in

Clinical Psychology

by

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The dissertation of Kevin C. Frissell is approved, and it is acceptable in quality and form for publication on microfilm:

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DEDICATION

I would like to dedicate this work to my wife, Katie: The reason I decided to torture myself through 7 years of graduate school and the most patient and loving person I have ever met.

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ACKNOWLEDGEMENTS

I am extremely grateful to many who have supported me throughout my doctoral training. First, I would like to thank my research mentor and dissertation committee chair, Sandra A. Brown, for her guidance and commitment to my education and professional growth, most recently evidenced through her insistence that I graduate immediately. A number of other mentors and supervisors have been very generous with their time and resources. All members of my dissertation committee, Tammy Wall, May Yeh, Joe Price, and Susan Tapert (honorary member), have been wonderful teachers and consummate examples of healthy balance of career and family. This work, and the completion of my education, would not have bee possible without the support and understanding of Elizabeth Klonoff and Robert Heaton. I am eternally grateful for their presence. Special appreciation also goes to the staff in Sandra Brown's research lab and numerous undergraduate interns and post-doc scholars for their support. I am also thankful to Laura MacPherson, Jane Metrik, Marya Schulte, and Nikki Sintov for helping to make the grueling process of graduate school personal and enjoyable through the formation of long-lasting friendships.

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ABSTRACT OF THE DISSERTATION

Characteristics of Substance Use Situations for Adolescents with Comorbid Disorders: A Comparison of Adult and Adolescent Classification Systems

by

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Doctor of Philosophy in Clinical Psychology

University of California, San Diego, 2007

San Diego State University, 2007

Professor Sandra A. Brown, Chair

The current project is a secondary analysis of a treatment sample of adolescents (age 13 to 18; 54% female; N=221) possessing both a DSM Axis I substance use disorder and a comorbid Axis I internalizing (e.g., major depression, generalized anxiety disorder) and/or externalizing (e.g., conduct disorder, oppositional defiant disorder) disorder. Social cognitive theory applied to addictive behaviors assumes that characteristics of situations common to an individual's substance use prior to treatment for a substance use disorder represent situational characteristics that will pose high risk for relapse following treatment. The long-term objective of the current project is to inform the development of prevention and treatment programs for addictive behaviors. Specifically, patterns of substance use situations for "comorbid adolescents" were identified so that psychosocial interventions can be specifically tailored to focus on the needs of the heterogeneous population of adolescent substance users. The current project specifically investigated the structure of comorbid

adolescent substance use situations. First, the fit of two adult classification systems of pretreatment substance use situations were compared to an alternative, developmentally informed classification system. Next, pretreatment substance use situational profiles for comorbid adolescents were identified and differences in substance use situations across profile groups were described. Secondarily, differences were explored across substance use situation profile groups in relation to several covariates. Specifically, aims of secondary analyses were to validate the situational profiles obtained in earlier analyses, and to determine associations of specific profile groups with comorbid psychopathology, gender, ethnicity, age, and substance use history. Results from a series of confirmatory factor analyses (CFAs) indicated that the 5-factor model corresponding to the developmentally informed classification system best represented the structure of substance use situations for comorbid adolescents. Separate factors represented substance use situations involving conflict with others/unpleasant emotions (CO/UE); positive social interactions/urges (PS/U); pleasant emotions (PE); physical/sexual (P/S); and testing personal control (TPC). Substance use situational profiles were determined through the conduct of cluster analyses on the substance use situation factors. A four-cluster solution was identified representing participants who used substances frequently in all situations (all high group); frequently in situations involving pleasant emotions (high PE group); and those who did not use frequently in any situations (all low group); or in pleasant emotions and physical/sexual situations (low PE/P/S group). Exploratory analyses revealed no differences among cluster groups in terms of age and gender, and limited differences in terms of ethnicity and comorbid psychopathology. Most notably,

consistent differences were found among situation clusters when examining associations among cluster groups and substance use history. For example, adolescents were 1.1 times more likely to be classified in the high PE cluster, compared to the low PE and P/S cluster, for every 50 times they used marijuana in their lifetime (Wald = 7.68; $p < .01$; OR = 1.002). Further, adolescents were 1.23 times more likely to be classified in the high PE cluster, compared to the all low cluster, for every lifetime drug-related problem experienced (Wald = 9.13; $p < .01$; OR=1.23). Findings indicate that the clusters likely represent valid profiles of substance use situations for comorbid adolescents and that severity of substance use is likely associated with situational patterns of use. Evaluation of situational patterns of substance use as part of substance abuse treatment may help tailor coping skills interventions to subgroups of comorbid adolescents with differential situational substance use patterns. Replication of the current study and extension to longitudinal outcomes should be conducted to determine if cluster groups are reliable across samples, and if prospective relationships among clusters and substance use outcomes exist.

I. INTRODUCTION

A. Objectives of the Current Study

Despite promising findings for adults, less attention has been paid to adolescents in the extant substance use literature in regards to the applicability of social cognitive theory for addictive behaviors. Further, substance use treatment models have been transferred to adolescent populations without adequate regard for developmental factors that may subtly influence the utility of cognitive social learning theory for adolescents. It is likely that developmental issues play a role in the types of substance use situations frequently encountered by youth and, therefore, the optimal focus of cognitive-behavioral treatments may differ for adolescents compared to adults. Additionally, the adult and adolescent literature indicate differences in substance use situations for those with and without comorbid psychopathology, highlighting the need to focus on comorbidity as a possible factor influencing the topography of substance use situations for youth.

The long-term objective of the proposed project is to inform the development of prevention and treatment programs for addictive behaviors by identifying patterns of pretreatment substance use situations for comorbid youth so that psychosocial interventions can be specifically tailored to focus on the needs of the heterogeneous population of adolescent substance users. The proposed study will utilize a pre-existing database of "comorbid adolescents" (N=221) possessing both a DSM Axis I

substance use disorder and an Axis I internalizing and/or externalizing disorder. By utilizing a sample of comorbid adolescents first assessed during inpatient treatment for psychiatric problems, a population traditionally underserved in substance abuse research will be investigated. With this sample, an adult and a developmentally informed substance use situation classification systems will be compared. Common profiles of substance use in various situations will be identified and differences in substance use profiles will be described. Finally, the heterogeneity of this sample will allow for the exploration of differences in substance use profiles by psychiatric comorbidity, gender, ethnicity, age, and substance use history (e.g., specific substance of choice, frequency of use of various substances).

B. Social Cognitive Theory Applied to Addictive Behaviors

Social cognitive theory (Bandura, 1986) applied to addictive behaviors assumes that characteristics of situations common to an individual's use prior to treatment for a substance use disorder (SUD) represent situational characteristics that will pose high risk for relapse following treatment (Marlatt & Gordon, 1985; Marlatt, 1996; Witkiewitz & Marlatt, 2004). Social cognitive mechanisms such as substance use outcome expectancies and situational self-efficacy have been hypothesized as significant mediators of the occurrence and severity of substance use in various situations (see figures 1 and 2). In it's most recent conceptualization (figure 2), social cognitive theory recognizes relapse to substance use as a dynamic process, involving transactional relationships between proximal risk and protective factors, cognitive and physiological processes, and behaviors (coping, substance use), in the context of high-risk situations and distal risk factors (Witkiewitz & Marlatt, 2004).

Relapse prevention therapy (RP; e.g., Annis & Davis, 1989) stems from this theoretical orientation and has demonstrated efficacy with adult substance abusers (Irvin, Bowers, Dunn, & Wang, 1999; Rawson et al, 2001). Briefly, RP (and social cognitive theory) proposes that substance use following treatment occurs in response to a high-risk situation through complex interactions between situation-specific coping mechanisms and cognitive processes such as outcome expectancies (i.e., anticipated effects of taking the substance; Witkiewitz & Marlatt, 2004). In the RP model, high-risk situations are assessed for an individual at the onset of treatment (based on pretreatment substance use) and are the focus of interventions to teach adaptive situation-specific coping skills and alter expectations of reinforcement from substance use (Annis & Davis, 1989). RP is believed to exert its effects by teaching adaptive coping skills to successfully navigate the high-risk situation, improving self-efficacy, and by challenging outcome expectancies to reflect more realistic consequences from use. In a recent meta-analysis of RP for substance use, Irvin et al. (1999) found that RP was less effective in treating abuse of other substances besides alcohol. This finding points to the need to modify RP programs to address how individual differences influence risk for relapse (Witkiewitz & Marlatt, 2004). The proposed study investigates the characteristics of pretreatment substance use situations for comorbid adolescents in an attempt to direct how psychosocial treatments can be honed to address specific needs of substance abusing adolescents.

C. Substance Use Situations

The construct of substance use situations is paramount to a social cognitive perspective of substance use disorders and enjoys a long history of investigation that

has identified and categorized the types of substance use situations and frequency of use in these situations for adult substance abusers, non abusers, and relapsers (e.g., Annis, 1982; Marlatt & Gordon, 1985; Longabaugh, Rubin, Stout, Zywiak, & Lowman, 1996; Carrigan, Samoluk, & Stewart, 1998). An important consideration in the investigation of substance use situations is the distinction between situations involved in relapse to substance use and the general use situations encountered during the lengthy history of substance use reported by many substance abusers. Much research has been generated over the past several decades investigating qualities of both types of substance use situations, those that are generally encountered and those specific to relapse, from a social cognitive perspective (e.g., Marlatt & Gordon, 1985; Longabaugh et al., 1996; Carrigan et al., 1998). As social cognitive theory assumes that learning history exerts significant influence over which situations will represent high risk for relapse, both generally encountered substance use situations and relapse situations are important in appropriately assessing the applicability of social cognitive theory in the treatment of substance abuse. Consequently, although the proposed study focuses solely on pretreatment substance use situations, the study's rationale cannot be fully appreciated without considering the literature on relapse situations.

D. Relapse Situations

With regards to relapse situations for adults, research to date has identified and classified the types of situations common to relapse to substance use (e.g., Marlatt & Gordon, 1985). In their seminal work on the prevention of relapse, Marlatt and Gordon (1985) identified a hierarchy of situations frequently precipitating relapse to substance use and the frequency of their occurrence. Level 1 of the hierarchy included

the distinction between intra (58%) and interpersonal (42%) relapse situations. The hierarchy further distinguished among the intra and interpersonal situations to include several categories in level 2. Under intrapersonal situations, level 2 situations and their frequency of occurrence included negative emotional states (37%), negative physiological states (4%), positive emotional states (6%), testing personal control (4%) and urges and temptations (7%). Under interpersonal situations, level 2 situations included interpersonal conflict (15%), social pressure (24%) and positive emotional states (3%). Finally, level 3 of the hierarchy included two situational domains under each of five level two categories. Level 3 categories included coping with frustration/anger and coping with other negative emotions under intrapersonal negative emotional states; coping with negative physiological states associated with prior use and coping with other negative physiological states under intrapersonal negative physiological states; substance use occurring in the presence or absence of substance cues under intrapersonal urges and temptations; and coping with direct or indirect social pressure under interpersonal social pressure.

While this taxonomy has provided a useful guide for tailoring cognitive-behavioral interventions, it has proven difficult to replicate some results from the original research and establish predictive validity, limiting conclusions about the construct validity of the taxonomy and the social cognitive model applied to relapse (e.g., Donovan, 1996; Lowman, Allen, Stout, & the Relapse Research Group, 1996). In general, research from the Relapse Replication and Extension Project showed that the basic level 2 categories of relapse situations identified by Marlatt and Gordon (1985) were mostly confirmed across several studies conducted at multiple sites when using

the original coding scheme developed in the Marlatt and Gordon study (Donovan, 1996). However, it was difficult for interviewers to discriminate among intra and interpersonal situations concerning negative and positive emotional states, leading to low inter-rater reliability of classification using Marlatt and Gordon's coding scheme (Longabaugh et al., 1996). Further, as Marlatt and Gordon's coding scheme was hierarchical and limited coders to endorse only one relevant situation for each relapse episode, some situations lower on the hierarchy (e.g., urges and temptations) were likely underestimated in their frequency of occurrence due to participants frequently endorsing higher order situations in addition to lower order situations (Longabaugh et al., 1996). Consequently, recommendations were made to alter the Marlatt and Gordon coding system to dispose of the intra and interpersonal distinction, and the hierarchical and single situation coding requirements (Donovan, 1996; Longabaugh et al., 1996; Lowman et al., 1996).

Contrary to Marlatt and Gordon's original findings, the Relapse Replication and Extension Project also found incongruent results and considerable variability across the studies in the frequency of relapse in various situations. Related specifically to predictive validity, the studies did not find support for the taxonomy using the Marlatt and Gordon coding scheme in predicting drinking outcome, time to relapse, or the relationship between relapse situations and psychiatric diagnosis (Maisto, Connors, & Zywiak, 1996; Stout, Longabaugh, & Rubin, 1996). However, evidence for concurrent validity was found by a significant association between baseline (pretreatment) level 2 Marlatt and Gordon relapse codes and factor scores on the inventory of drinking situations (IDS; insert citation), a measure that assesses past year

frequency of drinking in identical contexts to level 2 of Marlatt and Gordon's taxonomy (Maisto, Connors, & Zywiak, 1996). Similarly, a factor analysis of the Reasons for Drinking Questionnaire (RDQ) and subsequent analyses confirmed the structure of Marlatt and Gordon's level 3 codes and specifically indicated that scores on the negative emotions factor were higher for women and prospectively correlated with several alcohol use variables, lapse duration, occurrence of a second lapse, trait anger, and level of depressive symptoms. Men scored higher on a factor involving social pressure and positive emotions. Further, a factor representing negative physiological states, testing control, and urges/temptations was negatively correlated with time to lapse (Zywiak, Connors, Maisto, & Verner, 1996). Another study found no gender differences in the topography of relapse situations using Marlatt and Gordon codes, but found that men relapsed more often alone and women relapsed more often in the presence of romantic partners (Rubin, Stout, & Longabaugh, 1996).

Given the many incongruent findings from these replication and validity studies, literature summaries highlight limitations that render conclusions of the taxonomy's construct validity tenuous and point to the necessity of further research (e.g., Donovan, 1996; Lowman et al., 1996). Results from these studies may indeed point to limitations of the taxonomy or may be invalid due to limitations in reliability of Marlatt and Gordon's coding system. The latter point seems likely due to the research that supported Marlatt and Gordon's taxonomy and construct validity resulting primarily from studies using self report instruments such as the IDS and RDQ, and not the studies using Marlatt and Gordon's interview coding scheme (i.e., Maisto, Connors, & Zywiak, 1996; Zywiak et al., 1996). Perhaps more relevant limitations

relate to the confound in the replication studies' designs (i.e., associating pretreatment relapse situations with relapse situations after participants received interventions that may have altered the risk for relapse in the most salient situations) and interpretation of the social cognitive model of relapse. Specifically, the above studies relied on weak theoretical assumptions, namely that situational characteristics of one previous relapse episode should reveal themselves in future relapse episodes. It is likely that taking into account substance abusers more general learning history (e.g., history of frequency of substance use in various situations, not only relapse situations) will provide a more representative measure of situational vulnerability to substance use. This point was illuminated in the replication studies suggesting that profiles of the relative frequency of use in various situations may provide a more clear picture of situational risk for relapse (e.g., Maisto, Connors, & Zywiak, 1996).

E. Relationships Among Relapse Situations and Psychiatric Comorbidity

It is important to note that recent research independent of Marlatt and Gordon's original study and the above replication studies has investigated relapse situations for heterogeneous samples of adults and adolescents. Population estimates for adults indicate that those with substance-use disorders have rates of other Axis I psychopathology (e.g., depression and anxiety disorders) ranging from 29% (Kessler et al., 1996) to 37% (Burns & Teesson, 2002; Regier et al., 1990), with substantially higher rates in clinical settings. There is evidence that psychiatric comorbidity may influence the frequency of relapse in various situations. Tate, Brown, Unrod, and Ramo (2004) compared relapse contexts for adults with substance use disorders alone and substance use disordered adults with other concurrent Axis I psychopathology.

Echoing studies from the Relapse Prevention and Extension Project (e.g., Maisto, Connors, & Zywiak, 1996) they found that negative emotional states preceded substance use for a greater proportion of comorbid (77.6%) than noncomorbid (54.3%) adults. In addition, the majority of substance use disordered individuals with comorbid psychopathology relapsed alone (51.7%) while those without such psychopathology relapsed more often with others (65.7%).

F. Relationships Among Relapse Situations and Adolescents

With regards to adolescents, few studies have investigated relapse situations using Marlatt and Gordon's taxonomy. One study of adolescents indicates potential developmental differences. Specifically, Brown and colleagues have identified that while adolescents tend to relapse in situations similar to adults, situations involving social pressure are the most frequently endorsed with 66% of adolescents relapsing in response to social pressure (Brown et al., 1989) compared to 24% of adults (Marlatt & Gordon, 1985). Taking into account the variability in replication studies for adults described above, it still seems likely that the relative frequency of relapse in social pressure situations is much greater for adolescents given that, across the replication studies' multiple independent research sites, the rates of relapses classified as social pressure situations did not exceed 24% for adults (Lowman et al., 1996).

Similar to adults, rates of adolescent comorbidity are high and likely influence the nature of relapse situations. In treatment samples, adolescent rates of comorbid substance use and other Axis I disorders have varied from 50% (Grilo, Becker, Walker, & Levy, 1995) to 85% (Hovens, Cantwell & Kiriakos, 1994). To examine whether comorbid and non-comorbid adolescents, like adults, differ regarding the

circumstances of post-treatment alcohol or drug use, Anderson, Frissell, and Brown (2006) examined social and environmental situations for initial post-treatment alcohol or drug use for youth with comorbid alcohol/substance-use disorders and Axis I psychopathology. Similar to their noncomorbid peers (e.g., Brown et al., 1989), for comorbid adolescents, post-treatment use frequently occurred in situations involving social pressure (69%). This finding suggests that some of the situational aspects for first use are the same for substance use disordered youth after treatment, regardless of psychiatric status. Interestingly, however, youth with comorbid substance use and Axis I mental health disorders relapsed most frequently when dealing with temptations/urges (85%) and also requently endorsed negative affective states (68%). Thus, comorbid youth also appear to share characteristics of adults with comorbid psychopathology in regards to relapse context.

The Anderson et al. (2006) investigation also examined how diagnosis and psychiatric symptoms related to relapse situations for comorbid youth following treatment. Specifically, the number of disruptive disorder diagnoses was predictive of relapse in negative interpersonal situations (i.e., frustration, anger, and tension situations). For youth experiencing more anxiety symptoms, relapse more often was associated with situations involving negative physiological states and interpersonal conflict. Individuals with anxiety disorders are often highly sensitive to cues relating to threat (DSM-IV; APA, 1994). In situations where they are faced with physiological distress, they may have a lower threshold for these experiences and look for remedy through substance use. Depressive disorders and symptom counts were not predictive of relapse situation.

G. Pretreatment Substance Use Situations

A wealth of research has been conducted investigating the structure of pretreatment use situations for adult alcohol and other substance users (e.g., Annis, Graham, & Davis, 1987; Turner et al., 1997). Research generally indicates that adult pretreatment substance use situations conform to Marlatt and Gordon's (1985) taxonomy of relapse situations. The preponderance of research has investigated pretreatment situations using multiple paper and pencil assessment instruments such as the Inventory of Drinking Situations (IDS-100 and IDS-42; Annis, 1982) and the Inventory of Drug Taking Situations (IDTS-50; Turner et al., 1997). Both measures assess the frequency of substance use in similar situations (note, the IDTS assesses situations involving both alcohol and other substances and the IDS assesses alcohol only). Although several studies have found support for alternative factoral groupings of pretreatment substance use situations (e.g. Cannon, Leeka, Patterson, & Baker, 1990), the majority of validity studies have revealed factor structures for adults that are congruent with Marlatt and Gordon's level 2 of the taxonomy (e.g., Annis et al., 1987; Turner et al., 1997; Carrigan et al., 1998; Stewart, Samoluk, Conrod, Pihl, & Dongier, 2000).

Several studies investigating gender homogeneous female (e.g., Carrigan et al., 1998) and male (e.g., Turner et al., 1997) samples of adults have found the factor structure of pretreatment substance use situations conforms to Marlatt and Gordon's taxonomy equally for males and females. However, there is evidence that gender differences may exist in the frequency of use in various pretreatment situations for adults. Specifically, Annis and Graham (1995) investigated situational profiles of adult

drinkers in treatment for alcohol dependence. The authors classified the sample based on their profiles across all eight IDS subscale scores (i.e., level 2 of Marlatt & Gordon's taxonomy) and identified four clusters of individuals corresponding to those who drank *more* frequently in 1) negative emotion and conflict situations, and 2) positive emotion, pleasant times with others, and social pressure situations, and those who drank *less* frequently in 3) physical discomfort situations, and 4) testing personal control situations. Further, similar to the relapse situations literature, women were more likely to be classified in cluster 1 for their pretreatment substance use, indicating that women were more likely to drink most frequently in negative emotion and conflict situations. Another study investigating drinking situations in a nontreatment college sample found that men, compared to women, drank more frequently in situations related to the IDS subscales of pleasant times with others, social pressure to drink, testing personal control, and urges and temptations. These gender differences are also consistent with research on alcohol outcome expectancies in adults showing that, compared to women, men tend to expect alcohol consumption to result in increased social assertion and global positive changes (Brown, Goldman, Inn, & Anderson, 1980; Mooney, Fromme, Kivlahan, & Marlatt, 1987; Rohsenow, 1983), and women tend to expect alcohol consumption to result in tension reduction, compared to men (Mooney et al., 1987).

To our knowledge, there is no existing examination of the factor structure of pretreatment substance use situations with adolescent samples. Such research is necessary in order to determine whether Marlatt and Gordon's taxonomy applies to adolescent substance users as well as it has to adult substance users. Furthermore,

studies of relapse situations and cognitive mechanisms of relapse among adolescents and adults indicate potential developmental differences. Specifically, as described above, Brown and colleagues have identified differences in relapse situations among adult and adolescent comorbid and noncomorbid substance abusers (Brown et al., 1989; Anderson et al., 2006; Tate et al., 2004). Similarly, other research by Brown and colleagues has identified that adolescent substance users tend to hold less differentiated cognitions and behaviors associated with substance use than adults, as evidenced by adolescents holding similar alcohol outcome expectancies (Christiansen, Goldman, & Brown, 1985), and substance use situation-related self-efficacy (Ramo & Brown, 2004; Ramo et al., 2005) compared to adults, but representing these cognitions and behaviors less complexly (i.e., with fewer empirically derived factors).

The most relevant data pointing to the likelihood that the factor structure of pretreatment substance use situations differ for adolescents, compared to adults, are preliminary findings that show the factor structure of situation-related self-efficacy differs for adolescents compared to adults (Ramo & Brown, 2004; Ramo et al., 2005). Using the Drug Taking Confidence Questionnaire (DTCQ; Sklar, Annis, & Turner, 1997), a measure assessing confidence in not using substances in situations *identical* to those assessed on the Inventory of Drug Taking Situations, and holding an adult factor structure consistent with Marlatt and Gordon's taxonomy, it was found that comorbid adolescents tend to hold less complex factor structures for situations involving coping self-efficacy, and that fewer specific coping self-efficacy situations are relevant for comorbid adolescents compared to adults. Consequently, a 5-factor adolescent specific factor structure was a superior fit to the data compared to a factor

structure conforming to Marlatt and Gordon's taxonomy. The adolescent-specific factor structure was determined empirically through exploratory factor analyses and adult and adolescent structures where then compared using confirmatory factor analyses.

Given developmental differences in relapse situations and the identified cognitive and behavioral mechanisms of substance use, pretreatment use situations may also vary as a function of developmental level. It is consonant with a cognitive social learning theory perspective (e.g., Bandura, 1986) to predict that coping self-efficacy specific to a given substance use situation will be negatively correlated with frequency of substance use in that situation. Therefore, it is worthwhile to test whether a factor structure for substance use situations for comorbid adolescents conforms to a factor structure found for an equivalent measure of self-efficacy for coping with identical high risk situations (i.e., the DTCQ). If pretreatment substance use situations do not conform to the same factor structure as the DTCQ did for comorbid adolescents, then potential conclusions can be drawn from the identified differences. Conclusions may have implications for the refinement of cognitive social learning theory.

Related to psychiatric comorbidity, there is evidence that comorbidity may influence pretreatment situational characteristics of use. For adults, one qualitative study has investigated the relationship between severe mental illness and pretreatment substance use situations and found that adults with severe mental illness may use in unique situations compared to noncomorbid substance users (Bradizza & Stasiewicz, 2003). Specifically, severely mentally ill substance users were found to use in situations congruent with Marlatt and Gordon's taxonomy, however, these individuals

also reported frequent use in situations involving psychological symptoms, loss, and loss of appetite. For adolescents, psychiatric diagnosis and the severity of substance-use symptoms have also been shown to interact. For example, severity of depressive disorders is associated with more substance withdrawal symptoms, individuals with externalizing disorders tend to demonstrate more substance dependence symptoms, and the severity of ADHD symptoms is related to higher prevalence of alcohol dependence (Abrantes, Brown, & Tomlinson, 2004).

Although a direct association between internalizing symptoms, externalizing symptoms, and pretreatment substance use situations has not been investigated, it is possible that comorbid adolescents use substances more often in pretreatment situations involving their psychiatric symptoms, therefore contributing to the association between severity of comorbid psychopathology and severity/prevalence of substance dependence. Further, given the associations between psychiatric symptoms and relapse situations from the adult and adolescent literature, social cognitive theory would hypothesize that these associations reflect a learning history that would be evidenced by high reported frequency of use in psychiatric symptom congruent pretreatment substance use situations.

Related to gender differences, ethnicity, stage of adolescent development (age), and substance use history, important gaps in the adolescent literature exist. Specifically, it is currently unclear if gender differences exist for adolescent pretreatment substance use situations. It is possible that, due to the hypothesized developmental nature of differentiation of substance use situations, gender differences in substance use situations emerge during adulthood, or manifest themselves

differently in adolescence. It is also unclear if ethnicity influences the manifestation of the quality and frequency of substance use situations for adults and adolescents. It appears that no studies have evaluated possible invariance in classification of relapse or pretreatment substance use situations for ethnically diverse samples, or have investigated ethnic differences in the frequency of relapse or pretreatment substance use in a variety of situations similar to those in the studies described above.

Similarly, no studies were identified that investigated either relapse situations or pretreatment substance use situations as a function of stage of adolescent development, so it is also unclear if age of adolescents impacts the manifestation of the quality and frequency of substance use situations. As adolescence is a time of increasing autonomy and divergence from parental to peer support, it is possible that younger adolescents use substances more or less frequently in various situations compared to older adolescents. This may be further compounded due to substance use and abuse being less common among younger adolescents (e.g., Shedler & Block, 1990; Kaminer, 1999) and their array of situations likely limited due to less chance for exposure. Last, related to substance use history, research generally indicates that for adults, the quality of relapse situations and the quality and frequency of pretreatment substance use situations are similar irrespective of class of substance (e.g., Marlatt, 1996; Turner et al., 1997). However, due to illicit substance use being less normative in adolescent populations (e.g., Shedler & Block, 1990) it is possible that the frequency of substance use in various situations is different for adolescents dependent on class of substance and/or severity of use.

H. Aims/Hypotheses

Because a driving assumption of social cognitive theory of addictive behaviors is that the most frequently endorsed pretreatment use situations represent high risk situations for relapse, examining the validity of the Marlatt and Gordon taxonomy of pretreatment substance use situations for comorbid adolescents is a necessity. As mentioned above, studies of adolescent relapse situations and studies of cognitive mechanisms of relapse indicate that developmental differences in pretreatment situations are likely. Brown and Colleagues have identified that adolescent substance users tend to hold less differentiated cognitions associated with substance use than adults (e.g., Christiansen et al., 1985**;** Ramo & Brown, 2004). In order to determine if a comorbid adolescent-specific factor structure is superior to an adult factor structure of pretreatment use situations, the current study proposes to compare the fit of adult (e.g., Marlatt & Gordon's level 2 taxonomy) and adolescent specific (i.e.**,** Ramo & Brown, 2004) factor structures for the IDTS. Specifically, it is hypothesized that the factor structure of pretreatment use situations for comorbid adolescents will more closely resemble the factor structure found for comorbid adolescent situation-specific self-efficacy (DTCQ; figure 3), and less closely resemble the predominant factor structure of adult pretreatment use situations found in the literature (i.e., Marlatt & Gordon's taxonomy; figure 4) and an alternative adult factor structure also previously identified (i.e., Cannon et al., 1990)

As research described above indicates, one promising method for enhancing the validity of situational categorization is to assess information on diverse pretreatment substance use situations that provide a more complete representation of learning history, and not simply situations from one substance use (e.g., relapse) event.

Further, given the Relapse Replication and Extension Project's recommendations for determining profiles of substance use situations in describing participants' situational risks for relapse, the proposed study will determine group profiles based on pretreatment substance use situations for comorbid adolescents. Differences among profile groups in relation to the frequency of pretreatment substance use in various situations will be described.

Last, there is limited research examining the relationship among situational characteristics of pretreatment substance use and personal characteristics. Therefore, an ancillary goal of the proposed study is to explore the relationship among frequency of substance use in various pretreatment situations and personal characteristics among comorbid adolescent substance abusers. To this end, situational profile groups will be compared in relation to type/severity of comorbid psychopathology, gender, ethnicity, age, and substance use history (i.e., specific substance of choice and frequency of use/problems). Findings from this study will help treatment providers identify situations that present high risk for relapse, and personal characteristics associated with situational risk, in order to hone psychosocial treatments to produce more beneficial effects.

II. Method

A. Data Source and Procedure

The proposed study involves the secondary analysis of a preexisting treatment data set of adolescents possessing both a DSM Axis I substance use disorder and at least one comorbid Axis I internalizing and/or externalizing disorder. Data for the current study come from a longitudinal study of clinical course of comorbid adolescents (N=221). Participants were recruited (consecutive admissions) from inpatient substance abuse and psychiatric programs at one of four San Diego, California inpatient facilities. Youth were selected on the basis of evidence of comorbid alcohol and other substance use disorders and psychiatric disorders through medical chart screenings of new admissions. The University of California, San Diego Committee for the Protection of Human Subjects approved parental consent was first obtained prior to the medical chart screening, and after participant screening. Additional informed consent procedures for the research study were completed with the parent or legal guardian and assent procedures with the youth.

Participants were interviewed by trained interviewers at intake, monthly for the first 6 months post-treatment, and at 12 and 24 months post-treatment. This study utilizes preexisting intake data collected from participants at the treatment facility following substance use detoxification. To be included in the study, participants must have met criteria for a DSM-III-R substance use disorder *and* at least 1 DSM-III-R internalizing or externalizing disorder. Exclusion criteria included living greater than 50 miles from the research site, no parent or resource person to corroborate information, presence of psychotic symptoms, and history of severe head trauma.

Additionally, a resource person (e.g., parent) was also recruited for each participant and participant interviews were corroborated to ensure accuracy. A random sample of youth also completed urine toxicology screens to verify use reports.

B. Participants

Participants for the current project include 221 comorbid adolescents (54% female) ranging from age 13 to 18 (mean=15.74). Of the 221 participants, all completed the primary measure under investigation (i.e., IDTS). Table 1 provides descriptive statistics for all IDTS items. Response rates on other measures (i.e., covariates) ranged from 127 to 202 participants. Table 2 displays the number of participants providing data for each covariate analyzed in the current study, descriptive statistics are also provided. Tabels 3 and 4 present correlations among the sets of psychopathology and substance use covariates examined in the current study, respectively. The ethnic distribution of participants is as follows: 70% Caucasian, 19% Latino, 6% African-American, 3% Asian, 1% Native-American, and 1% other or mixed ethnicity. Further, all participants possessed both a DSM-III-R substance use disorder (SUD) and at least one DSM-III-R Axis I internalizing or externalizing disorder. Twenty-one percent of participants had an internalizing disorder (major depression disorder, dysthymic disorder, anxiety disorder), 11% had an externalizing disorder (conduct disorder, oppositional defiant disorder, attention-deficit hyperactivity disorder), and 68% had both an internalizing and externalizing disorder. On average, youth met criteria for three comorbid Axis I diagnoses. Ninety-two percent of participants carried the diagnosis of drug dependence, 8% alcohol dependence, and 72% both alcohol and drug dependence. Most participants reported

that their substance of choice was marijuana (39%), followed by methamphetamine (31%), alcohol (10%), and other substances (19%). The average Hollingshead socioeconomic status score for the sample was 35.03 (*SD* = 13.20, range 11-72 (Hollingshead, 1965).

C. Measures

Structured Clinical Interview (Brown, Vik, & Creamer, 1989). Trained interviewers at study intake conducted a 90-minute confidential structured interview separately with the adolescent and parent. This procedure was used to gather demographic and background information as well as information regarding participant experiences with substance use, mental health services and related variables. All demographic information utilized in this study was garnered from this interview. For analyses, ethnicity was trichomized into categories representing Caucasian, Latino/a, and other/mixed ethnicities. Age was conceptualized in two ways: as a continuous variable and as a dichotomous variable with a cut point of 16 years old. The dichotomous categorization of age was used as a proxy measure for stage of development due to the association of 16 years old with driver's license. Youth 16 and older were presumed to have more exposure to diverse substance use due to obtainment of a driver's license and subsequent freedom.

Inventory of Drug Taking Situations (IDTS; Turner et al., 1997). Pretreatment substance use situations were assessed using the IDTS. The IDTS is a 50- item self-report questionnaire that assesses the frequency of substance use (range of "never" to "almost always" on a 4 point scale) in a variety of situations during the past year. Participants were first asked to report their drug of choice and then asked to

respond to each question for situations involving that drug. Studies using the IDTS have demonstrated the instrument's factoral, concurrent, and predictive validity for adults (e.g., Turner et al., 1997), however, as described throughout this proposal, the measure's validity among adolescents remains to be examined and is a major aim of the current project.

Costumary Drinking and Drug Use Record (Brown et al. 1998). Substance use was assessed at intake using the Customary Drinking and Drug Use Record (CDDR). The CDDR assesses alcohol and drug involvement and DSM-IV substance use disorder diagnoses. The CDDR ascertains current and lifetime quantity, frequency, and variability of alcohol use, and frequency and diversity of nine other drugs (tobacco, marijuana, amphetamines, barbiturates, hallucinogens, cocaine, inhalants, opiates, and prescription medications). The CDDR also assesses consequences of substance use, withdrawal, and dependence symptoms. The CDDR has been found to be both reliable and valid when used with adolescents and adults from clinical and community samples (e.g., Brown et al., 1998). The current study used variables from the CDDR for investigation of secondary aims. For this set of analyses, variables assessing substance of choice; lifetime frequency of times drunk, stoned on any drug, marijuana use, amphetamine use, and other drug use; lifetime number of alcohol and drug withdrawal symptoms experienced; and lifetime number of alcohol and drug problems experienced were analyzed. Substance of choice was included as a 4-level categorical variable (i.e., marijuana, amphetamines, alcohol, other illicit drugs) due to distributional properties. Lifetime frequencies of times drunk, stoned on any drug, and times used marijuana, amphtamines, and other illicit drugs were analyzed as

continuous variables, as were the sum of alcohol and drug withdrawal symptoms, and counts of 17 alcohol and drug related problems.

Diagnostic Interview Schedule for Children-Computerized Version (DISC-III-R; Piacentini et al., 1993). Axis I mental heath disorders at study intake were assessed using the DISC-III-R. The DISC-III-R was separately administered to each adolescent and collateral reporter (e.g., parent); results from the two interviews were combined in a standard fashion to determine diagnoses. Specifically, if the adolescent or parent reported the youth met a criterion, this was counted toward the diagnosis. This procedure maximizes reliability and validity of diagnoses (Breton, Bergeron, Valla, Berthiaume, St-Georges, 1998; Jensen et al., 1995). Axis I diagnoses of the current sample were rationally grouped into mood spectrum diagnoses (major depressive disorder, dysthymia, mania, hypomania), anxiety spectrum diagnoses (simple phobia, social phobia, agoraphobia, panic disorder without agoraphobia, panic disorder with agoraphobia, avoidant, overanxious disorder, generalized anxiety disorder, obsessive-compulsive disorder) and disruptive (i.e., externalizing) diagnoses (oppositional defiant disorder, attention-deficit/hyperactivity disorder, conduct disorder). For purposes of analyses, mood and anxiety spectrum disorders were further grouped into internalizing diagnoses. Eating disorders and psychotic-spectrum disorder diagnoses were not included due to their low base rate in this sample.

Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). Level of depressive symptoms was assessed using the Beck Depression Inventory. The BDI has been extensively studied in adults and adolescents, demonstrating concurrent and discriminant validity, and reliability with respect to

sensitivity and specificity (e.g., Barrera & Garrison-Jones, 1988). The BDI assesses the severity of 21 depressive symptoms occurring in the previous two weeks. For the current study, total raw score on the BDI was included in analyses as a continuous variable.

State-Trait Anxiety Inventory (STAI; Spielberger, 1983). Level of anxiety symptoms was assessed using the State-Trait Anxiety Inventory. The STAI is a 40-item measure assessing state and trait characteristics of anxiety. Extensive research on the STAI over the past several decades has determined it to be a reliable and valid measure in a variety of samples including nonsubstance abusing and substance abusing adolescents (Spielberger, 1989). Most studies of the STAI have validated a structure that differentiates anxiety into trait and state components (Spielberger & Vagg, 1984). For the current study, two variables representing the STAI subscales of state anxiety and trait anxiety were included in analyses. Each subscale consists of 20 items assessing different aspects of anxiety using a likert rating (1-4; 1=almost never, 4=almost always). Total raw scores on each subscale were treated as continuous variables for analyses.

Child Behavior Checklist (CBCL; Achenbach, 1991). The CBCL is a parent self-report instrument that assesses a variety of behavior problems and social competence in offspring occurring over the past 6-months. The CBCL includes three Social Competence scales (activities, social, school), several Behavioral Problem scales corresponding to internalizing, externalizing, and total problems, and several Narrow Band scales (withdrawn, somatic complaints, anxious/depressed, social problems, thought problems, attention problems, delinquent behavior, aggressive

behavior). The CBCL has 113 items which assess the above domains using a 3-point scale (0=not true, 1=somewhat/sometimes true, 3, very true or often). The CBCL has been extensively investigated with adolescent normative data available for a variety of clinical populations (McConoughy, 2001). For the current study, the Behavioral Problem scales and the Narrow Band scales will be analyzed. Item counts for the Narrow Band scales range from 8 to 18 items. Items assessing internalizing problems include all items from the anxious/depressed, withdrawn, and somatic complaints narrow band scales (32 items). Items assessing externalizing problems include all items from the rule-breaking behavior and aggressive behavior Narrow Band scales (35 items). Following Achenbach's (1991) recommendation, analyses will include total score for each CBCL scale. Achenbach recommends that t-scores not be used for research purposes.

III. Data Analyses

A. Comparison the Fit of Adult and Developmentally Informed Models of Pretreatment Substance Use Situations

The fit of two adult models of pretreatment substance use situations assessed with the IDTS were compared to the fit of a proposed developmentally appropriate classification system for comorbid adolescents (i.e., Ramo & Brown, 2004). The two adult models corresponded to the 8-factor model previously found by Turner et al., 1997, and the 3-factor model previously found by Cannon et al., 1990. The comorbid adolescent model is the 5-factor model found to ft the DTCQ data for comorbid adolescents by Ramo & Brown (2004). Table 5 displays IDTS items and corresponding factors for each model. Figures 3 and 4 graphically depict the 5- and 8-factor models. Specifically, confirmatory factor analyses (CFAs) using Maximum Likelihood procedures were conducted on the IDTS to test the hypothesis that the developmentally appropriate factor structure found for comorbid adolescents on the DTCQ will provide a better fit to the data than the adult factor structures found for the IDTS by Turner et al. (1997) and Cannon et al. (1990).

Primary data assumptions for conducting Maximum Likelihood CFA are multivariate normality and adequate sample size in relation to the number of variables in the tested model (Tabachnick & Fidell, 2001; Fabrigar, Wegener, MacCallum, & Strahan, 1999). The assumption of multivariate normality of IDTS items was assessed by examining values for skew and kurtosis. All values were acceptable so transformations of variables were not conducted (see Table 1). A potential problem

that arose when conducting CFAs for the proposed study related to sample size. Specifically, guidelines for conducting factor analysis usually recommend a sample size reflecting a ratio of 5 participants for each measured variable, or a sample of at least 200 participants to reveal stable, unbiased, estimates (e.g., Fabrigar et al., 1999). Taking these suggestions into account, the number of cases in the proposed sample with complete IDTS data (N=221) fell slightly short of the recommended sample size based on the participant to measured variable ratio, and borderline on minimum sample size requirements to conduct a reliable CFA. To help avoid potential problems of sample size, two strategies were to be considered if none of the proposed factor models adequately fit the data: 1) conducting the CFA using item parceling techniques, and 2) conducting CFAs separately for each individual factor.

Initial item-level CFAs did not produce adequate fit indexes for any tested model. Therefore, item parceling techniques were used in subsequent analyses. Following recommendations by Thompson and Melancon (1996), items on each factor were combined into parcels in order to increase the power of the CFAs. The process of combining items involved identifying skew values for each item and matching item parcel dyads, sequentially, that had highest relative positive and negative skew and summing values for each dyad parcel. Parcels were then included in the CFA analyses in place of individual items. This process effectively reduces the number of items in the CFA that are to be analyzed thus increasing power. Further, this process also serves to normalize distributions of included items to more appropriately conform to the CFA assumption of multivariate normality, which may improve reliability of the analyses. However, as mentioned above, violations of multivariate normality likely did

not occur with the IDTS data examined. CFAs using item parcels did produce adequate fit indexes, therefore separate CFAs for individual factors were not conducted.

To evaluate fit of the proposed factor models the comparitive fit index (CFI), the normed fit index (NFI), root mean square error of approximation (RMSEA), were evaluated, as well as idexes of fit adjusted for pasimony (i.e., PCFI, PNFI), which adjust the CFI and NFI for model complexity. Hu and Bentler (1999) suggest that CFI and NFI values above .90 and RMSEA values below .06 indicate good model fit. There are currently no established guidelines for PCFI and PNFI values, however higher values represent better model fit. For purposes of the current study, parsimony adjusted indexes with the highest value will be judged as representing superior model fit, considering model complexity.

B. Determining Situational Profiles of Pre-Treatment Substance Use Situations

Pretreatment substance use situational profiles of comorbid adolescents were determined, and differences in substance use situations across profile groups were described. Specifically, to determine pretreatment substance use situational profiles of comorbid adolescents, hierarchical cluster analysis was performed to discriminate among groups of individuals in relation to standardized factor scores from the CFA of the IDTS for the best fitting model. Hierarchical cluster analysis demarcated cluster groups to maximize between group variability and minimize within group variability. The Ward method evaluating differences among cases in terms of multivariate Euclidian distance was selected to evaluate clusters of cases in terms of their standardized factor scores across IDTS factors. The Ward method uses an ANOVA

procedure to group cases into distinct groups based on similarities in their scores on independent variables. This method is more sensitive than other methods (e.g., nearest neighbor) to cluster differences in the multivariate topography of scores on independent variables, in contrast to overall values (Everitt, Landau, & Leese, 2001). The topography of responses across IDTS factors was deemed of most interest to the current study.

Choosing the number of clusters representative of the data by hierarchical cluster analysis is a somewhat subjective process based on a priori assumptions. In the case of the current study, it was expected that, like adults, multiple distinct groups of adolescents exist in terms of their profiles of pre-treatment substance use situations. The number of clusters was then chosen through identifying large gaps in Euclidian distance among clusters that may distinguish meaningful groups of cases in terms of pre-treatment substance use situations. This was accomplished through examination of a dendrogram and agglomeration schedule that, respectively, depict Euclidian distances graphically and numerically.

As suggested by Everitt et al. (2001), following hierarchical cluster analysis, the cluster solution obtained was reanalyzed using an alternative clustering method to provide information on the reliability of the cluster solution. Specifically, the Quick Cluster procedure (SPSS, version 13) was used. The Quick Cluster method uses a clustering algorithm to classify cases into a specified number of clusters through an iterative process. It also allows for the entry of initial cluster centers to begin the iterative process to aid in converging on a final solution. For the current analyses, initial cluster centers were entered into the Quick Cluster analysis and the number of

clusters determined from the hierarchical cluster analysis was specified. Initial cluster centers were derived from the cluster centers resulting from the hierarchical cluster analyses. Kappa was computed to assess reliability by determining agreement in grouping cases between clustering methods adjusting for chance.

To determine differences across profile groups in the frequency of pretreatment substance use in various situations, separate ANOVA contrasts were conducted to compare profile groups (grouping variable) in relation to factor scores (dependent variables) for each pretreatment use situation. Type I error was corrected for multiple pairwise comparisons using a Tukey HSD correction.

C. Concurrent Validity of Cluster Groups

To provide evidence of concurrent/construct validity of cluster groups, exploratory analyses were conducted to assess associations of substance use situation profile groups (i.e., clusters) with covariate measures of psychiatric comorbidity, gender, ethnicity, age, and substance use history (i.e., substance of choice, frequency of substance use, withdrawal symptoms, and alcohol- and drug-related problems). Specifically, separate univariate multinomial logistic regressions were conducted to predict profile group membership (dependent variable) based on each covariate (independent variables). Multinomial logistic regression is not subject to the same assumptions as linear regression in relation to normality and heteroskedasticity (Tabachnick & Fidell, 2001). Outlier analyses did not reveal any cases with leverage over results. For all univariate analyses, omnibus multinomial logistic regressions were conducted followed by post-hoc contrasts of cluster groups. As this series of analyses was exploratory and multinomial regressions were likely underpowered (see

power analysis below), all post-host contrasts are reported regardless of significance of the corresponding omnibus test. A significance level of $p < .01$ for post-hoc tests was used to strike a balance between adjusting for type I error and identifying promising variables that may differ between cluster groups. Significant results are described in the text in terms of odds ratios (ORs).

D. Power Analysis

A primary focus of the project's data analysis involved the comparison of an adult and adolescent-specific factor structure of the IDTS for comorbid adolescents. Specifically, CFAs were conducted on the IDTS. As mentioned above, a potential problem was encountered when conducting CFAs due to sample size limitations. Specifically, the current study's sample size had a less than optimal ratio of participants to each measured variable, and a borderline sample size to reveal stable, unbiased, estimates (Fabrigar et al., 1999). To help offset potential problems of sample size CFAs were conducted in two ways for each model tested: using individual items and using item parcels as the unit of analysis.

The proposed project's other primary focus involved identifying profiles of groups of participants based on their IDTS factor scores obtained through conduct of the CFAs described above. To this end, cluster analyses were conducted to identify natural groupings of cases in terms of their pre-treatment substance use situations assessed on the IDTS (i.e., standardized factor scores). Cluster analyses are not subject to power limitations due to sample size or effect size estimates. In fact cluster analyses are most appropriate for analyses of samples with less than 300 cases due to the relative ease of demarcating groups when assessing fewer cases (Everitt et al., 2001).

The project's secondary aims involve the exploration of the relationships among pretreatment substance use situational profiles and covariates such as level of comorbid symptom severity and gender. Because there are no previous studies examining these relationships for adolescents, the estimate of effect size for the current study's power analysis of pretreatment situational profiles/personal characteristics analyses comes from a previous study (Annis & Graham, 1995) that investigated gender differences in pretreatment substance use profiles of noncomorbid adult alcohol abusers. These authors found a large association between gender and pretreatment substance use profile of r=.61. Prior to data analyses, power analyses were conducted assuming a medium effect size (Cohen's h=.5; Cohen, 1977) and comparing proportions of males and females in two pretreatment substance use situational profiles. Given these assumptions, the study's power with a sample size of 185 was estimated at .96 at alpha (two-tailed)=.05. At alpha=.01, estimated power was .80. These power estimates were computed adjusting the sample size based on unequal groups. Given these estimates, power levels were anticipated to be adequate (.80) to protect alpha=.05 for 3 post hoc (Bonferroni adjustment) comparisons. However, actual sample sizes for the multinomial logistic regressions were 175 and lower (lowest n=127) for all but one analysis. Gender was the exception where 202 cases were analyzed. Further, for each analyses, four post-hoc contrasts were conducted, not three as previously assumed, due to the identification of four IDTS cluster groups. Therefore, multinomial logistic regressions conducted on the majority of covariates were likely underpowered. Readers are cautioned to interpret results with the power limitation in mind.

IV. Results

The conduct of analyses for the current project proceeded sequentially. As a beginning step, confirmatory factor analyses (CFAs) were conducted with the Inventory of Drug Taking Situations (IDTS) in order to determine the appropriate factor model that best fits the IDTS data for the current sample of comorbid adolescents receiving treatment for a substance use disorder. These analyses were followed by the conduct of cluster analyses of IDTS factor scores from the most appropriate factor model. The aim of conducting cluster analyses was to determine natural groupings of individuals in terms of the substance use situations frequently encountered for comorbid adolescents. Following the identification of IDTS clusters, multinomial logistic regressions were conducted to contrast clusters in terms of several participant characteristics (i.e., age, gender, ethnicity, substance use, and psychiatric diagnoses and symptom severity) in order to verify the validity of clusters and to determine characteristics of cluster groupings that may aid in developing targeted substance use interventions for comorbid adolescents.

A. Comparison of the Fit of Adult and Adolescent Factor Structures

Confirmatory factor analyses compared the fit of Marlatt's 8-factor IDTS model previously found to adequately represent the IDTS structure for adults (i.e., Turner et al., 1997) to a 3-factor IDTS structure also previously identified in the adult literature (i.e., Cannon et al., 1990), and a 5-factor model previously found to represent the structure of comorbid adolescents situational self-confidence (Ramo & Brown, 2004). These analyses were conducted in several ways in order to account for deficiencies in study power due to relatively small sample size.

First, CFAs were conducted on the 8-, 3-, and 5-factor models using individual IDTS items as the unit of analyses. Table 6 shows fit results from these factor models. In general, most indexes of model fit were best for the 5-factor model, compared to the 8- and 3-factor models. Examination of these fit indexes, however, reveals that, for all models, fit indexes were indicative of poor model fit. As reported in Table 6, values for these indexes were .84 and .73 (8-factor model) and .88 and .79 (5-factor model). Further, RMSEA values for the 8- and 5-factor models were both .07. The 3-factor model fit the data very poorly. For example, NFI and CFI indexes were .67 and .77, respectively, and the RMSEA value was .08. A direct empirical comparison made between the 8- and 3-factor models showed that the 8-factor model was a significantly better fit to the data (χ^2 diff (1) = 530.98, $p < .001$). A direct empirical comparison of the 8- and 3-factor models with the 5-factor model was not possible because the 5-factor model chi-square is calculated based on fewer items in the model. When considering parsimony adjusted fit indexes, the 5-factor model revealed slightly better fit than the 8- and 3-factor models for PCFI and PNFI indexes, respectively. As all fit indexes are partially dependent on sample size and number of scale items (Tabachnick & Fidell, 2001), and given the borderline sample size in the current study in relation to number of IDTS items, it is unclear if outcomes of these item-level analyses were biased towards providing inadequate fit values.

In order to analytically address above concerns related to sample size and number of IDTS items, separate CFAs were conducted for both the 8- and 5-factor models using item parceling techniques. The 3-factor model was not examined using

item parceling techniques due to the very poor fit indexes evidenced by the item-level CFA. As presented in Table 6, fit indexes for 8- and 5-factor CFAs were both substantially improved when testing these models using the item parceling technique described above. For example, the NFI and CFI fit indexes indicated that both models fit the data well, with slightly better values for the 5-factor model. NFI and CFI values were .90 and .96 for the 8-factor model and .92 and .96 for the 5-factor model. Further, values on the RMSEA index were also adequate with values of .056 and .059 for the 8- and 5-factor models, respectively. Parsimony adjusted measures were slightly better for the 5-factor model. The values for PCFI and PNFI for the 5-factor model were .83 and .79, respectively. In contrast PCFI and PNFI values for the 8-factor model were .82 and .77.

B. Identifying Natural Groupings of Comorbid Adolescents on Substance Use Situations.

To determine how comorbid adolescents group together in terms of the types of situations in which they frequently use substances, a series of cluster analyses were conducted. Following cluster analyses, descriptive analyses and ANOVA contrasts were conducted to describe each cluster and to determine differences among clusters in their profiles of use in IDTS situations.

Given the close CFA model fits of the 8- and 5-factor solutions, choice of the CFA model to include in the cluster analyses was based on theoretical considerations and parsimony. As noted above in the introduction to this study, it is postulated that substance use situations for adolescents may be less crystallized than for adults, resulting in fewer empirically-derived factors on measures pertaining to substance use.

Further, most closely in accordance with this is empirical evidence from research on the Drug Taking Confidence Questionnaire which shows that self-confidence in refraining from use in identical situations as assessed on the IDTS conforms, for comorbid adolescents, most accurately in the 5-factor model tested for the IDTS in this study (i.e., Ramo & Brown, 2004). From a standpoint of parsimony, compared to an 8-factor model, the 5-factor model presents a more simple explanation for how substance use situations are constituted for comorbid adolescents given approximate equivalence in measures of model fit. Therefore, the 5-factor IDTS CFA model (see Figure 3) was judged the most appropriate and, consequently, used to determine cluster membership for each adolescent for the current study.

Cluster analyses analyzed 5 IDTS standardized factor scores to determine cluster membership for each adolescent. Factor scores were calculated by weighting each participant's response to each item on each factor by the item's corresponding factor loading. For each factor, weighted values on each item were summed and standardized for inclusion in the cluster analyses. Items on each factor, not each item parcel dyad, were used in the calculation of factor scores in order to more precisely account for each individual item's influence on factor score.

First, factor scores for the 5-factor CFA solution were included as independent variables in a hierarchical cluster analyses using the Ward method to differentiate among participants in terms of pattern of factor scores. An examination of the resulting dendrogram and agglomeration schedule was conducted to identify large distances that differentiate among groups of participants and, therefore, enable the detection of similar groups of individuals in terms of IDTS factor scores by showing

that they are relatively proximal in terms of scores across all factors. The largest distances indicated that either a one-cluster or 4-cluster solution best fit the data. Given study hypotheses that multiple clusters would be identified, the 4-cluster solution was chosen and subsequently analyzed for reliability.

Step 2 of the current cluster analyses addressed reliability by using the Quick Cluster method in SPSS v13. For the current analyses, initial cluster centers were entered into the Quick Cluster analysis and a 4-cluster model was specified. Initial cluster centers were derived from the cluster centers resulting from the 4-cluster model identified in the hierarchical cluster analyses described above. Table 7 reports the concordance rates for case classification for the hierarchical cluster and Quick Cluster 4-cluster solutions. Results indicated adequate reliability of a 4-cluster solution. The Quick Cluster solution correctly identified 178 of 221 cases (81%) from the hierarchical cluster analysis. Within cluster concordance ranged from 71% to 100% of cases (kappa = .73).

Table 8 reports means and standard deviations (SD) for factor scores by cluster membership based on the hierarchical cluster analysis. Because factor scores, as computed, were standardized, the overall mean and SD were 0 and 1, respectively, for the entire sample. ANOVA contrasts comparing factor scores across cluster groups are presented in Table 9. All contrasts were significant at $p < .05$ (with Tukey HSD correction for type I error) with several exceptions. Specifically, cluster 2 and 4 did not differ on IDTS factors of conflict with others/unpleasant emotions (CO/UE), positive social interactions/urges (PS/U), and testing personal control (TPC), and clusters 3 and 4 did not differ on the pleasant emotions (PE) IDTS factor. Figure 5

presents a graphical description of clusters based on the mean of the cluster group for each factor. As pictured, cases classified in cluster 1 (all high cluster) scored high across all IDTS factors and cases classified in cluster 3 (all low cluster) scored low across all IDTS factors. Cluster 2 (high pleasant emotions cluster) is characterized by relatively moderate scores across all IDTS factors with the exception of the pleasant emotions factor, on which cases scored relatively high. Cluster 4 (low pleasant emotions and physical/sexual situations cluster) is characterized by relatively moderate scores on the CO/UE, PS/U, and TPC IDTS factors, and relatively low scores on PE and physical/sexual (P/S) factors.

C. Associations among cluster membership and demographic covariates

The relationships among IDTS cluster groups and demographic variables was assessed through the comparison of cluster groups and measures of gender, age, and ethnicity. Descriptive statistics for all covariates and other select background variables by cluster groups are reported in Table 2. For analyses of age, age was conceptualized in 2 distinct ways. First, age was considered a continuous variable and then age was included in the analysis as a dichotomous variable (i.e., <16 years and 16> years). Ethnicity was included in analyses as a three level categorical variable representing Caucasian, Latino/a, and other/mix ethnicity categories. Analyses of ethnicity used the Caucasian group as the reference. Therefore, significant differences on this variable between IDTS clusters indicate differences between the proportion of Latino and/or other/mixed ethnicities compared to the proportion of Caucasians.

No omnibus tests for mulinomial logistic regressions of demographic variables were significant at $p < .05$. Values for all multinomial logistic regression contrasts are

reported in Table 10. Contrasts of cluster groups indicated that clusters did not differ significantly in terms of gender and age (both continuous and dichotomous variables). Only one contrast of cluster groups was significant at $p < .01$ in terms of ethnicity. Specifically, those in the all low cluster were more likely than those in the high pleasant emotions group to be of other/mixed ethnicity, compared to Caucasian (Wald = 9.20, OR = 13.23, 95%CI = 2.49, 70.22).

D. Associations Among Cluster Membership and Comorbid Diagnoses

Cluster groups were compared in terms of comorbid diagnosis by assessing group differences in terms of mood/anxiety spectrum diagnoses (i.e., internalizing disorders) and disruptive disorder diagnoses (i.e., externalizing disorders). Cluster differences in rates of internalizing and externalizing comorbid disorders were tested in several ways. First, clusters were compared, through multinomial logistic regression, representing comorbid diagnosis as a 3-level variable (i.e., internalizing disorder, externalizing disorder, or both). The internalizing disorder level was chosen as the reference category. Therefore, significant differences on this variable between IDTS clusters indicate differences between the proportion of those with externalizing disorders or both internalizing and externalizing disorders compared to the proportion of those with internalizing disorders only. Multinomial logistic regression did not result in any significant differences among clusters in terms of internalizing/externalizing diagnoses.

Next, mood and anxiety spectrum diagnoses (internalizing disorders) were conceptualized as a 4-level categorical variable (i.e., no mood/anxiety disorder, anxiety disorder, mood disorder, or both anxiety and mood disorder) and this was

included in a multinomial logistic regression. The anxiety disorder level was chosen as the reference category. Therefore, significant differences on this variable between IDTS clusters indicate differences between the proportion of those with no anxiety/mood spectrum diagnoses, mood spectrum diagnoses, and/or both anxiety and mood spectrum diagnoses compared to the proportion of those with anxiety spectrum diagnoses only. Multinomial logistic regression did not result in any significant differences among clusters in terms of anxiety or mood spectrum diagnoses.

Disruptive disorder diagnoses (externalizing disorders) were conceptualized as a 2-level categorical variable representing the presence/absence of such a diagnosis. Similar to anxiety/mood spectrum diagnoses, cluster groups did not differ significantly in proportion of cases with disruptive disorder diagnoses.

E. Associations Among Cluster Membership and Comorbid Symptom Severity.

Differences among IDTS clusters on measures of comorbid internalizing and externalizing symptom severity were assessed through univariate multinomial logistic regressions on total BDI score, scores on the STAI subscales of state anxiety and trait anxiety, as well as scores on all symptom scales of the CBCL (i.e., internalizing symptoms, externalizing symptoms, anxious/depressed, withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behavior, and aggressive behavior).

Assessment of differences among IDTS cluster groups and level of depression as represented by total BDI score revealed no significant differences. Further, no significant differences were found on any comparisons of IDTS clusters by CBCL subscale scores and no differences were found on the STAI subscale representing state

anxiety. However, the omnibus test for the STAI subscale of trait anxiety was significant at $p < .05$ (χ^2 (3) = 8.28, -2LL = 202.51). One significant contrast was found, revealing that those in the low pleasant emotions and physical/sexual situations cluster had lower levels of trait anxiety compared to those in the all high cluster (Wald=6.32, $p < .01$, OR = .17; 95%CI = .05, .68).

F. Associations Among Cluster Group Membership and Substance Use History

Analysis of IDTS cluster differences by substance of choice conceptualized substance of choice as a 4-level variable encompassing alcohol, marijuana, amphetamines, and other drugs. Amphetamines were chosen as the reference category in the multinomial logistic regression. Therefore, contrasts among clusters on this variable tested the proportion of alcohol, marijuana, and other drug users compared to the proportion of amphetamine users. No significant cluster differences were found.

Tests of IDTS cluster differences on lifetime times drunk and stoned revealed no significant differences among clusters for the times drunk variable. However, the omnibus test for the times stoned variable was significant (χ^2 (3) = 23.67, $p < .001$, -2LL = 203.62). Significant contrasts indicated that, compared to those in the all high cluster, those in the all low cluster were less likely to have frequently been stoned on drugs (Wald = 7.93, $p < .01$, OR = .998; 95%CI = .997, .999), as were those in the low pleasant emotions and physical/sexual situations cluster (Wald = 17.62, $p < .001$, OR = .997; 95%CI = .996, .999). Those in the high pleasant emotions cluster were significantly more likely to have been stoned from drugs more frequently than those in

the low pleasant emotions and physical/sexual situations cluster (Wald = 8.44, $p < .01$, OR = 1.002, 95%CI = 1.001, 1.003).

For lifetime frequency of drug use, omnibus tests were significant at p< .05 for marijuana (χ^2 (3) = 22.83, $p < .001$, -2LL = 244.68), amphetamines (χ^2 (3) = 10.78, $p < .05$, -2LL = 218.75), and other drugs (χ^2 (3) = 10.56, $p < .05$, -2LL = 305.06). However, contrasts of IDTS clusters were significant at $p < .01$ for only lifetime frequency of marijuana. Specifically, those in the all low cluster were less likely to have used marijuana more frequently than those in the all high cluster (Wald = 10.43, $p < .01$, OR = .998, 95%CI = .996, .999). Those in the low pleasant emotions and physical/sexual situation cluster were also less likely to have frequently used marijuana than those in the all high cluster (Wald = 14.37, $p < .001$, OR = .998, 95%CI = .997, .999) and those in the high pleasant emotions cluster were more likely than those in the low pleasant emotions and physical/sexual situations cluster to have used marijuana frequently (Wald = 7.68, $p < .01$, OR = 1.002, 95%CI = 1.001, 1.003).

Lifetime number of alcohol and drug withdrawal symptoms experienced were examined in separate multinomial logistic regressions and did not result in any significant findings. However, examination of lifetime number of problems experienced from substance use did result in significant omnibus tests for alcohol (χ^2 (3) = 10.58, $p < .05$, -2LL = 142.25) and drug problems (χ^2 (3) = 30.92, $p < .001$, -2LL = 116.93). IDTS cluster contrasts for both variables were also significant. IDTS cluster contrasts for lifetime alcohol problems indicated that those who experienced more alcohol-related problems were less likely to be classified in the all low cluster

compared to the all high cluster (Wald = 6.90, $p < .01$, OR = .83, 95%CI = .72, .95) and the high pleasant emotions cluster (Wald = 7.93, $p < .01$, OR = .82, 95%CI = .71, .94). IDTS cluster contrasts for lifetime drug problems indicated that those who experienced more drug-related problems were less likely to be classified in the all low cluster (Wald = 19.71, $p < .001$, OR = .70, 95%CI = .60, .82) and the low pleasant emotions and physical/sexual situations cluster (Wald = 16.87, $p < .001$, OR = .76, 95%CI = .66, .87) compared to the all high cluster. Those who experienced more drug-related problems were also less likely to be classified in the all low cluster compared to the high pleasant emotions cluster (Wald = 9.13, $p < .01$, OR = .81, 95%CI = .70, .93).

V. DISCUSSION

A. Summary of Findings

The current project was designed to investigate the structure of comorbid adolescent substance use situations. Specifically, the fit of two adult classification systems of pretreatment substance use situations on the Inventory of Drug Taking Situations (IDTS) were compared to an alternative, developmentally informed classification system. Stemming from these analyses, pretreatment substance use situational profiles were determined by cluster analyses and described. Somewhat contrary to expectations, an 8-factor model previously investigated in the adult literature (i.e., Turner et al., 1997) corresponding to Marlatt & Gordan's (1985**;** Witkiewitz & Marlatt, 2004) taxonomy of adult relapse situations, and a developmentally informed adolescent 5-factor model (i.e., Ramo & Brown, 2004) provided approximately equivalent and acceptable fit indexes to the data from comorbid adolescents, with a slight advantage for the 5-factor model.

Due to conceptual considerations and issues of parsimony, the 5-factor model was determined most appropriate and was used in subsequent analyses. The 5-factor model was chosen for these analyses over the 8-factor model because the 5-factor model fit the data equally as well as the 8-factor model. The 5-factor model is consistent with theoretical expectations that substance use situations should be cognitively construed more diffusely for adolescents, compared to adults, and thus represented by fewer and less differentiated factors. The 5-factor model is also a simpler representation of the data. It follows that, given equivalent CFA fit indexes for 8- and 5-factor models, that the 5-factor model should be chosen as most valid due to

parsimony considerations. Standardized factor scores from the 5-factor model were analyzed by cluster analyses to determine profiles of substance use situations for participants.

Cluster analyses revealed that comorbid adolescents could be grouped into four clusters. ANOVA contrasts and descriptive analyses revealed that each cluster represented a distinct group of comorbid adolescents in terms of frequency of substance use in various situations. These analyses are consonant with previous research on the IDTS with adults (e.g**.,** Annis & Graham, 1996) that found adults could also be grouped into multiple profiles in terms of frequency of substance use in various situations.

As a secondary focus, differences were explored across substance use situation cluster groups in relation to several covariates: comorbidity, gender, ethnicity, age, and substance use history. Multivariate logistic regressions were conducted to validate the situational profiles obtained in earlier analyses and to determine associations of these covariates with specific profile groups. Most notably, consistent differences were found among situation clusters when examining associations among cluster groups and several measures assessing substance use history. Significant differences among IDTS clusters and substance use history variables support the validity of cluster groups as representing natural groups (Everitt et al., 2001) of comorbid adolescents in terms of patterns of substance use situations. Findings highlight that the cluster groups represent differential levels of concurrent risk for experiencing higher frequencies of problematic substance use.

B. Structural Grouping of Substance Use Situations: CFAs of the IDTS.

The current study highlights the importance of development when considering applying adult-based theoretical and data models to adolescent samples. In my evaluation of the factor structure of the IDTS, a model previously found to adequately apply to adult substance use situations also fit the data well for a comorbid sample of adolescents. However, a more parsimonious model based on a theoretical assumption regarding cognitive development, and previous empirical findings fit the data at least equally as well.

This 5-factor model included factors that can be described as conflict with others/unpleasant emotions (CO/UE); positive social interactions/urges (PS/U); pleasant emotions (PE); physical/sexual (P/S); and testing personal control (TPC). Previous research has found that adolescents most frequently use substances in social situations. It can be seen in the above factor descriptions, and in a visual comparison of scale items for the 8- and 5-factor solutions (see Table 5), that adolescents are possibly less likely to interpret emotional characteristics of substance use situations as distinct from the social characteristics (e.g., factor 1 of the 5-factor model). In other words, it is possible that, for comorbid adolescents, intrinsic and extrinsic situational influences are cognitively intertwined. This obfuscation of situational influence for comorbid adolescents could create difficulties in coping with these situations without using. Specifically, comorbid adolescents may have their coping resources taxed in such situations due to confusion surrounding appropriate coping resources to employ. Prior research with comorbid adolescents on the Drug Taking Confidence Questionnaire found that confidence in coping with substance use situations without using conforms to an identical factor structure (Ramo & Brown, 2004). This indicates

that adolescents perceive their adeptness for coping with high risk situations in similar terms and fits with assumptions of cognitive social learning theory (Bandura, 1986).

Brown and colleagues have found that adolescents tend to relapse more frequently than adults in situations involving social pressure (Brown et al., 1989). However, I could not identify any studies that have investigated the relationship among intrinsic emotional states and social situations. Taking current results under consideration, it is possible that adolescent and adult substance abusers internally process social situations differently, leading to differential rates of relapse in similar extrinsic situations.

C. Determining Profiles of Comorbid Adolescent Substance Use Situations.

The current study demonstrates the capacity to reliably group comorbid adolescents into multiple distinct profiles of frequency of substance use in qualitatively different situations. This was accomplished through the conduct of hierarchical cluster analysis and replication of four derived clusters with an alternative clustering procedure. ANOVA contrasts were reported comparing IDTS factor scores among clusters. However, these results are potentially confounded because the cluster analytic method's purpose is to create groups that differ, and should not be definitively used to judge cluster differences (Everitt et al., 2001). Evident from the cluster solutions (Figure 5) was that, prior to treatment, groups of comorbid adolescents in treatment for a substance use disorder differed in their frequency of use in various situations as assessed on the IDTS. Descriptively, the all high and all low groups appeared distinctly different in frequency of substance use across all IDTS factors. Perhaps more interesting, the remaining two clusters were dissimilar on only two

IDTS factors. The four-cluster solution represented comorbid adolescents who used substances frequently in all situations (all high group); frequently in situations involving pleasant emotions (high PE group); those who did not use frequently in any situations (all low group); and those who did not use frequently in pleasant emotions and physical/sexual situations (low PE, P/S group). Stability of these cluster groupings was evident through high agreement when comparing the classification of cases across clustering methods.

The all high group used substances frequently across all situations assessed on the IDTS and the all low group used infrequently across all situations, and most infrequently in situations involving urges to use. Therefore, it appears that the type of situations may matter little to individuals classified in these profiles as the type of situation does not seem to discriminate frequency of substance use. The high PE group used moderately across most situations, but tended to use more frequently in situations involving pleasant emotions. Therefore, pleasant emotions situations appear to represent the most risk of substance use for these individuals. The low PE, P/S group used moderately in most situations but used less frequently in pleasant emotions and physical/sexual situations. For these cases, pleasant emotion and physical/sexual situations appear to represent less risk for substance use.

One previous study examined profiles of substance use situations for adult drinkers (i.e., Annis & Graham, 1995). Compared to those adults, it does not appear that substance use profiles for comorbid adolescent substance abusers (i.e., alcohol and/or drug users) are similar. Specifically, adult drinkers were found to typically drink more often in negative emotion/conflict situations, and pleasant

emotions/pleasant social/ or social pressure situations; and less often in testing personal control and physical discomfort situations. For comorbid adolescents, clusters indicated that substance use occurred either more or less frequently across all situations (i.e., all highs and all lows), or was primarily differentiated by more or less use in positive emotion and physical/sexual situations. It is important to note that Annis and Graham (1996) used different statistical methods than hierarchical cluster analyses (i.e., modal profile analyses) to determine the profiles for adult drinkers. It is unclear if a more diverse sample of adult substance abusers, or the use of different clustering methods, would result in similar profile patterns to those found in the current study. Future research should investigate this topic to determine more definitively if adults and adolescents differ in their patterns of situations where they use substances.

D. Concurrent Validity of Cluster Groups

Exploratory analyses were conducted to access associations among cluster groups and background characteristics including demographics, comorbid psychopathology, and substance use history. Univariate multinomial logistic regressions revealed no differences among cluster groups in terms of age and gender, and limited differences in terms of ethnicity. Therefore, it does not appear that age of adolescents or increased freedom associated with obtaining a driver's license impacts the manifestation of the quality and frequency of substance use situations. Previous research by Annis and Graham (1996) found gender differences in patterns of substance use situations for adult drinkers. Specifically, women were more likely to be classified in a profile characterized by drinking most frequently in negative emotion

and conflict situations. Unfortunately, the lack of gender differences in the current study does not allow for a definitive conclusion regarding whether gender differences emerge in adulthood. This is due to the absence of a cluster group equivalent to the negative emotion and conflict situations profile from the adult literature, and the comorbidity and substance use characteristics of the current sample. However, lack of findings demonstrate that there was no evidence suggesting that gender differences in substance use situations manifest themselves differently in adolescence.

Related to ethnicity, only one contrast of cluster groups was significant. Specifically, those in the all low cluster were approximately 13 times more likely than those in the high pleasant emotions group to be of other/mixed ethnicity, compared to Caucasian. This is the first study to demonstrate ethnic differences among patterns of substance use situations for adolescents or adults. However, given the exploratory nature of findings in the current study, this finding should be interpreted cautiously.

Contrasts of IDTS cluster groups and psychopathology did not reveal any differences among clusters in terms of comorbid diagnosis assessed via the DISC. Considering symptom severity, only trait anxiety differed among clusters. Specifically, comorbid adolescents were approximately 6 times less likely to be classified in the low pleasant emotions and physical/sexual situations cluster, compared to the all high cluster, for each 1 unit decrease in score on the trait anxiety subscale of the STAI. Given the multitude of variables representing different aspects of psychiatric comorbidity in the current study, and only one significant contrast between cluster groups, it appears likely that comorbid diagnosis and symptom

severity do not substantially influence profiles of substance use situations for comorbid adolescents.

This result contrasts with the theoretical assumptions and the limited extant literature for adults. For example, social cognitive theory would hypothesize that associations among relapse situations and congruent psychiatric symptoms (e.g., Anderson, et al., 2006) should result from a learning history that would be evidenced by high reported frequency of use in psychiatric symptom congruent pretreatment substance use situations. This does not appear to be the case for comorbid adolescents in this study. Further, current results also contrast with previous research on adults. One previous study investigated the relationship between severe mental illness and pretreatment substance use situations and found that severely mentally ill adult substance users used substances in situations congruent with Marlatt and Gordon's taxonomy (Bradizza & Stasiewicz, 2003).

Substance use history, on the other hand, was more consistently associated with situational substance use profiles for comorbid adolescents. These findings contrast with the adult literature which has found that substance use situations are similar irrespective of class of substance (e.g., Marlatt, 1996; Turner et al., 1997) and is possibly reflective of the non-normative nature of illicit substance use in adolescence (e.g., Shedler & Block, 1990).

Tests of IDTS cluster differences on the lifetime times drunk variable revealed no significant differences among clusters for the times drunk variable. Further, no cluster differences were found when examining lifetime number of alcohol or drug withdrawal symptoms experienced. However, differences among clusters were found

for lifetime times stoned on drugs and time used marijuana. Of note, differences among clusters for both of these variables were approximately identical. It is possible, that the correspondence in these relationships was impacted by colinearity. Specifically, it seems likely that adolescents associate the word "stoned" with marijuana use and, therefore, responded similarly on both items assessing times stoned and times used marijuana. A high correlation between these variables (r = .82; see Table 4) supports this assumption. Results of these analyses revealed that, compared to the all high cluster, adolescents were 1.1 times less likely to have been classified in the all low cluster, and 1.15 times less likely to have been classified in the low pleasant emotions and physical/sexual situations cluster, for every 50 times stoned on drugs and for every 50 times they used marijuana. Compared to the low pleasant emotions and physical/sexual situations cluster, adolescents were 1.1 times more likely to be classified in the high pleasant emotions cluster for every 50 times stoned on drugs or used marijuana.

IDTS cluster contrasts for lifetime alcohol problems indicated that those adolescents were 1.2 times less likely to be classified in the all low cluster for every alcohol problem experienced, compared to the all high cluster, and 1.22 times less likely to be classified in the high pleasant emotions cluster for every alcohol problem. IDTS cluster contrasts for lifetime drug problems indicated that, compared to the all high cluster, adolescents were 1.43 times less likely to be classified in the all low cluster and 1.32 times less likely to be classified in the low pleasant emotions and physical/sexual situations cluster for each drug-related problem experienced. Each drug-related problem experienced also increased the odds of adolescents being

classified in the high pleasant emotions cluster by 1.23 times, compared to the all low cluster.

E. Clinical Implications

The long term objective of the current study was to investigate the structure of substance use situations for comorbid adolescents to inform prevention and treatment programs. Primary implications for prevention and treatment programs for comorbid adolescents mainly relate to the findings that these adolescents likely hold less differentiated factor structures than adults related to substance use situations, and that adolescents tend to fall into one of four distinct clusters that represent differential frequencies of substance use in relation to five types of situations. The 5-factor CFA shows that, in some instances, comorbid adolescent substance use situations group into factors that may represent a merging of intrinsic (e.g., negative emotions) and extrinsic (e.g., social pressure) use situations. Whereas, previous research has found that these situations appear more distinct for adults (e.g., Turner et al., 1997). Implications are such that relapse prevention programs, and primary/secondary substance prevention in general, should consider how to best intervene with comorbid adolescents to address these types of intrinsic/extrinsic situations. For example, a common focus of substance use intervention for youth and adults is to teach skills to cope with high risk situations, either separately or as part of a multicomponent intervention (e.g., Brown, 2001). For comorbid adolescents, some situations may be entrenched with both high risk external environments (e.g., social pressure) and internal mood states (e.g., anxiety). It may be difficult for some adolescents to effectively cope with the two concurrent types of situational chararacteristics. Although more research on this proposition is needed, one

potential effective adaptation to current coping skills interventions may be to teach comorbid adolescents to separate high risk situational characteristics into distinct components and then apply appropriate skills to each. It is also possible that different skill sets need to be conceived to effectively cope with such situations.

An additional clinical implication stems from the finding that different groups of comorbid adolescents have different profiles of substance use in relation to a variety of substance use situations. Identifying such patterns of high risk substance use situations could assist treatment providers in providing more focus to interventions by targeting interventions to distinct groups of adolescents. Current results, however, only provide information that groups of adolescents hold distinct substance use situational profiles and that these groups evidence differences in concurrent substance use characteristics. The question remains whether any of these groups hold heightened risk for prospective negative outcomes (e.g., relapse). If so, the utility of differentiating comorbid adolescents into substance use situational clusters may be broadened by the ability to focus resources on those most at risk for future negative outcomes.

F. Limitations and Future Directions

The current study has several limitations. Most notable is the limited sample size. It is possible that the limited sample size obscured results of the CFAs conducted on the IDTS due to the low number of cases in relation to the number of IDTS items. However, results of the CFAs for models using item parceling techniques suggest that this did not occur. Limited power may also have led to the underestimation of associations between cluster groups and covariates. Further, substantial missing data occurred for many covariates examined. In addition, the amount of missing data varied

for each covariate examined. It remains unclear how differences in missing data among covariates influenced the pattern of findings and if results would have changed using more complete data. A larger study would help to more definitively answer the question of whether a 5-factor structure best fits for substance use situations assessed with the IDTS for comorbid adolescents, and whether demographic and comorbid psychopathology are associated differentially with cluster groups.

In addition to sample size limitations, it is difficult to interpret the meaning of results from the CFAs for the 8- and 5-factor model due to two reasons. First, the models were based on different numbers of IDTS items which may influence fit indexes due to differences in power of the corresponding statistical tests. Consideration was given to rationally grouping 10 items excluded from the 5-factor model. These items were excluded during initial validation of the 5-factor model with the DTCQ (Ramo & Brown, 2004). This option was not pursued because it could unknowingly change the underlying structure of IDTS factors. Alternatively, it was presumed that using item parceling techniques would decrease the impact of differences in number of IDTS items between the 8- and 5-factor models. Parceling techniques increased the power for testing both CFAs by decreasing the number of variables in each model and, also, decreased differences in the number of items between models. In comparison, the 8-factor parcel model included 25 dyads while the 5-factor model included 20. Despite this increase in similarity in number of items, the parcel models still did not allow for equivalent comparisons of fit indexes. It is possible that, if models were equivalent in terms of number of items, different outcomes of CFAs would have resulted.

The other study aspect that leads to difficulties in interpretation is due to the results of the CFAs. Specifically, both the 8-factor adult model and 5-factor adolescent model fit the data well. Given that the current study only examined comorbid adolescents, it is unclear whether the 5-factor model is specific for youth or also extends to adults. It is possible that the 5-factor model would also fit equally well for adult substance abusers. Therefore, conclusions drawn from the current study may be spurious in terms of their stated developmental relevance. Future studies could remedy both limitations described here by examining 8- and 5-factor models for larger samples of adolescents and adults and testing each model for factor structure invariance.

An additional limitation relates to the use of the IDTS in the current study. Specifically, the IDTS was originally developed based on the adult relapse model (i.e., Marlatt & Gordon, 1986). Therefore, the situations assessed on the IDTS may be most relevant to adults and may exclude situations that may only be relevant to adolescents. Future research should investigate situations specifically related to adolescent substance use in order to refine measurement and to further explicate the construct of substance use situations for adolescents. It is unknown from results of the current study if a different factor structure would result if an adolescent-specific measure of substance use situations was developed.

Other sample characteristic, besides sample size, potentially impacts the external validity of the current study. Specifically, the sample was composed of comorbid adolescents who were entering treatment for a substance use disorder. It has been noted that few adolescents in need of substance abuse treatment actually receive

it (MacPherson, Frissell, Brown, & Myers, 2006). Therefore, it is unclear whether current results generalize to the broad population of comorbid adolescents.

In addition, although the current sample was somewhat diverse, the distribution of non-Caucasian ethnicities was low, with the exception of Latino/as. Therefore, logistic regressions did not allow for exploration of ethnic differences beyond a 3-category comparison (i.e., Caucasian, Latino/a, other ethnicity), in relation to cluster groups. Both gender groups were adequately represented in the current sample in terms of proportion. However, overall sample size also did not allow for more elegant analyses by gender than were conducted, such as invariance testing.

Predictive analyses evaluating associations among cluster groups and covariates were cross sectional. Although these analyses provided some evidence for the concurrent validity of the cluster groups identified, there is limited direct relevance to substance use outcomes. A guiding assumption of cognitive social learning theory applied to addictive behaviors is that situations individuals use substances in, prior to treatment, represent high risk situations for relapse. No direct evidence for the validity of this assumption was provided in the present study. The potential utility of the substance use situation clusters determined in the current study is, therefore, limited in regards to whether treatments can benefit from their identification (beyond the implications described above). Further, the current study did not provide results pertaining to the replicability of clusters. Although concurrent validity was tested, there is no guarantee that the clusters will hold true for other samples of comorbid adolescents.

Future research should attempt to both replicate the clusters found in the current study and to examine longitudinal relationships to determine if clusters are predictive of substance use outcomes. For example, knowing whether clusters are predictive of relapse or time to relapse would help to identify those at most risk for this outcome. Knowing this may allow treatment providers to intervene more effectively with such individuals. In sum, determining whether pre-treatment substance use situation clusters correspond to similar relapse situations would provide information on the validity of current conceptualizations of cognitive social learning theory of addictive behaviors.

APPENDIX

Table 1. Descriptive statistics for IDTS items

Item	Mean	SD	Skew	Kurtosis
When I was depressed about things in general	2.66	1.086	-.172	-1.265
When I felt shaky, sick, or nauseous	2.10	1.157	.541	-1.203
When I was happy	2.99	1.016	-.682	-.661
When I felt there was nowhere left to turn	2.73	1.220	-.284	-1.518
When I wanted to see whether I could use these drugs in moderation	2.29	1.110	.222	-1.318
When I was in a place where I had used or bought these drugs before	3.11	.982	-.956	-.089
When I felt tense or uneasy in the presence of someone	2.43	1.156	.096	-1.434
When I was invited to someone's home and felt awkward about refusing when they offered me these drugs	2.18	1.196	.385	-1.426
When I met some old friends and we wanted to have a good time	3.14	1.026	-.907	-.430
When I was unable to express my feelings to someone	2.33	1.177	.227	-1.466
When I felt that I had let myself down	2.35	1.188	.157	-1.500
When I had trouble sleeping	2.21	1.230	.326	-1.534
When I felt confident and relaxed	2.70	1.168	-.279	-1.403
When I was bored	3.07	1.051	-.810	-.620
When I wanted to proved to myself that these drugs were not a problem for me	2.27	1.186	.245	-1.480
When I unexpectedly found some of these drugs or happened to see something that reminded me of these drugs	2.77	1.090	-.360	-1.175
When other people rejected me or didn't seem to like me	2.15	1.212	.490	-1.363
When I was out with friends and they kept suggesting we go somewhere and use these drugs	3.04	1.111	-.794	-.787
When I was with an intimate friend and we wanted to feel even closer	2.28	1.124	.287	-1.303
When other people treated me unfairly or interfered with my plans	2.28	1.187	.322	-1.419
When I was lonely	2.48	1.223	-.010	-1.586
When I wanted to stay awake, be more alert, or be more energetic	2.41	1.285	.098	-1.694
When I felt excited about something	2.74	1.068	-.341	-1.121
When I felt anxious or tense about something	2.53	1.098	-.077	-1.303
When I wanted to find out whether I could use these drugs occasionally without getting hooked	2.18	1.177	.420	-1.348
When I had been drinking and thought about using these drugs	2.63	1.173	-.262	-1.354
When I felt that my family was putting a lot of pressure on me or that I couldn't measure up to their expectations	2.75	1.163	-.343	-1.357
When others in the same room were using these drugs and I felt that they expected me to join in	2.81	1.163	-.455	-1.274

Table continued

Item	Mean	SD	Skew	Kurtosis
When I was with friends and wanted to increase my enjoyment	3.14	.988	-.942	-.192
When I was not getting along well with others at school or work	2.33	1.149	.261	-1.365
When I started to feel guilty about something	2.38	1.100	.112	-1.312
When I wanted to lose weight	1.84	1.163	.960	-.715
When I was feeling content with my life	2.35	1.124	.178	-1.348
When I felt overwhelmed and wanted to escape	2.82	1.177	-.420	-1.348
When I wanted to test out whether I could be with drug-using friends without using these drugs	2.02	1.087	.628	-.971
When I heard someone talking about their past experiences with these drugs	2.44	1.165	.051	-1.463
When there were fights at home	2.58	1.194	-.108	-1.516
When I was pressured to use these drugs and felt that I couldn't refuse	2.17	1.222	.455	-1.410
When I wanted to celebrate with a friend	3.15	.979	-.961	-.134
When someone was dissatisfied with my work or I felt pressured at school or on the job	2.30	1.168	.245	-1.427
When I was angry at the way things had turned out	2.68	1.129	-.299	-1.294
When I had a headache or was in physical pain	2.41	1.178	.096	-1.487
When I remembered something good that had happened	2.33	1.097	.189	-1.286
When I felt confused about what I should do	2.58	1.144	-.151	-1.395
When I wanted to test out whether I could be in places where these drugs were being used without using any	1.88	1.055	.893	-.512
When I began to think how good a rush or a high had felt	3.11	1.075	-1.070	.096
When I felt that I needed courage to face up to someone	2.18	1.161	.432	-1.299
When I was with a group of people and everyone was using these drugs	3.16	1.021	-.968	-.281
When I was having a good time and wanted to increase my sexual enjoyment	2.11	1.131	.488	-1.211
When I felt that someone was trying to control me and I wanted to feel more independent	2.20	1.207	.366	-1.457

Table 2. Demographic, comorbidity, and substance use history descriptive statistics for total sample and by cluster groups.

		Cluster			
Demographics:	Total	All High	High PE	Low PE, P/S	All Low
Female (%) (N=202)	54.0	59.7	47.7	56.8	50.0
Ethnicity (%) (N=169)					
Caucasian	69.8	71.7	76.8	70.7	50.0
Latino	18.9	17.4	19.6	19.5	19.2
Other	11.2	10.9	3.6	9.8	30.8
Age (M (SD)) (N=145)	15.95 (1.21)	16.08 (1.16)	15.93 (1.34)	15.79 (1.17)	15.83 (1.10)
Age (% <16yr)	48.3	40.0	45.8	60.7	64.3
Comorbidity:	Total	All High	High PE	Low PE, P/S	All Low
DISC Diagnosis (%) (N=159)					
Internalizing Disorder Only	21.2	17.4	26.0	27.0	5.6
Externalizing Disorder Only	10.6	10.9	8.0	10.8	16.7
Internalizing and Externalizing	68.2	71.7	66.0	62.2	77.8
Any Internalizing	48.4	48.9	58.5	35.0	47.4
Any Externalizing	74.8	80.9	69.8	67.5	89.5
Internalizing:					
Any Mood	69.8	72.3	71.7	65.0	68.4
Any Anxiety	63.5	63.8	73.6	52.5	57.9
Mood Only	21.4	23.4	13.2	30.0	21.1
Anxiety Only	15.1	14.9	15.1	17.5	10.5
Symptom Severity (M (SD))					
BDI (N=154)	14.98 (12.09)	16.13 (12.47)	14.97 (11.92)	14.30 (11.66)	13.63 (13.09)
STAI:					
State Anxiety (N=151)	2.42 (.41)	2.53 (.42)	2.42 (.36)	2.31 (.43)	2.37 (.46)
Trait Anxiety (N=150)	2.45 (.35)	2.56 (.38)	2.43 (.32)	2.36 (.32)	2.38 (.38)
CBCL: (N=127)					
Anxious/Depressed	6.46 (4.70)	6.25 (4.58)	5.45 (4.76)	7.94 (4.64)	6.59 (4.58)
Withdrawn/Depressed	4.11 (3.11)	3.14 (2.55)	4.14 (3.38)	4.88 (3.15)	4.65 (3.12)
Somatic Complaints	3.47 (3.59)	3.36 (3.99)	3.12 (3.28)	4.41 (3.75)	2.82 (3.05)
Social Problems	4.96 (3.86)	4.28 (3.78)	4.62 (3.81)	6.31 (4.27)	4.71 (2.91)
Thought Problems	3.32 (3.32)	2.64 (3.11)	3.38 (2.95)	4.16 (4.14)	3.00 (2.78)
Attention Problems	4.90 (3.19)	4.83 (3.01)	4.57 (3.37)	5.63 (3.23)	4.47 (3.08)
Rule-breaking Behavior	7.35 (5.74)	6.81 (4.94)	6.17 (4.64)	9.03 (7.00)	8.29 (6.68)
Aggressive Behavior	11.39 (8.19)	9.72 (7.55)	10.50 (8.20)	13.88 (8.53)	12.47 (8.26)
Externalizing Symptoms	18.75 (12.90)	16.53 (11.52)	16.67 (11.97)	22.90 (14.47)	20.76 (13.65)
Internalizing Symptoms	14.04 (9.79)	12.75 (9.69)	12.71 (10.09)	17.22 (9.74)	14.06 (8.73)
Substance Use History (M (SD))	Total	All High	High PE	Low PE, P/S	All Low
CDDR: (N=175)					
Lifetime times used marijuana	434.74 (394.62)	596.34 (402.11)	490.96 (378.41)	271.95 (323.31)	263.36 (376.61)
Lifetimes times used amphet	142.81 (258.37)	247.44 (336.31)	110.09 (209.92)	89.60 (200.13)	99.68 (218.60)

Table continued

	Total	All High	High PE	Low PE, P/S	All Low
Times drunk in life	156.39 (254.19)	177.06 (256.83)	197.12 (288.65)	99.43 (216.41)	118.68 (211.51)
Times stoned (from drugs)	446.40 (400.66)	624.24 (398.27)	483.30 (375.09)	250.76 (334.55)	335.24 (406.02)
Alcohol problems	5.77 (4.00)	6.32 (4.75)	6.49 (3.65)	5.35 (3.84)	3.72 (2.56)
Drug problems	7.67 (3.71)	9.54 (3.30)	8.07 (3.45)	6.33 (3.60)	5.36 (3.32)
Freqotherdruguselife	131.98 (286.60)	210.66 (346.68)	147.93 (345.83)	63.77 (128.51)	55.60 (119.28)
Alcohol withdrawal symptoms	16.71 (39.43)	24.54 (64.17)	13.46 (20.36)	17.09 (25.60)	7.84 (22.72)
Drug withdrawal symptoms	103.79 (164.60)	149.12 (212.05)	94.75 (125.73)	75.93 (105.49)	78.83 (201.96)
Drug of choice (%) (N=175):					
marijuana	39.4	36.0	47.7	37.2	32.0
amphetamine	31.4	40.0	24.6	34.9	24.0
alcohol	10.3	10.0	8.8	14.0	8.0
other	18.9	14.0	19.3	14.0	36.0

Table 3. Correlations among psychiatric comorbidity covariates.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1) BDI	1	--	--	--	--	--	--	--	--	--	--	--	--	--	--
(2) State Anxiety	.00	1	--	--	--	--	--	--	--	--	--	--	--	--	--
(3) Trait Anxiety	.10	.69**	1	--	--	--	--	--	--	--	--	--	--	--	--
(4) Anxious/Depressed	-.09	-.05	-.05	1	--	--	--	--	--	--	--	--	--	--	--
(5) Withdrawn	-.02	-.19*	-.22*	.64**	1	--	--	--	--	--	--	--	--	--	--
(6) Somatic Complaints	.08	.00	-.02	-.59**	.57**	1	--	--	--	--	--	--	--	--	--
(7) Social Problems	-.03	.05	.01	.66**	.46**	.46**	1	--	--	--	--	--	--	--	--
(8) Thought Problems	.08	-.01	.02	.61**	.53**	.38**	.43**	1	--	--	--	--	--	--	--
(9) Attention Problems	-.14	.05	-.06	.56**	.47**	.54**	.61**	.51**	1	--	--	--	--	--	--
(10) Rule-Breaking Beh	.04	.02	-.02	.38**	.45**	.36**	.33**	.57**	.47**	1	--	--	--	--	--
(11) Aggressive Beh	-.02	.15	.00	.53**	.42**	.39**	.60**	.58**	.57**	.71**	1	--	--	--	--
(12) Externalizing Symptoms	.01	.10	-.01	.50**	.47**	.40**	.53**	.62**	.57**	.90**	.95**	1	--	--	--
(13) Internalizing Symptoms	.06	-.08	-.10	.90	.83	.83**	.63**	.60**	.61**	.45**	.53**	.54**	1	--	--
(14) Anxiety Disorder	.07	.03	.01	.28**	.20*	.21	.15	.17	.15	.12	.11	.12	.28**	1	--
(15) Mood Disorder	.05	.00	-.02	.22*	.13	-.04	.09	.22*	.00	.10	.17	.15	.13	.19*	1

*p<.05; **p<.01. Pearson correlations are reported for continuous measures. Point biserial correlations are reported when 1 variable is dichotomous.

Table 4. Pearson correlations among substance use history covariates.

	1	2	3	4	5	6	7	8	9
(1) Freq MJ Life	1	--	--	--	--	--	--	--	--
(2) Freq Amphet Life	.34*	1	--	--	--	--	--	--	--
(3) Freq Drunk Life	.36	.32**	1	--	--	--	--	--	--
(4) Freq Stoned Life	.82	.48**	.38**	1	--	--	--	--	--
(5) Freq Oth Drug Life	.40**	.39**	.38**	.37**	1	--	--	--	--
(6) Alc Withdrawal	.05	-.07	.25**	<.00	-.03	1	--	--	--
(7) Drug Withdrawal	.13	.29**	.20**	.20*	.12	.28**	1	--	--
(8) Alc Problems	.11	.17*	.41**	.09	.08	.34**	.20**	1	--
(9) Drug Problems	.33**	.32**	.14	.38**	.17*	.13	.36**	.46**	1

*p<.05; **p<.01.

Table 5. Item/factor membership by CFA models.

IDTS Item	Factor Number		
	8-factor (50 items)	3-factor (50 items)	5-factor (40 items)
1) Depressed about things in general	1	1	1
2) Felt there was nowhere left to turn	1	1	1
3) Felt that I had let myself down	1	1	1
4) I was bored	1	1	*
5) I was lonely	1	1	1
6) I felt anxious or tense about something	1	1	1
7) I started feeling guilty about something	1	1	1
8) I felt overwhelmed and wanted to escape	1	1	1
9) I was angry at the way things had turned out	1	1	1
10) I felt confused about what I should do	1	1	1
11) I felt shaky, sick, or nauseous	2	1	*
12) I had trouble sleeping	2	1	*
13) I wanted to stay awake, be more alert, or be more energetic	2	1	4
14) I wanted to lose weight	2	1	4
15) I had a headache or was in physical pain	2	1	*
16) I felt tense or uneasy in the presence of someone	3	1	1
17) I was unable to express my feelings to someone	3	1	1
18) Other people rejected me or didn't seem to like me	3	1	1
19) Other people treated me unfairly or interfered with my plans	3	1	1
20) I felt that my family was putting a lot of pressure on me or that I couldn't measure up to their expectations	3	1	1
21) I was not getting along well with others at school or at work	3	1	1
22) There were fights at home	3	1	1
23) Someone was dissatisfied with my work or I felt pressured at school or on the job	3	1	1
24) I felt that I needed courage to face up to someone	3	1	1
25) I felt that someone was trying to control me and I wanted to feel more independent	3	1	*
26) I was happy	4	2	3
27) I felt confident and relaxed	4	2	3
28) I felt excited about something	4	2	3
29) I was feeling content with my life	4	2	3
30) I remembered something good that had happened	4	2	3
31) I met some old friends and we wanted to have a good time	5	2	2
32) I was with an intimate friend and we wanted to feel even closer	5	2	4
33) I was with friends and wanted to increase my enjoyment	5	2	2
34) I wanted to celebrate with a friend	5	2	2
35) I was having a good time and wanted to increase my sexual enjoyment	5	2	4
36) I was invited to someone's home and felt awkward about refusing when they offered me drugs	6	2	*
37) I was out with friends and they kept suggesting we go somewhere and use drugs	6	2	2
38) Others in the same room were using drugs and I felt that they expected me to join in	6	2	2
39) I was pressured to use drugs and felt that I couldn't refuse	6	2	*
40) I was with a group of people and everyone was using drugs	6	2	2
41) I was in a place where I had used or bought drugs before	7	3	2
42) I unexpectedly found some drugs or happened to see something that reminded me of drugs	7	3	2
43) I had been drinking and thought about using drugs	7	3	*
44) I heard someone talking about their past experiences with drugs	7	3	*
45) I began to think how good a rush or a high had felt	7	3	2
46) I wanted to see whether I could use drugs in moderation	8	3	*
47) I wanted to prove to myself that drugs were not a problems for me	8	3	5
48) I wanted to find out whether I could use drugs occasionally without getting hooked	8	3	5
49) I wanted to test out whether I could be with drug-using friends without using drugs	8	3	5
50) I wanted to test out whether I could be in places where drugs were being used without using any	8	3	5

* Indicates item was not included in CFA model.

Table 6. CFA fit indexes by item-level and parcel models.

Fit Indexes	8-Factor		5-Factor		3-Factor
	50-Item	25-Parcel	40-Item	20-Parcel	50-Item
Chi-square	2317.33	540.85	1433.91	352.13	2848.31
Chi-square/df	2.01	1.68	1.96	1.77	2.43
NFI	.73	.90	.79	.92	.67
CFI	.84	.96	.88	.96	.77
RMSEA	.068	.056	.066	.059	.081
P-Ratio	.94	.85	.94	.86	.96
PNFI	.69	.77	.74	.79	.64
PCFI	.79	.82	.83	.83	.74

Table 7. Comparison of case classification across clustering methods.

		Hierarchical Clustering 4-Cluster Solution				
		Cluster 1	Cluster 2	Cluster 3	Cluster 4	Total
Quick Cluster Solution	Cluster 1	60	1	0	0	61
	Cluster 2	13	50	0	7	70
	Cluster 3	0	0	34	7	41
	Cluster 4	0	15	0	34	49
	Total	73	66	34	48	221

Note: cell values are n's.

Table 8. Factor score means (SD) for cluster groups.

Hierarchical Clustering 4-Cluster Solution				
IDTS Factors	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Factor 1	1.01 (.58)	-.28 (.67)	-1.19 (.51)	-.30 (.75)
Factor 2	.82 (.44)	.001 (.69)	-1.62 (.69)	-.10 (.66)
Factor 3	.81 (.63)	.40 (.49)	-1.12 (.66)	-1.00 (.50)
Factor 4	.92 (.81)	-.09 (.63)	-1.08 (.36)	-.51 (.79)
Factor 5	.82 (.98)	-.30 (.65)	-.98 (.27)	-.15 (.84)

Note: Cluster 1=all high; 2=high PE; 3=all low; 4=low PE, P/S.

Table 9. ANOVA cluster contrasts by IDTS factors.

IDTS Factor	Cluster Contrast	Mean Dif.	SE	T-Score
1	1 vs. 4	1.31	.12	11.11
	1 vs. 3	2.20	.13	16.67
	1 vs. 2	1.29	.11	11.94
	2 vs. 4*	.02	.12	.20
	2 vs. 3	.91	.13	6.79
	3 vs. 4	-.89	.14	-6.23
2	1 vs. 4	.93	.11	8.14
	1 vs. 3	2.44	.13	19.23
	1 vs. 2	.82	.10	7.90
	2 vs. 4*	.10	.12	.90
	2 vs. 3	1.62	.13	12.55
	3 vs. 4	-1.52	.14	-11.06
3	1 vs. 4	1.81	.11	17.08
	1 vs. 3	1.93	.12	16.27
	1 vs. 2	.40	.10	4.16
	2 vs. 4	1.41	.11	13.00
	2 vs. 3	1.52	.12	12.65
	3 vs. 4*	-.12	.13	-.91
4	1 vs. 4	1.42	.13	10.96
	1 vs. 3	2.00	.15	13.74
	1 vs. 2	1.01	.12	8.50
	2 vs. 4	.42	.13	3.13
	2 vs. 3	.99	.15	6.68
	3 vs. 4	-.57	.16	-3.64
5	1 vs. 4	.97	.14	6.70
	1 vs. 3	1.80	.16	11.11
	1 vs. 2	1.12	.13	8.43
	2 vs. 4*	-.15	.15	-.99
	2 vs. 3	.68	.16	4.14
	3 vs. 4	-.83	.17	-4.74

Note: Df=217 for all comparisons. All comparisons are significant at $p < .01$ with Tukey adjustment for multiple pairwise comparisons unless indicated. * indicates ns at $p < .05$. Results assume equal variances. Pattern of significance is the same not assuming equal variances.

Table 10. Multinomial logistic regression contrasts predicting cluster membership.

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
1 vs. 2	Demos					
	Gender	.48	.35	1.91	1.63	.17
	Ethnicity					
	Latino/a	.05	.52	.01	1.06	.92
	Other	-1.18	.87	1.85	.31	.17
	Caucasian (reference)	--	--	--	--	--
	Age					
	Continuous	-.10	.17	.38	.90	.54
	<16 (dichot)	.24	.40	.36	1.27	.55
	Comorbidity					
	Diagnosis					
	DISC					
	Internalizing d/o					
	None	.02	.76	.001	1.02	.98
	Mood	-.59	.71	.68	.56	.41
	Mood & Anxiety	.17	.59	.08	1.18	.78
	Anxiety (reference)	--	--	--	--	--
	Any Externalizing d/o	.60	.48	1.60	1.83	.21
	Symptoms					
	BDI	-.008	.02	.22	.99	.64
	State Anxiety	-.68	.52	1.75	.51	.19
	Trait Axiety	-1.14	.62	3.35	.32	.07
	CBCL					
	Anxious/depressed	-.04	.05	.63	.96	.43
	Withdrawn	.12	.08	2.25	1.13	.13
	Somatic	-.02	.07	.10	.95	.76
	Social Probs	.03	.06	.18	1.03	.68
	Thought Probs	.08	.08	1.11	.1.08	.29
	Attention Probs	-.03	.07	.14	.97	.71
	Rule-breaking	-.02	.04	.30	.98	.59
	Aggressive Beh	.01	.03	.20	1.01	.65
	Externalizing	.001	.02	.003	1.001	.96
	Internalizing	.000	.03	.000	1.000	.99

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
	Substance Use History					
	CDDR					
1 vs. 2	Lifetime					
	Drunk	.000	.001	.13	1.000	.72
	Stoned	-.001	.000	3.20	.999	.07
	Marijuana	-.001	.000	1.85	.999	.17
	Amphetamines	-.002	.001	5.48	.998	.02
	Other Drugs	-.001	.001	.85	.999	.36
	Alcohol Withdrawal	-.007	.006	1.44	.993	.23
	Drug Withdrawal	-.002	.001	2.08	.998	.15
	Alcohol Problems	.01	.05	.05	1.01	.83
	Drug Problems	-.14	.06	5.00	.87	.03
	Drug of Choice					
	Other Drug	.81	.60	1.84	2.25	.18
	Alcohol	.36	.72	.24	1.43	.62
	Marijuana	.76	.46	2.71	2.14	.10
	Amphetamines (reference)	--	--	--	--	--
1 vs. 3	Demos					
	Gender	-.39	.47	.72	.675	.40
	Ethnicity					
	Latino/a	.46	.66	.49	1.59	.48
	Other	1.40	.66	4.55	4.06	.03
	Caucasian (reference)	--	--	--	--	--
	Age					
	Continuous	-.17	.25	.46	.84	.50
	<16 (dichot)	.99	.62	2.55	2.70	.11

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
1 vs. 3	Comorbidity					
	Diagnosis					
	DISC					
	Internalizing d/o					
	None	.85	1.03	.68	2.33	.41
	Mood	.24	.99	.06	1.27	.81
	Mood & Anxiety	.31	.89	.12	1.37	.73
	Anxiety (reference)	--	--	--	--	--
	Any Externalizing d/o	-.70	.83	.70	.50	.40
	Symptoms					
	BDI	-.02	.02	.58	.98	.45
	State Anxiety	-.95	.69	1.86	.39	.17
	Trait Axiety	-1.61	.84	3.68	.20	.06
	CBCL					
	Anxious/depressed	.02	.06	.06	1.02	.80
	Withdrawn	.17	.10	3.02	1.19	.08
	Somatic	-.05	.09	.29	.95	.59
	Social Probs	.03	.08	.17	1.03	.68
	Thought Probs	.04	.10	.18	1.04	.67
	Attention Probs	-.04	.09	.15	.96	.70
	Rule-breaking	.05	.05	.81	1.05	.37
	Aggressive Beh	.04	.04	1.41	1.05	.24
	Externalizing	.03	.02	1.33	1.03	.25
	Internalizing	.02	.03	.23	1.02	.63
	Substance Use History					
	CDDR					
	Lifetime					
	Drunk	-.001	.001	.85	.999	.36
	Stoned	-.002	.001	7.93	.998	.005
	Marijuana	-.002	.001	10.43	.998	.001
	Amphetamines	-.002	.001	3.38	.998	.07
	Other Drugs	-.003	.002	2.92	.997	.09
	Alcohol Withdrawal	-.02	.01	2.50	.980	.11
	Drug Withdrawal	-.003	.002	1.96	.997	.16
	Alcohol Problems	-.19	.07	6.90	.83	.009
	Drug Problems	-.35	.08	19.71	.70	<.001
	Drug of Choice					
	Other Drug	1.46	.69	4.5	4.28	.03
	Alcohol	.29	.96	.09	1.33	.76
	Marijuana	.39	.63	.39	1.48	.53
	Amphetamines (reference)	--	--	--	--	--

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
1 vs. 4	Demos					
	Gender	.12	.39	.09	1.13	.76
	Ethnicity					
	Latino/a	.13	.56	.05	1.14	.82
	Other	-.09	.72	.02	.91	.90
	Caucasian (reference)	--	--	--	--	--
	Age					
	Continuous	-.20	.19	1.03	.82	.31
	<16 (dichot)	.84	.48	3.14	2.32	.08
	Comorbidity					
	Diagnosis					
	DISC					
	Internalizing d/o					
	None	.15	.77	.04	1.17	.84
	Mood	.09	.68	.02	1.09	.90
	Mood & Anxiety	-.50	.63	.62	.61	.43
	Anxiety (reference)	--	--	--	--	--
	Any Externalizing d/o	.71	.50	2.00	2.03	.16
	Symptoms					
	BDI	-.01	.02	.46	.99	.50
	State Anxiety	-1.32	.58	5.23	.27	.02
	Trait Axiety	-1.75	.70	6.32	.17	.01
	CBCL					
	Anxious/depressed	.08	.05	2.06	1.08	.15
	Withdrawn	.20	.09	5.27	1.22	.02
	Somatic	.07	.07	1.29	1.08	.26
	Social Probs	.14	.07	4.32	1.15	.04
	Thought Probs	.14	.08	3.32	1.15	.07
	Attention Probs	.08	.08	1.04	1.08	.31
	Rule-breaking	.07	.04	2.34	1.07	.13
	Aggressive Beh	.06	.03	4.16	1.07	.04
	Externalizing	.04	.02	3.91	1.04	.05
	Internalizing	.05	.03	3.28	1.05	.07

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
1 vs. 4	Substance Use History					
	CDDR					
	Lifetime					
	Drunk	-.002	.001	2.29	.998	.13
	Stoned	-.003	.001	17.62	.997	<.001
	Marijuana	-.002	.001	14.37	.998	<.001
	Amphetamines	-.002	.001	5.88	.998	.02
	Other Drugs	-.003	.001	4.22	.997	.04
	Alcohol Withdrawal	-.004	.005			.48
	Drug Withdrawal	-.003	.002	.50	.996	.07
				3.32	.997	
	Alcohol Problems	-.06	.05			.24
	Drug Problems	-.28	.07	1.38	.94	<.001
				16.87	.76	
	Drug of Choice					
	Other Drug	.13	.65			.84
	Alcohol	.47	.70	.04	1.14	.50
	Marijuana	.17	.48	.46	1.60	.73
	Amphetamines (reference)	--	--	.15	1.19	--
				--	--	
2 vs. 3	Demos					
	Gender	.09	.46	.04	1.09	.84
	Ethnicity					
	Latino/a	.41	.63	.43	1.50	.51
	Other	2.58	.85	9.20	13.23	.002
	Caucasian (reference)	--	--	--	--	--
	Age					
	Continuous	-.07	.25	.07	.93	.79
	<16 (dichot)	.76	.63	1.44	2.13	.23

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
2 vs. 3	Comorbidity					
	Diagnosis					
	DISC					
	Internalizing d/o					
	None	.83	1.01	.67	2.29	.41
	Mood	.83	1.01	.67	2.29	.41
	Mood & Anxiety	.15	.88	.03	1.16	.87
	Anxiety (reference)	--	--	--	--	--
	Any Externalizing d/o	-1.30	.81	2.61	.27	.11
	Symptoms					
	BDI	-.01	.02	.18	.99	.67
	State Anxiety	-.26	.68	.15	.77	.70
	Trait Axiety	-.48	.82	.34	.62	.56
	CBCL					
	Anxious/depressed	.06	.06	.80	1.06	.37
	Withdrawn	.05	.09	.32	1.05	.57
	Somatic	-.03	.09	.10	.97	.75
	Social Probs	.01	.08	.01	1.01	.93
	Thought Probs	-.04	.09	.17	.96	.68
	Attention Probs	-.01	.09	.01	.99	.91
	Rule-breaking	.07	.05	1.86	1.07	.17
	Aggressive Beh	.03	.04	.74	1.03	.39
	Externalizing	.03	.02	1.31	1.03	.25
	Internalizing	.02	.03	.25	1.02	.62

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
2 vs. 3	Substance Use History					
	CDDR					
	Lifetime					
	Drunk	-.001	.001	1.38	.999	.24
	Stoned	-.001	.001	2.40	.999	.12
	Marijuana	-.002	.001	5.62	.998	.02
	Amphetamines	.000	.001	.04	1.000	.84
	Other Drugs	-.003	.002	2.04	.997	.15
	Alcohol Withdrawal	-.02	.02	1.10	.990	.29
	Drug Withdrawal	-.001	.002	.23	.999	.64
	Alcohol Problems	-.20	.07	7.93	.82	.005
	Drug Problems	-.22	.07	9.13	.81	.003
	Drug of Choice					
	Other Drug	.65	.66	.95	1.91	.33
	Alcohol	-.07	.97	.01	.93	.94
	Marijuana	-.37	.63	.34	.69	.56
	Amphetamines (reference)	--	--	--	--	--
2 vs. 4	Demos					
	Gender	-.37	.39	.87	.69	.35
	Ethnicity					
	Latino/a	.08	.52	.02	1.08	.86
	Other	1.09	.90	1.46	2.97	.23
	Caucasian (reference)	--	--	--	--	--
	Age					
	Continuous	-.10	.20	.23	.91	.63
	<16 (dichot)	-.60	.48	1.55	.55	.21

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
2 vs. 4	Comorbidity					
	Diagnosis					
	DISC					
	Internalizing d/o					
	None	.13	.74	.03	1.14	.86
	Mood	.67	.70	.92	1.96	.34
	Mood & Anxiety	-.66	.61	1.18	.52	.28
	Anxiety (reference)	--	--	--	--	--
	Any Externalizing d/o	.11	.45	.06	1.11	.81
	Symptoms					
	BDI	-.01	.02	.07	.995	.80
	State Anxiety	-.64	.55	1.35	.53	.25
	Trait Axiety	-.61	.66	.85	.54	.36
	CBCL					
	Anxious/depressed	.12	.05	4.96	1.12	.03
	Withdrawn	.07	.08	.97	1.08	.32
	Somatic	.10	.07	2.16	1.10	.14
	Social Probs	.11	.06	3.20	1.12	.07
	Thought Probs	.06	.07	.86	1.06	.35
	Attention Probs	.11	.08	1.96	1.11	.16
	Rule-breaking	.09	.04	4.32	1.09	.04
	Aggressive Beh	.05	.03	2.94	1.05	.09
	Externalizing	.04	.02	4.03	1.04	.05
	Internalizing	.05	.02	3.60	1.05	.06
	Substance Use History					
	CDDR					
	Lifetime					
	Drunk	-.002	.001	3.24	.998	.07
	Stoned	-.002	.001	8.44	.998	.004
	Marijuana	-.002	.001	7.68	.998	.006
	Amphetamines	-.001	.001	.25	.999	.62
	Other Drugs	-.002	.001	2.69	.998	.10
	Alcohol Withdrawal	.004	.007	.33	1.004	.56
	Drug Withdrawal	-.001	.002	.48	.999	.49
	Alcohol Problems	-.07	.05	2.00	.93	.16
	Drug Problems	-.14	.06	5.64	.87	.02
	Drug of Choice					
	Other Drug	-.68	.63	1.15	.51	.28
	Alcohol	.11	.71	.03	1.12	.87
	Marijuana	-.59	.49	1.48	.55	.22
	Amphetamines (reference)	--	--	--	--	--

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
3 vs. 4	Demos					
	Gender	-.27	.50	1.11	.76	.58
	Ethnicity					
	Latino/a	.33	.66	.25	1.39	.62
	Other	1.50	.70	4.60	4.46	.032
	Caucasian (reference)	--	--	--	--	--
	Age					
	Continuous	.03	.27	.01	1.03	.92
	<16 (dichot)	.15	.68	.05	1.17	.82
	Comorbidity					
	Diagnosis					
	DISC					
	Internalizing d/o					
	None	.69	1.02	.46	2.00	.50
	Mood	.15	.99	.02	1.17	.88
	Mood & Anxiety	.81	.91	.80	2.25	.37
	Anxiety (reference)	--	--	--	--	--
	Any Externalizing d/o	-1.41	.82	2.95	.24	.09
	Symptoms					
	BDI	-.01	.02	.04	.995	.83
	State Anxiety	.37	.71	.28	1.45	.60
	Trait Axiety	.13	.85	.03	1.14	.88
	CBCL					
	Anxious/depressed	-.06	.06	.84	.94	.36
	Withdrawn	-.02	.09	.06	.98	.81
	Somatic	-.12	.09	1.89	.88	.17
	Social Probs	-.1-.10	.08	1.69	.90	.19
	Thought Probs	-.12	.09	1.15	.91	.28
	Attention Probs	-.02	.10	1.43	.89	.23
	Rule-breaking	-.02	.05	.15	.98	.70
	Aggressive Beh	-.0-.03	.04	.30	.98	.59
	Externalizing		.02	.27	.99	.60
	Internalizing		.03	1.03	.97	.31

Table continued

Cluster Contrast	Variable	B	SE	Wald	OR	P-value
3 vs. 4	Substance Use History					
	CDDR					
	Lifetime					
	Drunk	.001	.001	.17	1.001	.68
	Stoned	.001	.001	1.01	1.001	.31
	Marijuana	.000	.001	.01	1.000	.92
	Amphetamines	.000	.001	.045	1.000	.83
	Other Drugs	-.001	.002	.07	.999	.79
	Alcohol Withdrawal	-.02	.02	1.75	.98	.19
	Drug Withdrawal	.000	.002	.009	1.000	.92
	Alcohol Problems	-.13	.07	2.94	.88	.09
	Drug Problems	-.08	.07	1.15	.93	.28
	Drug of Choice					
	Other Drug	1.32	.72	3.42	3.75	.06
	Alcohol	-.18	.95	.04	.83	.85
	Marijuana	.22	.65	.12	1.25	.73
	Amphetamines (reference)	--	--	--	--	--

Note: Above analyses were conducted separately for each variable. *Analyses predicting cluster membership from IDTS drug type compared each drug type to those reporting marijuana use. **Analyses predicting cluster membership from comorbid disorder type compared each type of comorbid disorder to those with an internalizing disorder only.

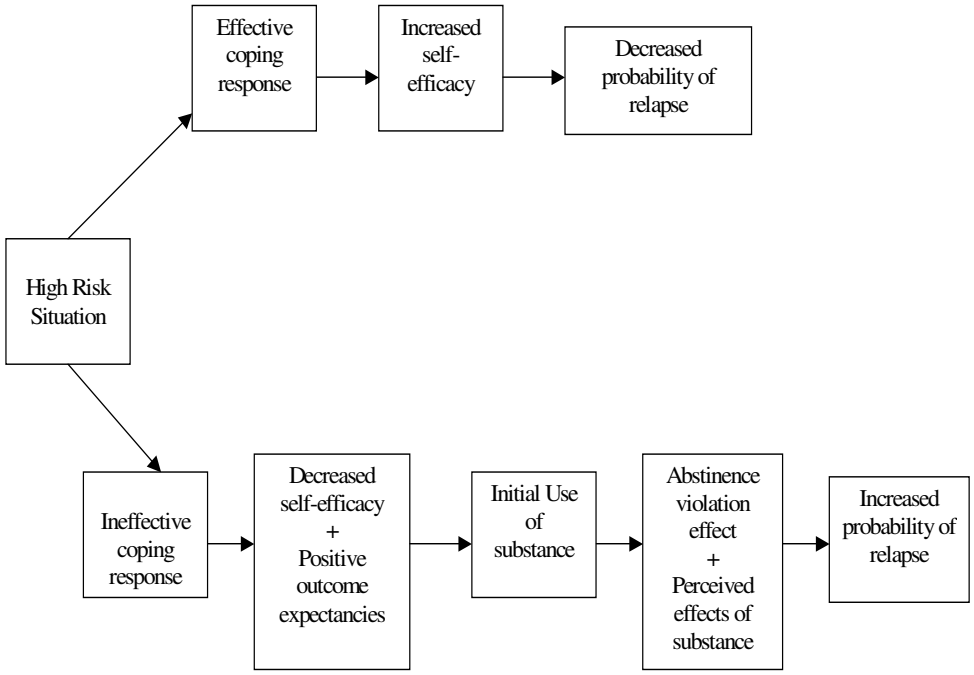

Figure 1. Cognitive-behavioral model of relapse (Witkiewitz & Marlatt, 2004)

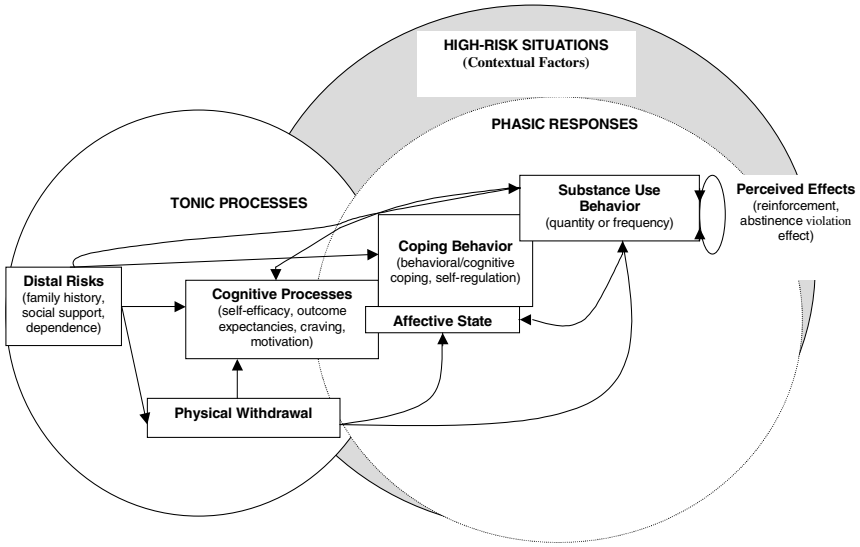

Figure 2. Dynamic Model of Relapse (Witkiewitz & Marlatt, 2004)

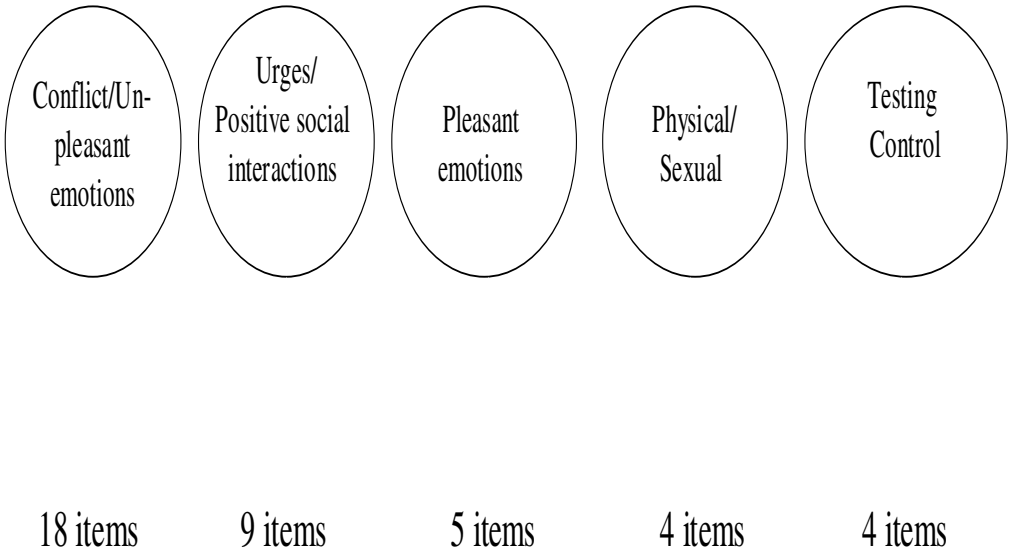

Figure 3. DTCQ factor structure (Comorbid Adolescents; 40 Items; Ramo & Brown, 2004)

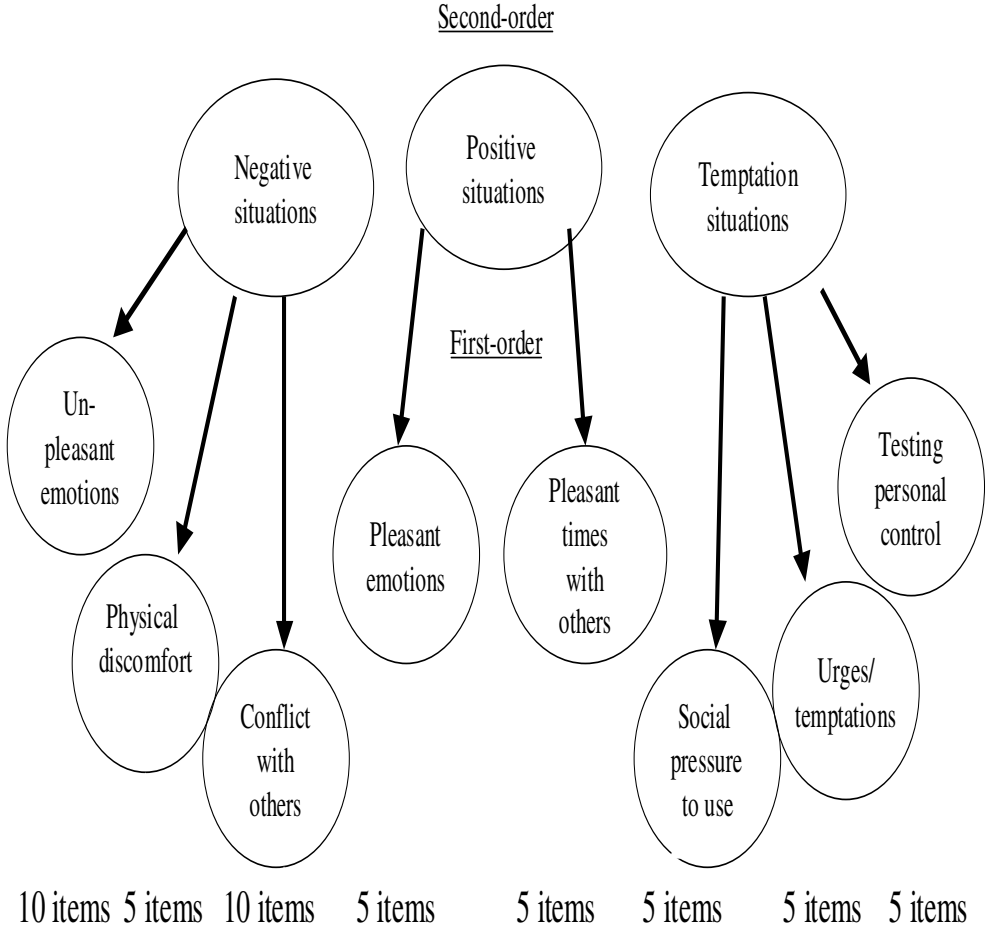

Figure 4. Marlatt & Gordon factor structure. Inventory of drug taking situations (IDTS; Turner et al., 1997)

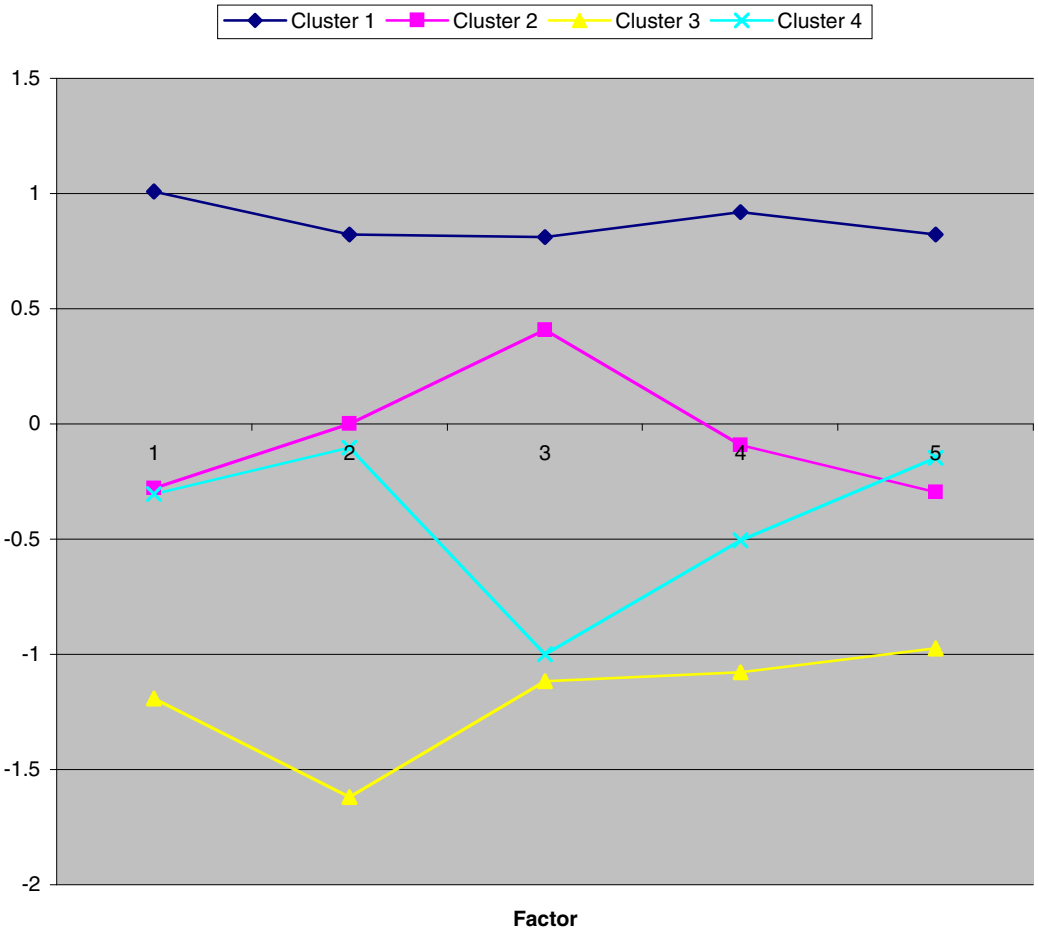

Figure 5. IDTS cluster groups from 5-factor IDTS solution.

Note: Custer 1 = all high; 2 = high PE; 3 = all low; 4 = low PE, P/S.

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