UNIVERSITY OF CALIFORNIA, SAN DIEGO

Anxiety and Alcohol Involvement Across the Substance Use Continuum

A dissertation submitted in partial satisfaction of the requirements for the degree
Doctor of Philosophy

in

Psychology

by

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2011

The Dissertation of Kristin Leigh Tomlinson is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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Chair

University of California, San Diego

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DEDICATION

I dedicate this dissertation to my mom and dad, Sharon and Thomas Tomlinson.

They never wavered in their belief in me, even when it looked like I might not make it. Without their unconditional love and moral support my dream of finishing this dissertation could not have happened.

EPIGRAPH

"You will never get to the end of the journey if you stop to toss a stone at every dog that barks."

Winston Churchill

"What a long, strange trip it's been."

Robert C. Hunter

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Anderson, K.G., Tomlinson, K.L., Robinson, J.M., & Brown, S.A. (2011). Friends or foes: social anxiety, peer affiliation, and drinking in middle school. *Journal of Studies on Alcohol and Drugs, 72*(1), 62-69.

Tomlinson, K.L., Tate, S.R., Anderson, K.G., McCarthy, D.M., & Brown, S.A. (2006). An examination of self-medication and rebound effects: Psychiatric symptomatology before and after alcohol or drug use relapse. *Addictive Behaviors*, 31, 461-474.

McCarthy, D.M., Tomlinson, K.L., Anderson, K.G., Marlatt, G.A., & Brown, S.A. (2005). Relapse in alcohol and drug disordered adolescents with comorbid psychopathology: Changes in psychiatric symptoms. *Psychology of Addictive Behaviors, 19*(1), 28-34.

Brown, S.A., Anderson, K.A., Ramo, D.E., & Tomlinson, K.L. (2005). Treatment of adolescent alcohol-related problems: A translational perspective. In Galanter (Ed.) *Recent Developments in Alcoholism, Volume XVII.*

Tomlinson, K.L., Brown, S.A., & Abrantes, A. (2004). Psychiatric Comorbidity and Substance Use Treatment Outcomes of Adolescents. *Psychology of Addictive Behaviors, 18*(2), 160-169.

Abrantes, A. M., Brown, S.A., & Tomlinson, K. (2004). Psychiatric comorbidity among inpatient substance abusing adolescents. *Journal of Child and Adolescent Substance Abuse, 13*(2), 83-101.

Myers, M.G., Aarons, G.A., Tomlinson, K.L., & Stein, M.B. (2003). Social anxiety, negative affectivity, and substance use among high school students. *Psychology of Addictive Behaviors, 17*(4), 277-283.

McCarthy, D.M., Simmons, J.R., Smith, G.T., Tomlinson, K.L., & Hill, K. (2002). Reliability, stability, and factor structure of the Bulimia Test Revised and Eating Disorder Inventory-2 scales in adolescence. *Assessment, 9*(2), 382-389.

Myers, M.G., Brown, S.A., Tate, S., Abrantes, A.M., & Tomlinson, K.L. (2001). Toward Brief Interventions for Adolescents with Substance Abuse and Comorbid Psychiatric Problems. In Monti, P.M., Colby, S.M., & O'Leary, T.A. (Eds.) *Adolescents and Substance Abuse*. (pp.275-296). New York: Guilford Press.

Costanzo, P.R., Musante, G.J., Friedman, K.E., Kern, L.S., & Tomlinson, K.L. (1999). The gender specificity of emotional, situational, and behavioral indicators of binge eating in a diet-seeking obese population. *International Journal of Eating Disorders, 26*(2), 205-210.

ABSTRACT OF THE DISSERTATION

Anxiety and Alcohol Involvement Across the Substance Use Continuum

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The link between anxiety disorders and alcohol abuse and dependence has been established in adults, but the relationship between anxiety and adolescent alcohol involvement is less clear. In this dissertation, we compared explanatory models of substance use including the self-medication hypothesis, the social learning model, and the rebound hypothesis to characterize the association between anxiety and alcohol use in groups with various levels of experience with drinking. Additionally, we included depression symptoms in our studies to assess whether the relationships we found between anxiety and alcohol were unique or similar to those found with other forms of negative affect. In chapter 1, we investigated the relationships between several types of social anxiety symptoms and the onset of alcohol use in middle school students. We found that social

anxiety significantly predicted initiation of drinking at both extremely high and low levels, and sex differences were observed. Chapter 2 follows with an analysis of the impact of social anxiety, depression, and alcohol expectancies on youths' drinking. We found that the self-medication hypothesis characterized the relationship between depression symptoms and drinking behavior, while the relationship between social anxiety and alcohol use was explained by social learning theory. Chapters 3 and 4 examined alcohol and drug use relapse characteristics in an adolescent substance use disordered treatment sample. In chapter 3 we found that compared to youth with only a substance use disorder, comorbid youth relapsed more often and more rapidly after treatment. In chapter 4, anxiety symptoms were more likely reported to improve than worsen immediately after relapse and in the two weeks following the relapse episode, indicating support for the self-medication hypothesis, while depression symptoms worsened in youth who relapsed with stimulants, which is consistent with a rebound effect. Chapter 5 is a replication of the study in chapter 4 with adults post-treatment for substance use disorders, with and without comorbid psychopathology. Unlike in the adolescent sample, almost no adults reported improvements in any psychiatric symptoms following relapse, however depression symptoms were rated as worsening more than anxiety symptoms.

INTRODUCTION

Anxiety and Alcohol Involvement Across the Substance Use Continuum

Anxiety symptoms have been hypothesized to play a role in the development of alcohol use disorders in medical literature as early as the nineteenth century (Westphal, 1871). The link between anxiety disorders and alcohol abuse and dependence has been established in adults, but the relationship between anxiety and adolescent alcohol involvement is less clear. Evidence suggests that the anxiety-alcohol use relationship differs between youth with limited alcohol experience and youth diagnosed with alcohol abuse/dependence. In the following studies, we examined the relationship between anxiety symptoms and alcohol involvement across the substance use continuum. We compared explanatory models of substance use including the self-medication hypothesis, the social learning model, and the rebound hypothesis to characterize the association between anxiety and alcohol use in groups with various levels of experience with drinking. Additionally, we included depression symptoms in our studies to assess whether the relationships we found between anxiety and alcohol were unique or similar to those found with other forms of negative affect. Our goal was to further understanding of how anxiety impacts the development of early drinking behavior and of the role anxiety symptoms play in substance use relapse after treatment in adolescents and adults with substance use disorders, with and without comorbid psychiatric disorders.

High rates of comorbidity between anxiety disorders and alcohol use disorders are found in representative community surveys of adults (e.g., Grant et al., 2004; Kessler et al., 1997) as well as in treatment samples of adult substance abusers (e.g., Brady, 2001; Hesselbrock, Meyer, & Hesselbrock, 1992; Regier et al., 1990). Predominant theoretical models used to explain the relationship between anxiety and the use and abuse of alcohol include the tension reduction theory (Conger, 1956) and the self-medication hypothesis (Quitkin, Rifkin, Kaplan, & Klein, 1972). More recently, Cloninger and colleagues (1985) hypothesized two subtypes of alcoholics: type 1 and type 2 alcoholics. Type 1 alcoholics are thought to have anxious personality traits with high harm avoidance, and are thought to drink in order to alleviate or reduce negative affect (Labouvie, Pandina, White, and Johnson, 1990). Indeed, the belief or expectation that alcohol consumption will reduce anxiety is often reported as a motivation for alcohol use (Clark & Sayette, 1993).

The link between anxiety disorders and alcohol use disorders among adolescents is less delineated. Among adolescents in treatment for substance use disorders, psychiatric disorders, or both, the rates of comorbidity between alcohol use disorders and anxiety disorders is elevated (eg., Deas-Nesmith, Brady, & Campbell, 1998). However, epidemiological studies of adolescents have not found a link between anxiety disorders and alcohol use disorders (e.g., Kandel, Johnson, Bird, & Canino, 1997). Anxiety symptoms may protect youth from

early alcohol involvement if their anxiety increases behavioral inhibition. Individuals with behavioral inhibition tend to be overcontrolled and fearful of engaging in risky behavior (Rubin & Asendorpf, 1993; Kochanska, 1993). If behaviorally inhibited adolescents perceive alcohol as a risky behavior (eg. risk of getting caught by parents, being out of control when drunk) then they may be deterred from engaging in the behavior. There is data to support this hypothesis. Internalizing symptoms were negatively correlated with alcohol use over time in a community sample of adolescents (Stice, Barrerra, & Chassin, 1998). Students who remained abstinent from alcohol over a one-year period had elevated internalizing symptoms compared to adolescents who transitioned from abstinence to moderate alcohol use (Stice, Myers, & Brown, 1998). In a longitudinal study, Shedler and Block (1990) found that adolescents who had never tried drugs (alcohol use was not assessed) were overcontrolled, anxious, and not socially at ease at age eighteen. These youth at age eleven were described as anxious, inhibited, and shy.

Social Anxiety and Early Alcohol Involvement

Social anxiety in particular may pose a salient risk for alcohol use because of the desire to reduce anxiety in social situations, such as parties or social gatherings, where drinking is likely to occur. Studies of adolescents in treatment for psychiatric problems, substance use disorders, or both tend to find that social anxiety is a risk for alcohol involvement (e.g., Clark, Bukstein, Smith, &

Kaczynski, 1995; Deas-Nesmith et al., 1998; Hovens, Cantwell, & Kiriakos, 1994). In these studies, social anxiety preceded alcohol use 65-100% of the time and the average time between onset of social anxiety and alcohol involvement was two years. By contrast, studies of community samples of adolescents have found either no relationship between social anxiety and substance involvement, or a protective relationship, in which social anxiety was seen to decrease the risk for subsequent alcohol and drug use (e.g., Kandel et al., 1997; Myers, Aarons, Tomlinson, & Stein, 2003).

In chapter 1, we investigated the relationships between several types of social anxiety symptoms and the onset of alcohol use in middle school students. We found that social anxiety significantly predicted initiation of drinking at both extremely high and low levels, and sex differences were observed. A high level fear of negative evaluation was associated with drinking initiation, while both high and low levels of generalized social avoidance and distress (social anxiety is experienced in familiar situations) predicted drinking in both sexes. Additionally, girls with very low levels of social avoidance and distress related to new or unfamiliar situations were more likely to have initiated drinking than any other group. We concluded that social anxiety acts as either a risk or a protection for initiating drinking in middle school, depending on the type of symptoms, the level of symptoms (either very low or very high levels of anxiety), and there are gender differences in the relationship between symptoms and alcohol use.

In chapter 2, we examined whether the self-medication hypothesis or social learning theory characterized the impact of social anxiety and depression on early adolescent drinking behavior. The self-medication hypothesis (Carrigan and Randall, 2003; Khantzian, 1985) is a motivational theory of substance use which hypothesizes that individuals use alcohol and other drugs to alleviate or cope with negative affect (Sher and Trull, 1994). The self-medication hypothesis predicts that social anxiety and depression will both increase risk for elevated levels of drinking frequency and intensity. Additionally, socially anxious youth will exhibit higher rates of drinking in social contexts (e.g., at parties) while youth with elevated depression symptoms will be more likely to drink alone.

According to social learning theory, adolescent alcohol use is a learned behavior acquired through exposure to alcohol use models and social interactions that provide access and reinforcement for drinking (Petraitis, Flay, & Miller, 1995). Additionally, learning theories posit that through exposure to models of drinking behavior, cognitions about alcohol effects are developed, and these cognitions (expectancies) have a direct influence on drinking decisions and behavior (e.g., Brown, 1985; Christiansen & Goldman, 1983). The social avoidance behavior and peer neglect experienced by socially anxious youth may decrease exposure to peer modeling of alcohol use as well as access to alcohol and social reinforcement at social events in which adolescents typically drink. Therefore, social learning theory predicts that social anxiety will decrease risk for alcohol use overall and especially in social situations due to social avoidance.

Furthermore, the correlation between alcohol expectancies and drinking will be diminished in socially anxious youth due to less frequent opportunities for forming drinking-related social expectancies based on personal experience.

We found that the self-medication hypothesis characterized the relationship between depression symptoms and drinking behavior, while the relationship between social anxiety and alcohol use was explained by social learning theory. Socially anxious youth had lower rates of drinking, and drank at parties less often than youth without elevated social anxiety. Social anxiety also moderated the relationship between expectancies and drinking behavior in the way expected by a social learning model rather than the self-medication hypothesis.

Psychiatric Comorbidity and Substance Use Relapse in Adolescence

Treatment outcome studies of adolescents with alcohol and drug use disorders indicate a high incidence of relapse after treatment (e.g., Brown & D'Amico, 2001; Catalano, Hawkins, Wells, Miller, & Brewer, 1990). Alcohol- and drug-abusing youth entering treatment commonly present with comorbid Axis I psychiatric disorders including anxiety, mood, and disruptive disorders (e.g., Brown, Gleghorn, Schuckit, Myers, & Mott, 1996). While the detrimental effect of comorbid psychopathology has been well documented among adults (e.g., Thomas, Melchert, & Banken, 1999; Tomasson & Vaglum, 1998), few studies have examined the relationship between specific types of comorbid

psychopathology and treatment outcomes of adolescent substance abusers (Brown & D'Amico, 2001).

In chapter 3 we compared alcohol and drug use outcomes of youth with and without a comorbid Axis I psychiatric diagnosis in the six months following treatment. We found that compared to youth with only a substance use disorder diagnosis, comorbid youth were more likely to relapse on alcohol or drugs and relapsed more rapidly after treatment, even though they were more likely to receive alcohol and drug treatment in the six month follow-up period. Interestingly, although drinking rates did not differ by group, comorbid adolescents experienced more alcohol dependence and withdrawal symptoms post-treatment.

Next, we examined whether treatment outcome differed by type of psychiatric diagnosis. Although 57% of the comorbid sample was diagnosed with at least one anxiety disorder including social phobia, simple phobia, separation anxiety disorder, agoraphobia, panic disorder, generalized anxiety disorder, obsessive-compulsive disorder, and post-traumatic stress disorder, the majority of these youth were also diagnosed with a mood disorder and/or a disruptive disorder as well. For this reason, we were unable to investigate the specific impact of anxiety disorders. We divided youth into three groups: internalizing only (mood and/or anxiety diagnosis; 10%), externalizing only (conduct disorder and/or ADHD; 13%), and youth with both externalizing and externalizing disorders (77%). Youth in the internalizing group were less likely to relapse than those in

the other two groups. This data parallels findings in the adult literature that depressive or anxiety symptoms, which are common during treatment, may not always be prognostic of poorer short-term outcomes (Brown & Schuckit, 1988; Schuckit, Irwin, & Brown, 1990).

Anxiety Symptoms Before and After Alcohol or Drug Use Relapse

According to the self-medication hypothesis, anxiety symptoms may increase the risk of alcohol or drug relapse after treatment for substance use disorders because individuals will be motivated to use in order to alleviate distressing symptoms. Anxiety symptoms have been associated with substance use relapse in adults (e.g., Connors, Maisto, & Zywiak, 1996; Svanum & McAdoo, 1989). Less research has focused on the impact of alcohol or drug use relapse on post-relapse anxiety symptoms. The self-medication hypothesis predicts that psychiatric symptoms should diminish in severity following a relapse, at least temporarily. In contrast, Blume, Schmaling, and Marlatt (2000) argued that both biological and behavioral processes provoke a "rebound effect", where substance use may produce or increase psychiatric symptoms. In chapters 4 and 5 we examined evidence for self-medication and rebound effects by testing the relationship between anxiety, mood, and psychotic symptoms prior to and following the initial relapse episode of adolescents and adult veterans post-treatment for alcohol and/or drug use disorders. Symptoms were recorded for two weeks before and immediately prior to the relapse, and two weeks after and immediately after the relapse episode.

In chapter 4, changes in psychiatric symptoms before and after the first relapse episode were examined in adolescents with comorbid substance use disorders and Axis I psychiatric diagnoses. The most common symptoms that youth reported they experienced prior to relapse were depressed mood (85%), sleep difficulties (56%), anxious mood (55%), and irritability (77%). Following the relapse episode, youth were 42% more likely to report that their anxious mood improved than worsened immediately after the relapse, and 52% more likely to report improvement two weeks after. Irritability was 4.6 times more likely to have improved than worsened two weeks after the relapse episode. Depressed mood was also reported to have improved more often than it worsened two weeks post-relapse. Using drugs other than alcohol, marijuana, or stimulants was associated with improved anxiety symptoms, while stimulants were associated with a worsening of depression symptoms. We found support for the self-medication hypothesis with respect to youths' anxiety symptoms, while youths may have experienced rebound effects from stimulants that increased their depressed mood.

In chapter 5 we investigated changes in psychiatric symptoms before and after the first post-treatment relapse episode for alcohol or drug use disorders in veterans with and without comorbid Axis I psychopathology. Fifty-seven percent of the comorbid group had a diagnosis of post-traumatic stress disorder, and 6.7% had another anxiety disorder diagnosis. While psychiatric diagnosis did not predict the type of symptoms experienced prior to relapse, individuals in the comorbid group reported more symptoms. As in chapter 4, depressed mood,

anxious mood, and irritability were the most commonly reported symptoms in both groups. However, unlike the adolescent sample, almost none of the adults in the present study reported improvement in any symptoms. The majority of symptoms were reported to stay the same before and after the relapse, however, depression symptoms were more likely to have gotten worse compared to anxiety symptoms. Interestingly, although PTSD did not predict worsening of anxiety symptoms, bipolar disorder was associated with worsening of depression and anxiety symptoms. This study replicated the findings in chapter 4, in which depression symptoms were more often exacerbated after relapse than anxiety symptoms. However, unlike the previous study, the current study found support for the rebound hypothesis for both anxiety and depression symptoms and found little support for the self-medication hypothesis.

REFERENCES

Blume, A. W., Schmaling, K. B., & Marlatt, G. A. (2000). Revisiting the self-medication hypothesis from a behavioral perspective. *Cognitive and Behavioral Practice, 7*, 379-384.

Brady, K.T. (2001). Comorbid post-traumatic stress disorder and substance use disorders. *Psychiatric Annals, 31,* 313-319.

Brown, S. A. (1985). Expectancies versus background in the prediction of college drinking patterns. *Journal of Consulting and Clinical Psychology, 53*, 123-130.

Brown, S.A., & D'Amico, E.J. (2001). Outcomes of alcohol treatment for adolescents. *Recent Developments in Alcohol, 15*, 307-327.

Brown, S. A., Gleghorn, A. A., Schuckit, M. A., Myers, M. G., & Mott, M. A. (1996). Conduct disorder among adolescent alcohol and drug abusers. *Journal of Studies on Alcohol, 57*(3), 314-324.

Brown, S.A. & Schuckit, M.A. (1988). Changes in depression among abstinent alcoholics. *Journal of Studies on Alcohol, 49*(5):412-7.

Carrigan, M.H. & Randall, C.L. (2003). Self-medication in social phobia: A review of the alcohol literature. *Addictive Behaviors, 28*, 269-284.

Catalano, R. F., Hawkins, J. D., Wells, E. A., & Miller, J. (1991). Evaluation of the effectiveness of adolescent drug abuse treatment, assessment of risks for relapse, and promising approaches for relapse prevention. *The International Journal of Addictions, 25*, 1085-1140.

Christiansen, B. A., & Goldman, M. S. (1983). Alcohol-related expectancies versus demographic/background variables in the prediction of adolescent drinking. *Journal of Consulting & Clinical Psychology, 51*(2), 249-257.

Clark, D. B., Bukstein, O. G., Smith, M. G., & Kaczynski, N. A. (1995). Identifying anxiety disorders in adolescents hospitalized for alcohol abuse or dependence. *Psychiatric Services, 46*(6), 618-620.

Clark, D.B. & Sayette, M.A. (1993). Anxiety and the development of alcoholism: Clinical and scientific issues. *The American Journal on Addictions, 2,* 59-76.

Cloninger, C.R., Bohman, M., Sigvardsson, S., & von-Knorring, A.L. (1985). Psychopathology in adopted-out children of alcoholics: The Stockholm adoption study. In: Galanter, M., (Ed.) *Recent Developments in Alcoholism.* Vol. 3. (pp. 37-51). New York: Plenum Press.

Conger, J. J. (1956). Alcoholism: theory, problem and challenge. II. Reinforcement theory and the dynamics of alcoholism. *Quarterly Journal of Studies on Alcohol, 17*, 296–305.

Connors, G. J., Maisto, S. A., & Zywiak, W. H. (1996). Understanding relapse in the broader context of post-treatment functioning. *Addiction, 91,* S173–S189.

Deas-Nesmith, D., Brady, K. T., & Campbell, S. (1998). Comorbid substance use and anxiety disorders in adolescents. *Journal of Psychopathology & Behavioral Assessment, 20*(2), 139-148.

Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, S.P., Dufour, M.C., Compton, W., Pickering, R.P., & Kaplan, K. (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry, 61*(8), 807-816.

Hesselbrock, V., Meyer, R., & Hesselbrock, M. (1992). Psychopathology and addictive disorders: the special case of antisocial personality disorder. In C. P. O'Brien, & J. H. Jaffe (Eds.), *Addictive States* (pp. 179–191). New York: Raven.

Hovens, J. G., Cantwell, D. P., & Kiriakos, R. (1994). Psychiatric comorbidity in hospitalized adolescent substance abusers. *Journal of the American Academy of Child & Adolescent Psychiatry, 33*(4), 476-483.

Kandel, D. B., Johnson, J. G., Bird, H. R., & Canino, G. (1997). Psychiatric disorders associated with substance use among children and adolescents: Findings from the Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) Study. *Journal of Abnormal Child Psychology, 25*(2), 121-132.

Kessler, R.C., Crum, R.M., Warner, L.A., Nelson, C.B., and others. (1997). Lifetime co-occurrence of DSM-III-R alcohol abuse and dependence with other psychiatric disorders in the National Comorbidity Survey. *Archives of General Psychiatry, 54*(4), 313-321.

Khantzian, E. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry, 142*, 1259-1264.

Kochanska, G. (1993). Toward a synthesis of parental socialization and child temperament in early development of conscience. *Child Development, 64*(2), 325-347.

Labouvie, E.W., Pandina, R.J., White, H.R., & Johnson V. (1990). Risk factors of adolescent drug use: an affect-based interpretation. *Journal of Substance Abuse, 2*(3), 265-85.

Myers, M.G., Aarons, G.A., Tomlinson, K.L., & Stein, M.B. (2003). Social anxiety, negative affectivity, and substance use among high school students. *Psychology of Addictive Behaviors, 17*(4), 277-283.

Petraitis, J., Flay, B. R., & Miller, T. Q. (1995). Reviewing theories of adolescent substance abuse: Organizing pieces of the puzzle. *Psychological Bulletin, 117*(1), 67-86.

Quitkin, F.M., Rifkin, A., Kaplan, J., & Klein, D.F. (1972). Phobic anxiety syndrome complicated by drug dependence and addiction: A treatable form of drug abuse. *Archives of General Psychiatry, 27*(2), 159-162.

Regier, D.A., Farmer, M.E., Rae, D.S., Locke, B.Z., Keith, S.J., Judd, L.J., & Goodwin, F.K. (1990). Comorbidity of mental disorders with alcohol and other drug abuse: Results from the epidemiologic catchment area (ECA) study. *Journal of the American Medical Association, 264*, 2511-2518.

Rubin, K. H., & Asendorpf, J. B. (1993). Social withdrawal, inhibition, and shyness in childhood: Conceptual and definitional issues, *Social withdrawal, inhibition, and shyness in childhood.* (pp. 3-17). Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.

Shedler, J. & Block, J. (1990). Adolescent drug use and psychological health: A longitudinal inquiry. *American Psychologist, 45*(5), 612-630.

Sher, K. J., & Trull, T. J. (1994). Personality and disinhibitory psychopathology: Alcoholism and antisocial personality disorder. *Journal of Abnormal Psychology, 103*, 92–102.

Schuckit, M.A., Irwin, M., Brown, S.A. (1990). The history of anxiety symptoms among 171 primary alcoholics. *Journal of Studies on Alcohol, 51*(1):34-41.

Stice, E., Barrera, M., Jr., & Chassin, L. (1998). Prospective differential prediction of adolescent alcohol use and problem use: Examining the mechanisms of effect. *Journal of Abnormal Psychology, 107*(4), 616-628.

Stice, E., Myers, M. G., & Brown, S. A. (1998). A longitudinal grouping analysis of adolescent substance use escalation and de-escalation. *Psychology of Addictive Behaviors, 12*(1), 14-27.

Svanum, S. & McAdoo, W. (1989). Predicting rapid relapse following treatment for chemical dependence: A matched-subjects design. *Journal of Consulting and Clinical Psychology, 57*(2), 222-226.

Thomas, V. H., Melchert, T. P., & Banken, J. A. (1999). Substance dependence and personality disorders: Comorbidity and treatment outcome in an inpatient treatment population. *Journal of Studies on Alcohol, 60,*

271−277.

Tómasson, K. & Vaglum, P. (1998). Psychiatric co-morbidity and aftercare among alcoholics: a prospective study of a nationwide representative sample. *Addiction, 93*(3), 423-31.

Westphal, C. (1871). Die agoraphobia: Eine neuropathische erscheinung. *Archiv fur Psychiatrie and Nervenkrankheiten, 3*, 138-161.

Chapter 1

Social anxiety and onset of drinking in early adolescence

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Abstract

The present study examines several types of social anxiety that may be associated with the onset of alcohol use in middle school students, and whether the relationship differs by sex and grade. Students in the seventh and eighth grades (N = 2621) completed the Social Anxiety Scale for Adolescents and a measure of lifetime drinking via school-wide surveys. Distinct aspects of social anxiety were associated with higher and lower rates of onset of alcohol use. A high level of fear of negative evaluation was associated with drinking initiation in boys and girls, while girls who reported no social anxiety or distress in new situations were more likely than other groups to have started drinking by early adolescence. Youth with either very low or very high levels of generalized anxiety had higher rates of drinking than youth with scores in between. These findings suggest that the relationship between social anxiety and initiation of alcohol use is complex and varies by type of anxiety symptomatology.

Social anxiety and onset of drinking in early adolescence

Early adolescence is a developmental period marked by physical, cognitive, and social transitions. The onset of puberty signifies the beginning of the physical transition from childhood into adulthood and is also associated with significant emotional and cognitive changes. At the same time, entry into middle school is an environmental transition that tends to increase the influence of social and interpersonal relationships on psychosocial development. The convergence of these major life transitions require an ability to adapt to the biological changes associated with puberty while adjusting to the increased social demands related to changes in the relative importance of peer and parental relationships (Windle, et al., 2008). Many youth develop emotional and behavioral problems during this phase of development. For example, social anxiety increases in early adolescence (Vernberg, Abwender, Ewell, & Beery, 1992; Inderbitzen, Walters, & Bukowski, 1997), when peer relationships become of paramount importance (e.g., Hartup, 1992; Inderbitzen, 1994). Many early adolescents also experiment with alcohol use, with approximately 40% of 8th graders reporting lifetime use in a national survey (Johnston, O'Malley, Bachman, & Schulenberg, 2008). The current study examines whether specific aspects of social anxiety are associated with drinking initiation in youths.

The self-medication hypothesis (Khantzian, 1985) predicts that socially anxious youth will attempt to reduce tension or anxiety by drinking when they

find themselves in a social situation where alcohol is present (Kushner, Sher, Wood, & Wood, 1994). Retrospective studies of adults with comorbid social anxiety disorder and alcohol dependence indicate that social anxiety precedes alcohol use (Buckner, Timpano, Zvolensky, Sachs-Ericsson, & Schmidt, 2008; Kushner, Sher, & Beitman, 1990). However, the relationship between social anxiety and adolescent drinking is unclear: in clinical samples of youth social phobia has up to a 33% comorbidity rate with alcohol and drug use disorders, (Clark, Bukstein, Smith, & Kaczynski, 1995; Hovens, Cantwell, & Kiriakos, 1994), yet in community samples social anxiety is associated with lower rates of alcohol use (Myers, Aarons, Tomlinson, & Stein, 2003; Wu et al., 2010).

The different relationships found between social anxiety and alcohol involvement in clinical and community samples of adolescents may be due to differences in the way social anxiety is measured. Social anxiety and alcohol use and problems are consistently linked in youth diagnosed with social phobia, a DSM-IV psychiatric disorder. In these studies a diagnosis of social phobia is given to adolescents whose anxiety score is above a certain threshold. Yet studies of youth in schools and the community that measure social anxiety using a continuous scale report inconclusive results. Together, these results may indicate a non-linear, threshold relationship between social anxiety and adolescent drinking. Developmental research indicates that social anxiety increases in early adolescence (Inderbitzen et al., 1997; Vernberg et al., 1992), as self-conscious

emotions increase (Elkind, 1967). Self-conscious emotions have been shown to have social benefits during adolescence, including reinforcing positive social behaviors and reparation of social errors (Yee & Flanagan, 1985). There is also research suggesting that a lack of self-conscious emotion is a contributing cause of problem behavior (Keltner, 1995). Therefore, in early adolescence the experience of some social anxiety is normative and expected as youth become increasingly self-conscious. A nonlinear relationship between social anxiety and alcohol use is consistent with this developmental framework of adolescent self-consciousness and social anxiety: adolescents most at risk for early drinking may be those at the extremes, with either high (including youth with social phobia) or very low levels of social anxiety.

Previous studies that have examined the relationship between social anxiety and alcohol use have considered social anxiety to be a one-dimensional construct. However, it may be useful to examine whether certain dimensions of social anxiety are uniquely associated with alcohol initiation in early adolescents. Watson and Friend (1969) identified two dimensions of social anxiety: fear of negative evaluation by others (FNE) and social avoidance and distress experienced in the presence of others (SAD).

Fear of negative evaluation by one's peers in a situation where alcohol is present may influence adolescents to drink due to peer pressure and a desire to fit in if drinking is perceived as normal or expected behavior. While the relationship between peer pressure and adolescent alcohol involvement has been well

established, no studies have examined the specific role of FNE in adolescent alcohol use. However, FNE has been found to be positively correlated with drinking in college and adult samples (Lewis & O'Neill, 2000; Stewart, Morris, Mellings, & Komar, 2006).

Social anxiety and shyness are closely related constructs (e.g., Rubin & Asendorpf, 1993), and shy individuals engage in social avoidance behavior (e.g., Vernberg et al., 1992). In the same studies in which FNE was found to predict alcohol use, Lewis and O'Neill (2000) found that shyness was unrelated to drinking in their adult sample, and Stewart et al., (2006) found that SAD was negatively correlated with drinking frequency in college students. This evidence suggests that these two aspects of social anxiety are associated with drinking behavior in different ways in adults.

Social avoidance and distress has been further differentiated into two separate dimensions in children and adolescents: new/unfamiliar and generalized (Buss, 1991; Asendorpf, 1993). The first type of social anxiety is characterized by wariness and behavioral inhibition with strangers and in unfamiliar situations, while the second type includes social anxiety and withdrawn behavior with familiar peers. LaGreca and Stone (1993) note that social avoidance and inhibition in new situations is less problematic for the development of normal socialization and friendship development than the more pervasive avoidance seen in youth with high levels of generalized social anxiety. Middle school is a critical time for exposure to new social situations, and high levels of the generalized form

of SAD may put adolescents at risk for drinking alcohol to self-medicate anxiety in social contexts with peers. Conversely, experiencing some SAD in new/unfamiliar situations may protect youth from early onset alcohol use if they consider drinking alcohol to be a risky behavior, while a complete lack of anxiety in new situations may be associated with more alcohol experimentation. Although no studies have specifically examined the relationship between SAD and alcohol use in adolescents, behavioral inhibition has been found to protect against substance use (Fergusson & Horwood, 1999; Shedler and Block, 1990).

The purpose of this investigation is to examine the different processes by which social anxiety may be associated with the initiation of alcohol use in a sample of middle school students. In order to delineate unique relationships between different aspects of social anxiety and drinking, we tested three specific components of social anxiety: fear of negative evaluation (FNE), social anxiety and distress experienced in new or unfamiliar situations (SAD-N), and generalized social anxiety and distress (SAD-G). We hypothesized nonlinear relationships, such that the impact of social anxiety would only be seen at the extreme ends. Specifically, the highest level of FNE and SAD-G, and the lowest level of SAD-N, were hypothesized to be associated with higher rates of drinking initiation than all other levels. We also tested the social anxiety composite score, and predicted that its association with drinking would be modest compared to the separate tests of its subscales. Given that sex differences have been found in

social anxiety such that girls report higher levels of FNE and SAD-N but not SAD-G compared to boys (Inderbitzen-Nolan & Walters, 2000; LaGreca & Lopez, 1998; Myers, Stein, & Aarons, 2002) and sex differences have been found in the relations between social anxiety and alcohol use disorders (Buckner & Turner, 2009), and marked grade differences are seen in alcohol use we explored sex and grade (seventh vs. eighth grade) differences in our analyses.

Method

Participants

In the spring of 2002, 2,621 seventh and eighth grade students between the ages of 11 – 14 in four San Diego County middle schools completed a survey of health-related behaviors. Respondents were dropped from the analyses if they did not provide data on drinking behavior (n = 5) or social anxiety symptoms (n = 56). This resulted in a final sample of 2,560 youth evenly split by sex (48.6% female) and grade (51.5% seventh and 48.5% eighth grade) who identified themselves as Caucasian (57.8%), Asian-American (9.9%), African-American (2.3%), Hispanic (12.1%), American Indian (2.8%), Hawaiian/ Pacific Islander (2.6%), Other (10.0%), and Multiracial (2.5%). Youth who were dropped from the analyses did not differ from the final sample on age, sex, or grade. Chi-square analysis could not be used to examine possible ethnic differences between youth

retained and dropped due to cell counts less than 5 in 20% of the cells. Characteristics of the final sample are described in Table 1.1.

Measures

Alcohol use. Initiation of alcohol use was measured with a single categorical item (*During your LIFE, how many times have you had at least one drink of alcohol [regular size can/bottle of beer or wine cooler, glass of wine, shot of liquor, etc.]:* 0 (never), 1 (1 to 2 times), 2 (3 to 5 times), 3 (6-10 times), 4 (11-50 times), and 5 (51+ times)). This variable was dichotomized so that youth were categorized as having ever drunk alcohol (yes/no).

Social Anxiety Scale for Adolescents-Revised (SAS-A). The SAS-A (La Greca & Lopez, 1998) has 22 items, 18 anxiety-related and 4 filler, assessing social preferences and activities. It is divided into three subscales: FNE (e.g., "I worry about what others think of me"), SAD-N (e.g., "I get nervous when I meet new people"), and SAD-G (e.g., "I feel shy even with peers I know well"). Youth indicated on a 5-point scale how much each item characterized themselves. Scores from the three subscales were summed to form a total score with a range of 18-90, with higher scores reflecting greater social anxiety. SAS-A has been found to have good internal consistency (Ginsberg, La Greca, & Silverman, 1998; La Greca and Stone, 1993) and reliability and validity (Inderbitzen-Nolan & Walters, 2000).

Demographics. Respondents completing the survey were asked to provide information about age, sex, and race/ethnicity. Ethnic differences were found in drinking initiation (χ^2 [df = 7] = 90.96, p < .001). Students who identified as African American were most likely to report lifetime drinking (54.2%), while Asian American students reported the least incidence of drinking (16.9%). Asian Americans also reported higher SAD-N scores compared to the other ethnic groups (F [df = 7] = 2.37, p = .02). Due to these differences we decided to include ethnicity as a covariate in our models.

Procedure

To obtain parental consent, consent forms were posted certified mail to all students' homes. Parents were informed that completion of the survey was voluntary and were given the opportunity to notify the school if they did not want their child to participate. Parents who did not wish their children to participate could notify the school verbally or in writing (0.5%). Trained research staff from the University of California, San Diego (UCSD) administered the survey in the normal classroom setting. Students were informed that the surveys were confidential and anonymous, and that no identifying information was collected, after which they provided assent to participate in the survey. Only youth with both parental consent and child assent were included into the study. As this survey was part of the school-wide assessment of health-related behaviors, there was a high

level of student involvement (99%). The participating school districts and the UCSD Institutional Review Board approved all procedures.

Analytic Strategy

Our a priori hypotheses included the possibility that the anxiety measures have threshold and/or non-monotonic relationships with lifetime drinking. Logistic regression does not accommodate non-monotic relationships. Piece-wise logistic regression was an option, but its use is complicated by the requirement to establish the number and location of knots from the same data being fit to the regression model. We opted to divide scores on the SAS-A and its subscales into quantiles, because this approach allows the model to be structured without relying on patterns in the data, is the most flexible in fitting thresholds and non-monotonic curvilinear response, and provides a simple interpretation. In this report seven quantiles were used to examine whether extremely low or high scores increased likelihood of alcohol use. Separate logistic regressions were used to determine whether SAS-A subscales and the composite score quantiles predict initiation of alcohol use. All models were re-run with anxiety scores divided into five and nine quantiles and results were found to be consistent. The predictors in the first regression were: SAS-A composite score, sex, grade, all 2-way interactions (SAS-A x sex; SAS-A x grade; sex x grade), the three-way interaction (SAS-A x sex x grade), and ethnicity. The remaining three regressions were modeled similarly with FNE, SAD-N, and SAD-G. In each regression, the

quantile with the lowest base-rate was used as the reference group when reporting odds ratios and predicted probabilities. Models were estimated using maximum likelihood and the significance of the total effect for each factor evaluated with a likelihood ratio test comparing nested models (Rabe-Hesketh & Skrondal, 2005). Categorical associations were tested with Chi-squared tests. Relationships between demographic factors and the subscales were tested with ANOVA's. All reported confidence intervals are at the 95% level.

Results

Table 1.1 provides information regarding the demographic, social anxiety, and alcohol use characteristics of the sample. Social anxiety scores were consistent with previous studies of seventh and eighth grade girls and boys. Grade and sex were found to be associated with the initiation of alcohol use (χ^2 [df = 3] = 122.64, p < .001) and sex differences were seen in mean scores on the anxiety subscales. Girls reported higher levels of FNE (F [df = 3] = 11.34, p < .001), seventh grade girls reported higher SAD-N than eighth grade boys (F [df = 3] = 3.24, p = .02), and boys reported higher levels of SAD-G than seventh grade girls (F [df = 3] = 6.22, p < .001). However, boys' and girls' SAS-A total score means did not statistically differ from one another. Correlations between the three subscales ranged from .58-.63.

The omnibus model tests and overall effect tests of the predictors in the logistic regressions are provided in Table 1.2. Sex and grade and their interaction were entered into the regression models to determine whether these variables predict alcohol use when social anxiety is being simultaneously tested. Being male and being in the eighth grade significantly predicted having consumed alcohol in one's lifetime in all four regression models. The odds ratios for the sex (female reference) ranged from 1.90 (CI = 1.05 – 3.42) to 2.84 (CI = 1.40 – 5.76) and the grade (seventh grade reference) ranged from 2.30 (CI = 1.12 – 4.73) to 4.14 (CI = 2.05 – 8.38). None of the sex x grade interactions were statistically significant. There was also an overall effect of ethnicity in the four models. Compared to Caucasian students, Asian students were less likely to drink in all models, with *OR*'s ranging from 0.36 (CI = 0.18 – 0.74) to 0.38 (CI = 0.20 – 0.74). African American and Hawaiian/ Pacific Islander students drank the most, with *OR*'s ranging from 2.25 (CI = 1.02 – 4.96) to 2.33 (CI = 1.02 – 5.36) for African Americans and 2.25 (CI = 1.05 – 4.83) to 2.42 (CI = 1.10 – 5.31) for Hawaiian/ Pacific Islanders when using Caucasians as the reference group.

The general measure of social anxiety was first examined for association with initiation of drinking. The overall model test was significant (χ^2 [df = 34] = 226.18, p<.001). Additionally, the total effect of SAS-A with its interaction terms was found to have a significant overall association with drinking initiation (LR χ^2 [df = 24] = 41.92, p =. 01). Consistent with expectations, neither the separate

main effect nor interaction parameters of SAS-A were found to be individually significant (p's > .10).

We next tested whether a high level of fear of negative evaluation was associated with a greater likelihood of drinking. The overall effects of FNE in the model significantly predicted drinking (LR χ^2 [df = 24] = 50.91, p = .001) and our hypothesis that a high level of FNE would predict drinking initiation was supported (Figure 1.1). Youth in quantile seven were 50% more likely to drink than youth in the reference group with a predictive probability (P) of 0.45 (CI = 0.40 – 0.51) compared to 0.30 (CI = 0.25 – 0.34), and were significantly more likely to drink than all other groups as well ($p < .05 – p < .001$). None of the other groups were significantly different from one another. There were no significant interactions between FNE, sex, or grade (Table 1.2).

Next we determined whether a low level of social anxiety and distress in new situations was associated with an increased risk of having initiated alcohol use. The overall effects of SAD-N in the model (LR χ^2 [df = 24] = 57.62, p < .001) and the interaction of SAD-N and sex significantly predicted initiation of alcohol use (Table 1.2). Our hypothesis was supported in girls, but not in boys (Figure 1.2). Girls in quantile one (P = 0.44; CI = 0.35 – 0.53) were more than twice as likely to have drunk as girls in the reference group (P = 0.19; CI = 0.07 – 0.31), and were significantly more likely to drink than all other groups as well ($p < .05 – p < .001$). Girls in quantile three (P = 0.34; CI = 0.26 – 0.43) were

significantly more likely to drink compared to the reference group only. There were no significant differences among quantiles in boys.

Finally, we tested whether a high level of generalized social anxiety and distress predicted a greater risk of drinking initiation. The overall effects of SAD-G in the model (LR χ^2 [df = 24] = 49.51, p = .002) significantly predicted initiation of alcohol use (Table 1.2). As expected, youth in quantile seven (P = 0.43; CI = 0.37 – 0.49) were significantly more likely to drink than youth in the reference group, which was quantile two (P = 0.27; CI = 0.23 – 0.33), and were also significantly more likely to drink than youth in quantiles three through six ($p < .05 – p < .001$). Interestingly, youth in the first quantile also had significantly higher rates of drinking compared to the reference group (P = 0.37; CI = 0.32 – 0.40). Quantiles one and seven were not significantly different from one another (Figure 1.1).

Discussion

Early adolescence is an important time in which to study the relationship between social anxiety and the initiation of alcohol use as they both increase during this developmental period (e.g., Johnston et al., 2008; Inderbitzen et al., 1997; Partnership for a Drug Free America, 1999; Pride Surveys, 2009; Vernberg et al., 1992). The findings of this study indicate that social anxiety has a complex relationship with youths' likelihood to begin drinking alcohol by early adolescence. Results suggest nonlinear relationships between social anxiety subscales and alcohol use, as well as specificity in the direction of the risk

association. Although the three subtypes of social anxiety measured here are consistently found to be correlated (Inderbitzen-Nolan & Walters, 2000; Myers et al, 2002), they showed different patterns in their relationship with drinking initiation. Interestingly, as in some previous studies (e.g., Wu et al., 2010), the composite social anxiety measure was not found to significantly predict initiation of drinking. This is most likely due to the opposite directions of the different subscales' associations with drinking cancelling out the effect measured in the composite score.

Consistent with expectations, we found that boys and girls who reported the highest level of FNE were more likely to have drunk alcohol in their lifetime than youth without extreme social-evaluative fears. Fear of negative evaluation puts adolescents at unique risk for early onset of drinking if they also have a high perception of peer drinking (Anderson, Tomlinson, Robinson, & Brown, 2010). FNE can increase risk for drinking through higher susceptibility to peer pressure or simply a desire to fit in. Marmorstein, White, Loeber, and Stouthamer-Loeber (2010) found that boys high in social anxiety had a younger age of onset of alcohol use; however, the association disappeared when co-occurring delinquent behavior was accounted for. Other studies have found an association between anxiety and externalizing behavior (Abrantes, Brown, & Tomlinson, 2004; Clark, Jacob, & Mezzich, 1994; Russo & Beidel, 1994). Social skills deficits seen in highly socially anxious youth increases the risk for these adolescents to be neglected and rejected by their peers, which in turn puts these youth at risk for

joining more deviant "out groups" who engage in deviant behaviors such as early alcohol involvement (Connell, Dishion, & Deater-Deckard, 2006).

An intriguing finding from the present study is that girls who reported that they experienced *little or no* social anxiety and distress in new or unfamiliar situations were more likely to have started drinking than all other levels of SAD-N. It indicates that this constellation of social anxiety symptoms may have a protective effect, such that experiencing any social anxiety and distress in new or unfamiliar situations lessens the likelihood that girls will start to drink in middle school. Given the similarity between this construct and behavioral inhibition, which is a form of withdrawal characterized by the avoidance of novel social situations (e.g., Kagan & Reznick, 1986), it may be that this subscale is actually measuring behavioral inhibition. Initiating alcohol use is a novel experience that girls in particular seem to be especially at risk for engaging in earlier if they don't experience any of this type of anxiety. While prior studies found a negative correlation between behavioral inhibition and alcohol use in adolescents (Shedler & Block, 1990; Stice, Myers, & Brown, 1998), this study found that the most robust association between SAD-N and drinking initiation is at the extreme low end. In future studies it is important to determine whether extremely low scores on the SAD-N are associated with a high level of disinhibition. There was no discernable relationship between SAD-N and drinking initiation among boys and this may be due in part to differences in the social context of middle school drinking initiation for boys and girls. For example, girls are more likely to hang

out with older boys than boys are to hang out with older girls, and girls who date older boys are more than twice as likely to drink compared to girls who date boys their own age (The National Center on Addiction and Substance Abuse, 2004).

Our hypothesis that youth with the highest level of generalized social anxiety and distress would have the highest drinking rate was supported. However, the lowest level of SAD-G was also associated with elevated likelihood of drinking, and there was no statistically significant difference between the highest and lowest levels, indicating a U-shaped function. Important differences are seen in the relationships between the two subtypes of SAD. First, while low SAD-N was only associated with increased drinking rates in girls, low SAD-G was associated with elevated drinking in the entire sample. This indicates that in girls, a lack of any type of social anxiety and distress is associated with a risk for early onset of drinking. In contrast, the relationship between type of SAD and drinking is more specific in boys, as only a lack of SAD-G predicts drinking. Furthermore, high SAD-G, but not SAD-N, was found to predict drinking in boys and girls. This may not be surprising, since the generalized type of social anxiety is associated with more severe emotional and social impairments compared to social anxiety experienced in new situations (La Greca & Lopez, 1998). In these youth, the natural tendency toward behavioral inhibition may be overshadowed by the desire to self-medicate with alcohol when in social situations where alcohol is present. Although further research needs to be conducted to determine causal mechanisms for these findings, our results may suggest that subtypes of at-risk

youth are already beginning to emerge- low-anxious sensation-seekers and high-anxious self-medicators (e.g., Zucker, 1994).

There are several limitations to this study. While social anxiety is generally found to precede alcohol use and problems (e.g, Buckner, et al., 2008), the cross-sectional design of the present study precludes us from making causal inferences. An important next step in evaluating the risk or protective nature of these different aspects of social anxiety is to replicate these findings in a longitudinal study. It will also be important to measure the relationship between social anxiety and quantity, frequency, and age of onset of alcohol use to determine whether the relationships found between social anxiety and onset of drinking will hold when looking at other alcohol use measures. Although we included ethnicity as a covariate in the present study, future studies should determine whether there are important interactions between social anxiety and ethnicity. Additionally, it would have been useful to include personality/ temperament variables (e.g., sensation-seeking, impulsivity) and questions about behavior (e.g., other deviant behaviors) to reveal possible correlates with having extremely high or low social anxiety and how these factors may interact with social anxiety to increase or decrease the risk of early initiation of drinking. Furthermore, different aspects and levels of social anxiety in early adolescents may result in decision-making processes that lead to exposure to situations in which they are put at risk for drinking. Future research should also examine

drinking contexts to determine the situations in which socially anxious youth are most likely to drink.

Our findings shed light on two factors that may help to explain the discrepancies in the literature regarding social anxiety's impact on alcohol use during adolescence. First, previous studies of youth in community samples searched for linear associations between social anxiety and alcohol use, while the findings of the current study indicate that the relationship between these variables is likely non-linear. Second, the direction of the relationship depends on the specific aspect of social anxiety in question. This is consistent with the findings of Stewart, et al. (2006), in which FNE was positively associated with drinking problems in undergraduate college students, while social avoidance and distress was negatively related to drinking frequency. This study underscores the need to develop prevention efforts that more specifically target youths according to their unique social anxiety risk factors (e.g., promoting self esteem in high FNE youth; a risk education program for low SAD-N girls).

References

Abrantes, A. M., Brown, S.A., & Tomlinson, K. (2004). Psychiatric comorbidity among inpatient substance abusing adolescents. *Journal of Child and Adolescent Substance Abuse, 13(2),* 83-101.

Anderson, K.G., Tomlinson, K.L., Robinson, J.M., & Brown, S.A. (2010). Friends or foes: social anxiety, peer affiliation, and drinking in middle school. *Journal of Studies on Alcohol and Drugs.*

Asendorpf, J. B. (1993). Abnormal shyness in children. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 34*(7), 1069-1081.

Buckner, J.D., Timpano, K., Zvolensky, M.J. Sachs-Ericsson, N., & Schmidt, N.B. (2008). Implications of comorbid alcohol dependence among individuals with social anxiety disorder. *Depression and Anxiety, 25,* 1028-1037.

Buckner, J.D., & Turner, R.J. (2009). Social anxiety disorder as a risk factor for alcohol use disorders: A prospective examination of parental and peer influences. *Drug and Alcohol Dependence*, *100,* 128-137.

Buss, A. H. (1991). The EAS theory of temperament. In J. Strelau & A. Angleitner (Eds.), *Explorations in temperament: International perspectives on theory and measurement.* (pp. 43-60). New York, NY: Plenum Press.

Clark, D. B., Bukstein, O. G., Smith, M. G., & Kaczynski, N. A. (1995). Identifying anxiety disorders in adolescents hospitalized for alcohol abuse or dependence. *Psychiatric Services, 46*(6), 618-620.

Clark, D. B., Jacob, R. G., & Mezzich, A. (1994). Anxiety and conduct disorders in early onset alcoholism. In T. Babor (Ed.), *Types of alcoholics: Evidence from clinical, experimental, and genetic research.* (pp. 181-186). New York, NY: New York Academy of Sciences.

Connell, A. M., Dishion, T. J., & Deater-Deckard, K. (2006). Variable- and person-centered approaches of early adolescent substance use: Linking peer, family, and intervention effects with developmental trajectories. *Merrill-Palmer Quarterly, 52*(3), 421-448.

Elkind, D. (1967). Egocentrism in Adolescence. *Child Development*, 38,1025-1033.

Fergusson, D. M., & Horwood, L. J. (1999). Prospective childhood predictors of deviant peer affiliations in adolescence. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 40*(4), 581-592.

Ginsburg, G.S., La Greca, A.M., & Silverman, W.K. (1998). Social anxiety in children with anxiety disorders: relation with social and emotional functioning. *Journal of Abnormal Child Psychology, 26*(3), 175-185.

Hartup, W. W. (1992). Friendships and their developmental significance. *Childhood social development: Contemporary perspectives.* (pp. 175-205). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Hovens, J. G. F. M., Cantwell, D. P., & Kiriakos, R. (1994). Psychiatric comorbidity in hospitalized adolescent substance abusers. *Journal of the American Academy of Child & Adolescent Psychiatry, 33*(4), 476-483.

Inderbitzen, H. M. (1994). Adolescent peer social competence: A critical review of assessment methodologies and instruments. *Advances in Clinical Child Psychology, 16,* 227-259.

Inderbitzen, H. M., Walters, K. S., & Bukowski, A. L. (1997). The role of social anxiety in adolescent peer relations: Differences among sociometric status groups and rejected subgroups. *Journal of Clinical Child Psychology, 26*(4), 338-348.

Inderbitzen-Nolan, H.M. & Walters, K.S. (2000). Social Anxiety Scale for Adolescents: Normative data and further evidence of construct validity. *Journal of Clinical Child Psychology, 29*(3), 360-371.

Johnston, L.D., O'Malley, P.M., Bachman, J.G., & Schulenberg, J.E. (2008). *Monitoring the Future National Survey on Drug Use, 1975-2007. Volume I: Secondary School Students* (NIH Publication No. 08-6418A). Bethesda, MD: National Institute on Drug Abuse.

Kagan, J. & Reznick, J.S. (1986). Shyness and temperament. In W.H. Jones, J.M. Cheek & S.R. Briggs (Eds.), *Shyness: Perspectives on research and treatment* (pp. 81-90). New York: Plenum Press.

Keltner, D. (1995). Signs of appeasement: Evidence for the distinct displays of embarrassment, amusement, and shame. *Journal of Personality and Social Psychology, 68*, 441–454.

Khantzian, E. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry, 142*, 1259-1264.

Kushner, M., Sher, K., & Beitman, B. (1990). The relation between alcohol problems and the anxiety disorders. *American Journal of Psychiatry, 147*, 685-695.

Kushner, M.G., Sher, K.J., Wood, M.D., & Wood, P.K. (1994). Anxiety and drinking behavior: moderating effects of tension-reduction alcohol outcome expectancies. *Alcoholism: Clinical and Experimental Research, 18*(4), 852-860.

La Greca, A. M., & Lopez, N. (1998). Social anxiety among adolescents: Linkages with peer relations and friendships. *Journal of Abnormal Child Psychology, 26*(2), 83-94.

La Greca, A. M., & Stone, W. L. (1993). Social Anxiety Scale for Children--Revised: Factor structure and concurrent validity. *Journal of Clinical Child Psychology, 22*(1), 17-27.

Lewis, B. & O'Neill, K. (2000). Alcohol expectancies and social deficits relating to problem drinking among college students. *Addictive Behaviors, 25*, 295-299.

Marmorstein, N.R., White, H.R., Loeber, R., & Stouthamer-Loeber, M. (2010). Anxiety as a predictor of age at first use of substances and progression to substance use problems among boys. *Journal of Abnormal Child Psychology, 38,* 211-224.

Myers, M.G., Aarons, G.A., Tomlinson, K.L., & Stein, M.B. (2003). Social anxiety, negative affectivity, and substance use among high school students. *Psychology of Addictive Behaviors, 17*(4), 277-283.

Myers, M.G., Stein, M.B., Aarons, G.A. (2002). Cross validation of the Social Anxiety Scale for Adolescents in a high school sample. *Journal of Anxiety Disorders, 16*(2), 221-232.

The National Center on Addiction and Substance Abuse (CASA) at Columbia University (2004). *National Survey of American Attitudes on Substance Abuse IX: Teen Dating Practices and Sexual Activity.* Retrieved from http://www.casacolumbia.org/templates/PressReleases.aspx?articleid=366&zoneid=61.

Partnership for a Drug-Free America (1999). *1998 Partnership Attitude Tracking Study: Children in grades 4 through 6, teens in grades 7 through 12, parents of children under 19, Research Results (Release Date: April 26, 1999).* New York: Partnership for a Drug-Free America.

Pride Surveys (2009, August). *2008-09 National Survey- Grades 6 thru 12.* Retrieved from http://www.pridesurveys.com/customercenter/us08ns.pdf.

Rabe-Hesketh, S., & Skrondal, A. (2005). Multilevel and Longitudinal Modeling using Stata. College Station, TX: Stata Press.

Rubin, K. H., & Asendorpf, J. B. (1993). Social withdrawal, inhibition, and shyness in childhood: Conceptual and definitional issues. In K.H. Rubin & J.B. Asendorpf (Eds.), *Social withdrawal, inhibition, and shyness in childhood* (pp. 3-17). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Russo, M. F., & Beidel, D. C. (1994). Comorbidity of childhood anxiety and externalizing disorders: Prevalence, associated characteristics, and validation issues. *Clinical Psychology Review, 14*(3), 199-221.

Shedler, J. & Block, J. (1990). Adolescent drug use and psychological health: a longitudinal inquiry. *American Psychologist, 45*(5), 612-630.

Stewart, S.H., Morris, E., Mellings, T., & Komar, J. (2006). Relations of social anxiety variables to drinking motives, drinking quantity and frequency, and alcohol-related problems in undergraduates. *Journal of Mental Health, 15*(6), 671-682.

Stice, E., Myers, M.G., & Brown, S.A. (1998). A longitudinal grouping analysis of adolescent substance use escalation and de-escalation. *Psychology of Addictive Behaviors, 12*(1), 14-27.

Vernberg, E.M., Abwender, D.A., Ewell, K.K., & Beery, S.H. (1992). Social anxiety and peer relationships in early adolescence: a prospective analysis. *Journal of Clinical Child Psychology, 21*(2), 189-196.

Watson, D. & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of Consulting and Clinical Psychology, 33,* 448-457.

Windle, M., Spear, L.P, Fuligni, A.J., Angold, A., Brown, J.D., Pine, D., Smith, G.T., Giedd, J, & Dahl, R.E. (2008). Transitions into underage and problem drinking: Developmental processes and mechanisms between 10 and 15 years of age. *Pediatrics 121*(Suppl. 4), S273-S289.

Wu, P., Goodwin, R.D., Fuller, C., Liu, X., Comer, J.S., Cohen, P., Hoven, C.W. (2010). The relationship between anxiety disorders and substance use among adolescents in the community: specificity and gender differences. *Journal of Youth and Adolescence 39*(2),177-188.

Yee, D.K. & Flanagan, C. (1985). Family environments and self-consciousness in early adolescence. *Journal of Early Adolescence, 5*(1), 59-68.

Zucker R. A. (1994). Pathways to alcohol problems and alcoholism: A developmental account of the evidence for multiple alcoholisms and for contextual contributions to risk. In Zucker, R.A., Boyd, G., & Howard, J., (Ed.s), *The development of alcohol problems: Exploring the biopsychosocial matrix of*

risk (pp. 255-289). NIAAA Research Monograph 26, Rockville, MD: National Institutes of Health.

Table 1.1

Sample characteristics by sex and grade (N = 2560)

	7th Grade Girls (n = 647)	8th Grade Girls (n = 597)	7th Grade Boys (n = 672)	8th Grade Boys (n = 644)
Age [*M* (*SD*)]	12.6 (0.5)	13.5 (0.5)	12.7 (0.5)	13.6 (0.5)
Ethnicity				
Caucasian	57.3%	58.1%	58.9%	56.7%
Asian-American	11.6%	9.1%	8.1%	10.8%
African-American	1.7%	2.2%	2.1%	3.1%
Hispanic	11.3%	14.7%	12.2%	10.3%
American Indian	3.1%	2.9%	2.7%	2.5%
Hawaiian	2.7%	2.4%	2.6%	3.0%
Other	10.0%	7.8%	11.9%	10.2%
Multiracial	2.3%	2.9%	1.5%	3.4%
Ever Drank Alcohol?	21.9%[a]	41.9%[b]	29.8%[c]	48.6%[d]
Social Anxiety				
FNE [*M* (*SE*)]	17.8 (0.27)[a]	18.0 (0.28)[a]	16.4 (0.27)[b]	16.3 (0.27)[b]
SAD-G [*M* (*SE*)]	6.7 (0.12)[a]	6.9 (0.13)[ab]	7.3 (0.12)[b]	7.3 (0.13)[b]
SAD-N [*M* (*SE*)]	14.0 (0.19)[a]	13.8 (0.20)[ab]	13.5 (0.19)[ab]	13.2 (0.20)[b]
SAS-A [*M* (*SE*)]	38.3 (0.53)[a]	38.7 (0.55)[a]	37.2 (0.52)[a]	36.8 (0.53)[a]

Note: FNE = Fear of Negative Evaluation; SAD-G = Generalized Social Anxiety and Distress; SAD-N = Social Anxiety and Distress in New/Unfamiliar Situations; SAS-A = Social Anxiety Scale for Adolescents (composite score) from La Greca (1999). Means and percentages with different superscripts across rows are significantly different (range = $p<.05$ - $p<.001$).

Table 1.2

Effect tests for prediction of initiation of drinking by subtypes of social anxiety

	FNE (n = 2450)			SAD-N (n = 2473)			SAD-G (n = 2511)		
Variable	*df*	χ^2	*p*-value	*df*	χ^2	*p*-value	*df*	χ^2	*p*-value
Sex	1	19.06	.00	1	21.14	.00	1	16.99	.00
Grade	1	106.48	.00	1	85.87	.00	1	74.72	.00
Sex * Grade	1	0.26	.61	1	0.15	.70	1	0.14	.71
Scale	6	24.02	.00	6	28.41	.00	6	21.83	.00
Scale * Sex	6	5.35	.50	6	16.97	.01	6	6.05	.42
Scale * Grade	6	8.13	.23	6	5.71	.46	6	12.22	.06
Scale * Sex * Grade	6	10.98	.09	6	6.25	.40	6	7.85	.25
Ethnicity	7	88.79	.00	7	85.66	.00	7	82.77	.00

Note: FNE = Fear of Negative Evaluation; SAD-G = Generalized Social Anxiety and Distress; SAD-N = Social Anxiety and Distress in New/Unfamiliar Situations. The overall model tests of the logistic regression analyses are as follows: FNE = (χ^2 [*df* = 34] = 252.99, *p*<.001); SAD-N = (χ^2 [*df* = 34] = 261.76, *p*<.001); SAD-G = (χ^2 [df = 34] = 260.93, p<.001). Statistically significant parameters ($p \leq .05$) are highlighted in bold.

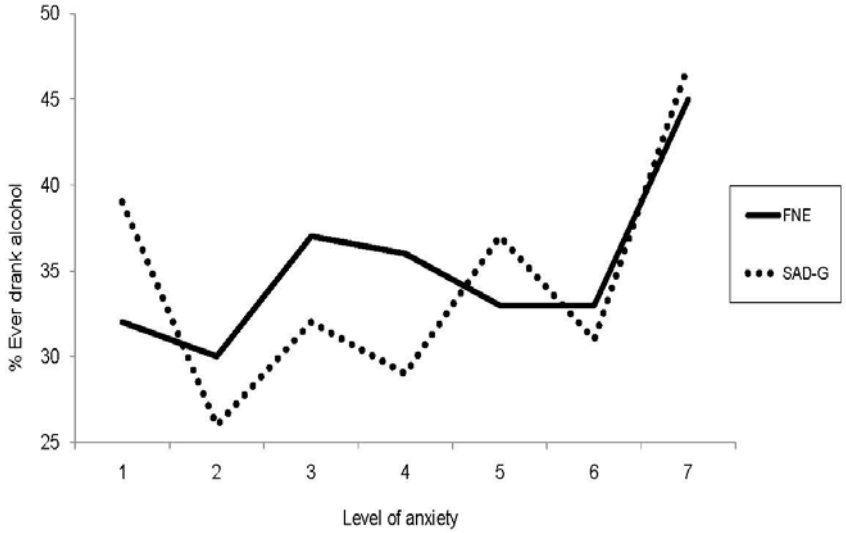

Figure 1.1. The predicted probabilities for the percentage of youth who ever drank alcohol as a function of level of fear of negative evaluation (FNE) and generalized social anxiety and distress (SAD-G).

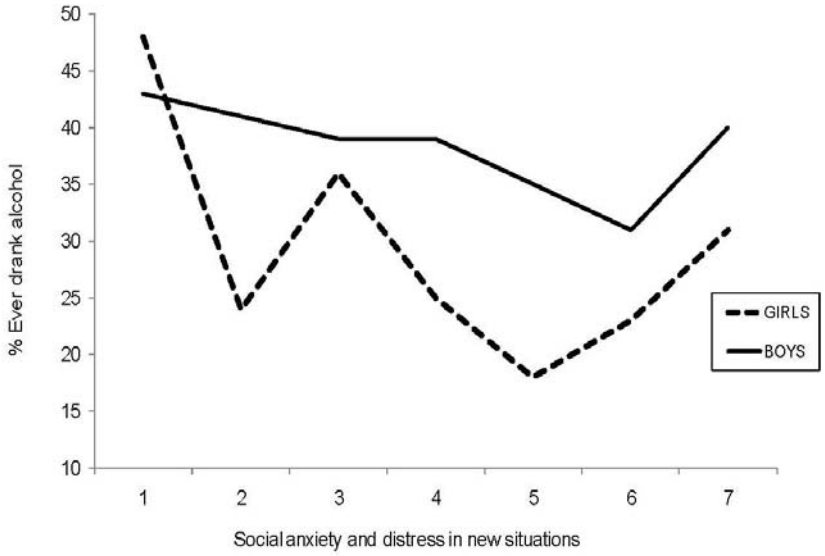

Figure 1.2: Sex differences in the predicted probabilities for the percentage of youth who ever drank alcohol as a function of level of social anxiety and distress in new/unfamiliar situations (SAD-N).

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Chapter 2

Self-medication or social learning? A comparison of models to predict early adolescent drinking

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Abstract

The current study examined the effects of social anxiety, depression, and alcohol expectancies of social behavior change on alcohol involvement to determine whether the self-medication and/or social learning models predicted drinking behavior in a sample of over 400 eighth grade students. Middle school students completed confidential surveys that assessed current alcohol use and expectancies as well as negative affectivity including social anxiety and depressive symptoms. Consistent with the self-medication hypothesis, depression symptoms predicted more frequent and heavier alcohol use as well as solitary drinking. The social learning model was supported by a negative association between social anxiety and quantity/frequency of drinking and less drinking at parties, and a positive association between alcohol expectancies and all drinking outcomes. Additionally, social anxiety moderated the association between expectancies and alcohol use. These findings suggest that self-medication and social learning processes may both play a role in predicting early adolescent alcohol use and the contexts in which youths drink.

Self-medication or social learning? A comparison of models to predict early adolescent drinking

Early adolescent alcohol use is a predictor of young adult alcohol dependence, other mental health problems (Grant & Dawson, 1997; Palmer et al, 2009), and delinquency (Dawkins, 1997; Gruber, DiClemente, Anderson, & Lodico, 1996). Understanding the mechanisms that increase risk for early onset and progression of drinking is important for targeting effective prevention strategies. While negative affectivity including social anxiety and depression is consistently associated with increased alcohol use by early adulthood (e.g., Fergusson, Boden, & Horwood, 2009; Grant et al., 2004; Kushner, Abrams, & Borchardt, 2000), the role of these two types of internalizing symptoms in early alcohol involvement is unclear. Some studies have found that negative affect and depression symptoms predict alcohol use in adolescence (e.g., Colder and Chassin, 1997; Crum, Storr, Anthony, Ialongo, 2008; Wu, Hoven, Okezie, Fuller, & Cohen, 200), and Zimmerman and colleagues (2003) found that baseline social phobia predicted the onset of hazardous alcohol use for youth. However, other studies have found internalizing symptoms to be negatively correlated with alcohol use over time in community samples of adolescents (Shedler and Block, 1990; Stice, Myers, & Brown, 1998). In addition, social anxiety has been shown to provide some protection against the initiation of alcohol and other drug use (Myers, Aarons, Tomlinson, & Stein, 2003). The self-medication model and the

social learning model are both theories that have been proposed to explain processes involved in the initiation, progression, and maintenance of alcohol use. The current study compares these two models by examining social anxiety, depression, and alcohol expectancies to predict alcohol use characteristics and drinking contexts among middle school students.

Self-Medication Model

The self-medication hypothesis (Carrigan and Randall, 2003; Khantzian, 1985) is a motivation focused theory of substance use which hypothesizes that individuals use alcohol and other drugs to alleviate or cope with negative affect (Sher and Trull, 1994). There is evidence to support this model of adolescent substance use. Depression is a known risk factor for adolescent substance abuse (Burke, Burke, & Rae, 1994; Neighbors, Kempton, & Forehand, 1992), and self-report studies indicate that adolescents use substances after experiencing emotional distress (Brook, Whiteman, Gordon, & Cohen, 1989; Hussong, Feagans Gould, & Hersh, 2008). Negative affect has also been found to significantly predict increase in substance use over time as youth transition from middle to late adolescence (Mason, Hitch, & Spoth, 2009). Social anxiety in particular may pose a salient risk for alcohol use because of the desire to reduce anxiety in social situations, such as parties or social gatherings, where drinking is likely to occur at this age. However, to date there have been no studies that have examined the drinking contexts of socially anxious youth in early adolescence. Studies of

adolescents in treatment for psychiatric problems, substance use disorders, or both tend to find that social anxiety is a risk for alcohol involvement (e.g., Clark, Bukstein, Smith, & Kaczynski, 1995; Deas-Nesmith, Brady, & Campbell, 1998; Hovens, Cantwell, & Kiriakos, 1994). In these studies, social anxiety preceded substance involvement 65-100% of the time and the average time between onset of social anxiety and substance involvement was two years. By contrast, studies of community samples of adolescents have found either no relationship between social anxiety and substance involvement, or a protective relationship, in which social anxiety was seen to decrease the risk for subsequent substance use (e.g., Kandel, Johnson, Bird, & Canino 1997; Myers et al., 2003). Together, these studies suggest that the self-medication model may be more useful in explaining processes involved in the maintenance or progression of problematic adolescent alcohol use that is associated with other forms of psychopathology rather than processes related to initiation or early adolescent drinking behaviors.

Social Learning Model

According to social learning theory, adolescent alcohol use is a learned behavior acquired through exposure to alcohol use models and social interactions that provide access and reinforcement for drinking (Petraitis, Flay, & Miller, 1995). The consistent strong association between adolescent drinking and their friends' drinking (e.g., Bauman and Ennett, 1996; Curran, Stice, & Chassin, 1997) is consistent with social learning, in which alcohol use is being modeled by one's

peers. The social avoidance behavior and peer neglect experienced by socially anxious youth may decrease exposure to peer modeling of alcohol use as well as access to alcohol and interpersonal reinforcement at social events in which adolescents most typically drink. Adolescents with social anxiety often avoid participating in extracurricular activities and social events (Albano, Chorpita, & Barlow, 2003) and are invited to friends' homes and parties significantly less often than nonanxious youth (Spence, Donovan, & Brechman-Toussaint, 1999). In addition, anxious youth, including those with generalized distress, fear of social evaluation or new situations, may self-select peers who are less likely to model risk-taking behavior including early adolescent alcohol use (Clark, Thatcher, & Cornelius, 20088). For example, Fergusson and Horwood (1999) found that children in the highest decile of anxious and withdrawn symptoms at age ten were less likely to associate with peers who used alcohol and drugs at age fifteen compared to less anxious/withdrawn children.

Alcohol Expectancies of Social Behavior

Learning theories posit that through exposure to models of drinking behavior, cognitions about alcohol effects are developed, and these cognitions (expectancies) have a direct influence on drinking decisions and behavior (e.g., Brown, 1985; Christiansen & Goldman, 1983). Expectancies about the social behavior change effects produced by alcohol (e.g., "drinking alcohol will make me more outgoing" and "alcohol makes people act stupid at parties") emerge

during childhood and early adolescence, and are the best predictor of adolescent alcohol use (eg. Aas, Leigh, Anderssen, & Jakobsen, 1998; Greenbaum, Brown, & Friedman, 1995; Christiansen & Goldman, 1983), including initiation of alcohol use and early onset (elementary and middle school) drinking (Anderson et al., 2005; Killen et al., 1996; Reese, Chassin, & Molina, 1994). Studies also indicate that social facilitation expectancies predict drinking behavior in adults with social phobia (e.g., Ham, Hope, White, & Rivers, 2002). Additionally, social anxiety reduction expectancies were examined in late adolescents (Tran, Haaga, & Chambless, 1997), and among those who did not expect alcohol to reduce their social anxiety, high social anxiety participants drank significantly less than their low-anxiety counterparts. However, no studies have been conducted to explore the relationship between social anxiety, social behavior expectancies and drinking context in early adolescence.

Current Study

The current study examined the effects of social anxiety, depression, and alcohol expectancies of social behavior on alcohol involvement to determine whether the self-medication and/or social learning model better characterized alcohol use in early adolescence. We examined drinking behavior by selecting middle school students in the eighth grade who reported drinking alcohol in the past 30 days, and predicted the frequency, quantity and severity of their drinking as well as the contexts in which they reported alcohol use with separate multiple

regression analyses. In order to determine whether or not drinking behaviors in our sample were consistent with either model, we made a priori predictions about specific patterns of relationships that should emerge based on each model.

Self-medication hypothesis

The self-medication model predicts that negative affect in general will increase risk of alcohol use. Therefore, both social anxiety (SA) and depression (DEP) should predict elevated drinking frequency and intensity and SA and DEP should interact to predict more severe drinking behavior than elevations in either symptom type alone. However, there should be evidence of symptom- specific influences on drinking context. Since youth high in SA are likely to self-medicate with alcohol in social situations, SA will predict higher rates of drinking at parties and with the opposite sex. Prior research suggests that depression is associated with solitary drinking among college drinkers (Christiansen, Vik, & Chambless, 2002), and drinking to cope was found to predict solitary drinking (Gonzalez, Collins, & Bradizza, 2009). Therefore youth high in DEP symptoms will be more likely to drink alone. Finally, if youth with elevated SA symptoms are self-medicating by drinking alcohol in social settings, expectancies about the effect of alcohol use on social behavior (AEQ) will moderate the relationship between SA and alcohol use, such that high SA youth who expect alcohol to improve their ability to interact socially will use alcohol more than non-socially anxious youth in social contexts, whereas high SA youth who expect alcohol to have deleterious

effects on their social behavior will be less likely to drink in social contexts than non-socially anxious youth.

Social learning hypothesis

The social learning model predicts that modeling of drinking behaviors and learned attitudes and beliefs about the effects of alcohol will predict drinking behavior. As in prior studies, positive AEQ will strongly predict alcohol use. However, SA will predict less frequent alcohol use overall and lower rates of drinking in social situations, presumably due to social avoidance behavior which will lead to less exposure to drinking models and access to alcohol. Furthermore, the relationship between AEQ and drinking will be diminished in SA youth due to less frequent opportunities for forming drinking-related social expectancies based on personal experience. Prior research suggests that girls low in SA are particularly at risk for heavier drinking in early adolescence (Tomlinson, Cummins, & Brown, in press), so we predict that the negative relationship between SA and drinking will be more pronounced in girls.

Methods

Participants

The current assessments were conducted with eighth grade students from four San Diego County middle schools (N = 1058) in 2003 as part of an anonymous survey on adolescent attitudes and behaviors related to alcohol and

drug use. As we were interested in current drinking behavior, 628 youth who reported no alcohol use in the past 30 days were dropped from the analyses. Out of the 430 youth (42.5%) who reported past 30 day alcohol use, 5.5% (N=24) respondents were dropped from analyses for missing data on at least one independent variable and were considered missing completely at random. Current drinkers with missing data did not differ from those who were retained on age, sex, ethnicity, or any of the outcome variables. This resulted in a final sample of 406 youth in the eighth grade (56.2% female) who identified themselves as Caucasian (47.5%), Asian-American (6.4%), African-American (5.2%), Hispanic (17.5%), American Indian (4.9%), Hawaiian/ Pacific Islander (5.9%), and Other or Multiracial (12.6%). There were no sex differences in alcohol use characteristics, social anxiety level, or alcohol expectancies, however girls reported a significantly higher level of depression than boys. Characteristics of the final sample are described in Table 2.1.

Measures

Social anxiety. Adolescents' social anxiety was assessed with the Social Anxiety Scale for Adolescents (SAS-A; La Greca and Lopez, 1998). Three factors have been identified in past research (Inderbitzen-Nolan and Walters, 2000; La Greca and Lopez, 1998): Fear of Negative Evaluation (e.g, "I worry about what others think of me"), Social Avoidance and Distress Specific to New Situations (e.g., "I get nervous when I meet new people"), and Generalized Social

Avoidance and Distress (e.g., "I feel shy even with peers I know well"). Students responded as to how often each statement described them on a scale from *never* (1) to *almost always* (5). Scores from the three subscales were summed to form a composite score, with high scores reflecting greater social anxiety. The SAS-A has been found to have good internal consistency (Ginsberg, La Greca, & Silverman, 1997; La Greca and Lopez, 1993) and reliability and validity (Inderbitzen-Nolan & Walters, 2000). Chronbach's alpha in this sample was .93.

Depression. Participants responded to two items that measured depressed mood: "Do you feel sad or hopeless?" and "Have you felt so sad that you could not do things you should do (go to school, be with friends?)". Students responded as to how often each statement described them on a scale from *never* (1) to *almost always* (5). The internal consistency of the items was .84.

Alcohol expectancies. The social behavior change subscale of the Alcohol Expectancies Questionnaire for Adolescents (AEQ-A; Brown, Christiansen, & Goldman, 1987) was used to measure the degree to which adolescents have positive and negative expectancies about the way alcohol will impact their social behavior (eg. "people become harder to get along with after they have a few drinks of alcohol"; "drinking alcohol makes people more friendly"). Responses were in a true/ false format. The AEQ-A has demonstrated predictive validity (Christiansen & Goldman, 1983; Aas et al., 1998) as well as convergent and

discriminative validity (Goldman, Brown, Christiansen, & Smith, 1991. In this sample the items demonstrated adequate internal consistency (α = .70).

Alcohol use. A categorical measure was used to assess past 30-day drinking (During the past 30 days, how many times have you had at least one drink of alcohol (regular size can/bottle of beer or wine cooler, glass of wine, shot of liquor, etc.)? [0 to 20+ times/mo]). Average drinks per occasion (When you drank alcohol during the PAST MONTH [30 days], about how many drinks did you have in one day? [0 to 12 drinks/episode]), heavy episodic drinking (… how many times did you have 5 or more drinks at one time? [0 to 12 times/month]), and maximum drinks per occasion (…what is the most drinks you had on one day? [0 to 12 drinks/episode]) were continuous measures. These items were derived from the statewide Healthy Kids Survey. In addition, the social contexts in which participants drank alcohol were also assessed. Respondents reported the frequency (0 to 10 times/month) in which they drank alcohol alone, with friends of the opposite sex, and at a party or social event (Fromme and Samson, 1983; Marlatt and Gordon, 1980).

Procedure

To obtain parental consent, consent forms were posted certified mail to all students' homes. Parents who did not wish their children to participate notified the school verbally (by phone), via email, or in writing (prepaid post card) (0.5%).

Trained research staff from the University of California, San Diego (UCSD) administered the survey in the normal classroom setting. Students were informed that the surveys were confidential and anonymous, and that no personal identifying information was collected, after which they completed additional personal assent to participate in the survey. Only youth with both parental consent and child assent were included into the study. As this survey was part of the school-wide assessment of health-related behaviors, there was a high level of student involvement (~95%). The participating school districts and the UCSD Institutional Review Board approved all procedures.

Analytic Strategy

In the first stage of data analysis, chi-squares and ANOVAs were conducted on all available data. Standard regression equations were used in analyses of continuous drinking variables, and logistic regression analysis was used to predict associations with ordinal variables. Models were estimated using maximum likelihood and the significance of the total effect for each factor evaluated with a likelihood ratio test comparing nested models (Rabe-Hesketh & Skrondal, 2005). All reported confidence intervals are at the 95% level.

As we were interested in the examining the main effects of social anxiety, depression, and expectancies as well as their possible interactions between these variables, all models included the same set of predictors: sex, social anxiety (SA),

depression (DEP), social behavior change expectancies (AEQ), and all 2-way interactions (SA x DEP; SA x AEQ; DEP x AEQ; Sex x SA; Sex x DEP; Sex x AEQ). Since we had no a priori hypotheses about the importance of higher order interactions between variables, and preliminary analyses revealed that three and four degree interactions were not significant predictors of the outcome variables, only two way interactions were included in final regression models. All variables included within the interaction terms were centered (Aiken and West, 1991) and standardized. When significant interactions were found, they were probed using the techniques described by Holmbeck (2002). Visual representations of these interactions depict one standard deviation above and below the mean on the moderator of interest.

Results

Association of social anxiety, depression, and alcohol expectancies to frequency of drinking in a multivariate regression analysis

We measured the frequency of drinking in the past 30 days with an ordinal variable that had four levels. An initial regression analysis revealed no differences between the two lower frequency groups (1-2 drinking episodes per month and 3-9 drinking episodes per month), and no differences between the higher two groups (10-19 drinking episodes per month and 20 or more drinking episodes per month). For parsimony, the groups were collapsed and a logistic regression was conducted

comparing youth who drank between one and nine times in the previous month (less frequent drinkers; 73%) to youth that drank ten or more times (more frequent drinkers; 27%). The overall regression model was significant, Wald $\chi^2(10) = 56.87$, $p < .001$. Level of DEP ($B = -0.42$, $SE = 0.18$, $p=.02$) and AEQ ($B = -0.52$, $SE = 0.16$, $p<.001$) predicted more frequent drinking, while SA ($B = 0.70$, $SE = 0.20$, $p<.001$) predicted less frequent drinking. There was also an interaction between SA and DEP ($B = -0.47$, $SE = 0.13$, $p<.001$) indicating that social anxiety and depression symptoms have a synergistic effect on frequency of drinking (Figure 2.1).

Association of social anxiety, depression, and alcohol expectancies to drinking intensity in multivariate regression analyses

Drinking intensity was evaluated next (Table 2.2). The overall models significantly predicted average number of drinks per occasion ($\chi^2[10] = 89.49$, $p < .001$), maximum drinks per occasion ($\chi^2[10] = 133.15$, $p < .001$), and heavy episodic drinking ($\chi^2[10] = 99.15$, $p < .001$). DEP and the social AEQ scale predicted higher intensity of use in all three models. SA predicted lower maximum drinks and lower heavy episodic drinking, while the interaction between SA and AEQ predicted lower intensity in all models. The interaction suggests that social anxiety has a dampening effect on the relationship between alcohol expectancies and drinking intensity such that as anxiety increases, the relationship between expectancies and drinking decreases in strength (Figure 2.2).

The maximum number of drinks per occasion was also predicted by the interaction between SA and DEP, indicating that depression decreases the protective effect of social anxiety and intensity of drinking. The relationship between heavy episodic drinking and AEQ was also moderated by DEP, such that in youth with high alcohol expectancies, those with elevated depression engage in heavy drinking more often than non-depressed youth. Additionally, as shown in Figure 2.3, there was an interaction between DEP and sex, indicating that depression was a greater risk for heavy drinking in boys than in girls.

Association of social anxiety, depression, and alcohol expectancies to drinking contexts in multivariate regression analyses

Finally, we predicted three contexts in which youth drank (alone, at a party, and with the opposite sex; Table 2.3). The overall models significantly predicted drinking alone ($\chi^2[10] = 37.73$, $p < .001$), drinking at parties ($\chi^2[10] = 85.83$, $p < .001$), and drinking with the opposite sex ($\chi^2[15] = 95.17$, $p < .001$). All three contexts were predicted by AEQ and the interaction between SA and AEQ. As with drinking intensity, SA dampened the relationship between AEQ and all drinking contexts. Interestingly, DEP predicted more frequent drinking alone, but did not predict drinking in the other two contexts, while SA significantly predicted less frequent drinking at parties. Solitary drinking was predicted by an interaction between AEQ and DEP, such that in youth with high alcohol expectancies, those with elevated depression engage in solitary drinking

more often than non-depressed youth. Drinking alone and with the opposite sex was predicted by the interaction between SA and DEP indicating that depression lowered the protective effect of social anxiety.

Multivariate analyses including ethnicity as a covariate

The models were also extended with ethnicity as a covariate and coefficients of the independent variables and their interactions in the models did not significantly change. There were ethnic differences found in some of the models. Ethnicity predicted the average number of drinks consumed per drinking episode ($F(6, 404) = 4.15$, $p<.001$), and pairwise comparisons indicated that African-American students drank more alcoholic beverages on average than Caucasians or Asian-Americans. African-Americans and Hawaiian/Pacific Islanders drank alone ($F[6, 396] = 4.28$, $p<.001$), and Hispanic youth drank at a party ($F[6, 402] = 2.12$, $p=.05$) more times than Caucasian youth. Although there was an overall effect of ethnicity on most drinks consumed ($F[6, 402] = 2.13$, $p=.04$), heavy episodic drinking ($F[6, 398] = 3.16$, $p=.005$), and drinking with the opposite sex ($F[6, 401] = 2.31$, $p=.03$), no significant differences were found in pairwise comparisons between ethnic groups.

Discussion

The purpose of the current study was to compare the utility of two theories of alcohol use and misuse, the self-medication hypothesis and social learning

theory, to further understanding of early adolescent alcohol involvement. Positive associations were found between depressive symptoms and alcohol use suggesting support for the self-medication hypothesis. However, alcohol use exhibited negative relations with social anxiety, and positive relations with social behavior change alcohol expectancies, indicating that social learning mechanisms may be influencing early adolescent drinking. Together, the results of the present study contribute to a growing body of literature underscoring the notion that although symptoms of both depression and social anxiety are risk factors for problematic alcohol involvement in adults, these two types of internalizing symptoms exhibit different relationships with alcohol use during early adolescence (e.g., Bekman, Cummins, & Brown, 2010).

Consistent with the self-medication hypothesis, depression symptoms are associated with more frequent alcohol use, drinking in higher volume, as well as drinking alone. The interaction between depression symptoms and social behavior change expectancies also predicted heavy episodic drinking and drinking alone. Although the self-medication model does not necessarily predict that depressive symptoms will moderate the relationship between these specific alcohol expectancies and drinking behavior, positive expectancies may serve as a general risk for heavy drinking in youth with elevated depression symptoms. Read and O'Connor (2006) found that college students high in neuroticism who held positive expectancies for drinking were at elevated risk for binge drinking (4 or more drinks for women and 6 or more drinks for men), but not moderate drinking.

Our results are consistent with prior studies in which depression symptoms and negative mood states are shown to be associated with alcohol use even at the early stages of development of drinking patterns (e.g., Hussong et al., 2008; Mason et al., 2009; Wu et al., 2008). However, data from a recent prospective longitudinal study which followed a cohort for 25 years from birth suggests that the direction of causality may be alcohol abuse or dependence leading to depression rather than vice versa (Furgusson et al., 2009). Due to the cross-sectional design of the current study, we cannot determine the direction of the relationship between depression and alcohol use in our sample of youth. Nevertheless, it is worrisome that symptoms of depression are already becoming associated with maladaptive alcohol use by middle school.

From a social learning perspective, the relationship between social anxiety and alcohol involvement with peers will be mediated by the extent to which these youth participate in social events where alcohol is present. In the present study, social anxiety predicted less frequent drinking, and youth consumed less alcohol per occasion when they did drink. Interestingly, social anxiety predicted less frequent drinking at parties, and there was a trend toward lower rates of drinking with members of the opposite sex, but social anxiety was not significantly associated with drinking in isolation. This suggests that social anxiety may buffer against social drinking simply because these youth are more likely to be absent from the social situation. There is evidence to support this in the current study. There was a weak, but significant negative correlation (r = -.12; p = .02) between

social anxiety and a survey item that assessed the frequency that youths socialized outside of school (*On how many days in the past two weeks did you hang out with friends (not when you were at school)?*).

Consistent with prior research and as predicted by social learning theory, expectancies about the effects of alcohol on social behavior were a powerful predictor of frequency, intensity, and context of past month alcohol use among middle school students who were current drinkers, indicating that youth with well developed beliefs about the social effects of alcohol drink more. However, high levels of social anxiety dampened the relationship between alcohol expectancies and personal alcohol consumption. This suggests that among socially anxious middle schoolers, alcohol related cognitions do not yet correspond to actual drinking behavior, and may be due to less frequent drinking in contexts during which social learning occurs. When these youth transition into high school and are exposed to more opportunities for drinking with peers, individuals with social anxiety may have an acceleration of the development of alcohol involvement and substance-related problems if they develop positive social facilitation expectancies related to drinking. Expectancies about alcohol's ability to increase social assertiveness was found to predict amount of drinking per month in adults with social anxiety disorder (Ham et al., 2002), and adolescents with high trait social anxiety who were exposed to a socially stressful situation consumed more alcohol than low-socially anxious individuals in the same situation (Kidorf and Lang, 1999).

Our prediction that social anxiety would have a stronger association with drinking in girls than in boys was not supported. We found no significant sex differences in the relationship between social anxiety and frequency or quantity of drinking, or drinking contexts. However, depression symptoms were associated with greater risk of heavy episodic drinking in middle school boys than in girls, in contrast to previous studies that find internalizing symptoms to be more associated with girls' alcohol use than boys' (e.g., Buckner and Turner, 2009).

As in prior studies (e.g., Bolton, Robinson, & Sareen, 2009), findings suggest that youth elevated in both depression and anxiety symptoms were at the greatest risk for more frequent drinking, which is consistent with our self-medication model prediction. However, in other instances where the interaction between depression and anxiety predicted drinking behaviors (i.e., maximum drinks per episode, drinking alone, and drinking with the opposite sex) depression dampened the negative association between anxiety and drinking. Interestingly, these analyses indicated that elevations in both types of symptoms cancelled out the effects seen with each individual type of symptom. Clearly, further studies are necessary to determine how these two types of negative affect interact to impact drinking risks, drinking decisions and early drinking behaviors of middle school students.

This study had the advantage of sampling a large number of middle school students from multiple schools in a large metropolitan area, which resulted in a

relatively diverse sample across race, ethnicity and socioeconomics. High levels of student participation allowed for adequate power to examine a complex set of relations among constructs of interest to predict to a variety of alcohol use characteristics. Notably, we assessed the contexts in which early adolescents engage in drinking in addition to standard questions regarding alcohol use. As always, the present study is limited in a number of ways. The cross-sectional nature of the study limits our ability to draw causal inferences. For example, depression symptoms could have been influenced by alcohol use rather than vice versa. In order to fully investigate the inter-relationships between social anxiety, depression, and alcohol expectancies, future studies are needed that assess these variables before the initiation of alcohol use and at multiple timepoints after the onset of drinking. Although youths' self-reports of alcohol use exhibit relatively strong reliability and validity when confidentiality is assured (Ciesla, Spear, & Skala, 1999; Frissel et al., 2004), we must acknowledge the limitations of self-report data. Furthermore, while we propose a theoretical model in which the relationship between social anxiety and alcohol use with peers is mediated by social isolation, we cannot eliminate the possibility that the lower levels of drinking observed in socially anxious youth in the current study are being driven by trait inhibition or risk avoidance motives rather than social isolation. Future research should directly measure these constructs to determine the roles that intrapersonal (e.g., behavioral inhibition) and interpersonal (e.g., social isolation) factors play in predicting alcohol involvement in high SA youth.

Our findings suggest that self-medication and social learning processes both play a role in predicting patterns of early adolescent alcohol use and the contexts in which youths drink. Depression symptoms already confer elevated risk for problematic drinking behavior, including binge drinking and drinking alone, and interventions that target depressed youth should include assessments of problem drinking. Youth with social anxiety who have not yet started drinking may benefit from prevention programs that target social behavior change alcohol expectancies.

References

Aas, H. N., Leigh, B. C., Anderssen, N., & Jakobsen, R. (1998). Two-year longitudinal study of alcohol expectancies and drinking among Norwegian adolescents. *Addiction, 93*(3), 373-384.

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions.* Newbury Park, London, Sage.

Albano, A. M., Chorpita, B. F., & Barlow, D. H. (2003). Childhood anxiety disorders. In E. J. Mash and R. A. Barkley (Eds.), *Child psychopathology* (2nd ed., pp. 279-329). New York: Guilford.

Anderson, K.G. , Smith, G.T., McCarthy, D.M., Fischer, S.F., Fister, S., Grodin, D., Boerner, L.M., & Kearfott Hill, K. (2005). Elementary school drinking: The role of temperament and learning. *Psychology of Addictive Behaviors, 19*(1), 21-27.

Bauman, K. E., & Ennett, S. T. (1996). On the importance of peer influence for adolescent drug use: Commonly neglected considerations. *Addiction, 91*(2), 185–198.

Bekman, N.M., Cummins, K., & Brown, S.A. (2010). Affective and personality risk and cognitive mediators of initial adolescent alcohol use. *Journal of Studies on Alcohol and Drugs*, *71*, 570-580.

Bolton, J.M., Robinson, J. & Sareen J. (2009). Self-medication of mood disorders with alcohol and drugs in the national epidemiologic survey on alcohol and related conditions. *Journal of Affective Disorders, 115*(3):367-375.

Brook, J. S., Whiteman, M., Gordon, A. S., & Cohen, P. (1989). Changes in drug involvement: A longitudinal study of childhood and adolescent determinants. *Psychological Reports, 65*(3), 707-726.

Brown, S. A. (1985). Expectancies versus background in the prediction of college drinking patterns. *Journal of Consulting and Clinical Psychology, 53*, 123-130.

Brown, S.A., Christiansen, B.A. & Goldman, M.S. (1987). The Alcohol Expectancy Questionnaire: An instrument for the assessment of adolescent and adult alcohol expectancies. *Journal of Studies on Alcohol, 48,* 483-491.

Buckner, J.D., & Turner, R.J. (2009). Social anxiety disorder as a risk factor for alcohol use disorders: A prospective examination of parental and peer influences. *Drug and Alcohol Dependence*, *100,* 128-137.

Burke, J. D., Burke, K. C., & Rae, D. S. (1994). Increased rates of drug abuse and dependence after onset of mood or anxiety disorders in adolescence. *Hospital & Community Psychiatry, 45*(5), 451-455.

Carrigan, M.H. & Randall, C.L. (2003). Self-medication in social phobia: A review of the alcohol literature. *Addictive Behaviors, 28*, 269-284.

Christiansen, B. A., & Goldman, M. S. (1983). Alcohol-related expectancies versus demographic/background variables in the prediction of adolescent drinking. *Journal of Consulting & Clinical Psychology, 51*(2), 249-257.

Christiansen, M., Vik, P. W., & Jarchow, A. (2002). College student heavy drinking in social contexts versus alone. *Addictive Behaviors, 27*, 393–404.

Ciesla, J. R., Spear, S. F., & Skala, S. Y. (1999). Reliability over time of self-reports given by adolescents and their parents in substance abuse outcome research. *Journal of Child & Adolescent Substance Abuse*, *9*(2), 57-73.

Clark, D. B., Bukstein, O. G., Smith, M. G., & Kaczynski, N. A. (1995). Identifying anxiety disorders in adolescents hospitalized for alcohol abuse or dependence. *Psychiatric Services, 46*(6), 618-620.

Clark, D.B., Thatcher, D.L., & Cornelius, J.R. (2008). Anxiety disorders and adolescent substance use disorders. In Y. Kaminer& O. Bukstein (Eds.) *Adolescent Substance Abuse, Psychiatric Comorbidity, and High Risk Behaviors* (pp. 271-289) **.** New York: Routledge.

Colder, C.R., and Chassin, L. (1997). Affectivity and impulsivity: Temperament risk for adolescent alcohol involvement. *Psychology of Addictive Behaviors 11*, 83–97.

Crum, R.M., Storr, C.L., Anthony, J.C., & Ialongo, N.S. (2008). Is depressed mood in childhood associated with an increased risk for initiation of alcohol use during early adolescence? *Addictive Behaviors, 33*(1), 24-40.

Curran, P., Stice, E., & Chassin, L. (1997). The relation between adolescent alcohol use and peer alcohol use: A longitudinal random coefficients model. *Journal of Consulting and Clinical Psychology, 65,* 135–140.

Dawkins, M.P. (1997). Drug use and violent crime among adolescents. *Adolescence, 32*(126), 395-405.

Deas-Nesmith, D., Brady, K. T., & Campbell, S. (1998). Comorbid substance use and anxiety disorders in adolescents. *Journal of Psychopathology & Behavioral Assessment, 20*(2), 139-148.

Fergusson, D.M., Boden, J.M., Horwood, L.J. (2009). Tests of causal links between alcohol abuse or dependence and major depression. *Archives of General Psychiatry, 66*(3), 260-266.

Fergusson, D. M., & Horwood, L. J. (1999). Prospective childhood predictors of deviant peer affiliations in adolescence. *Journal of Child Psychology & Psychiatry & Allied Disciplines, 40*(4), 581-592.

Frissell, K.C., McCarthy, D.M., D'Amico, E.J., Metrik, J., Ellingstad, T.P., & Brown, S.A. (2004). The impact of consent procedures on reported levels of adolescent alcohol use. *Psychology of Addictive Behaviors*, 18, 307-315.

Fromme, K., & Samson, H. H. (1983). A survey analysis of first intoxication experiences. *Journal of Studies on Alcohol*, *44*, 905-910.

Ginsburg, G.S., La Greca, A.M., & Silverman, W.K. (1998). Social anxiety in children with anxiety disorders: relation with social and emotional functioning. *Journal of Abnormal Child Psychology, 26*(3), 175-185.

Goldman, M.S., Brown, S.A., Christiansen, B.A., & Smith, G.T. (1991). Alcoholism and memory: broadening the scope of alcohol expectancy research. *Psychological Bulletin, 110*(1), 137-146.

Gonzalez, V.M.; Collins, R.L.; Bradizza, C.M. (2009). Solitary and social heavy drinking, suicidal ideation, and drinking motives in underage college drinkers. *Addictive Behaviors, 34*(12), 993-999.

Grant, B. F., & Dawson, D. A. (1997). Age at onset of alcohol use and its association with DSM-IV alcohol abuse and dependence: Results from the National Longitudinal Alcohol Epidemiologic Survey. *Journal of Substance Abuse, 9*, 103-110.

Grant, B.F., Stinson, F.S., Dawson, D.A., Chou, S.P., Dufour, M.C., Compton, W., Pickering, R.P., & Kaplan, K. (2004). Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders:

Results from the National Epidemiologic Survey on Alcohol and Related Conditions. *Archives of General Psychiatry, 61*(8), 807-816.

Greenbaum, P. E., Brown, E. C., & Friedman, R. M. (1995). Alcohol expectancies among adolescents with conduct disorder: Prediction and mediation of drinking. *Addictive Behaviors,* 20, 321-333.

Gruber, E., DiClemente, R.J., Anderson, M.M., & Lodico, M. (1996). Early drinking onset and its association with alcohol use and problem behavior in late adolescence. *Preventative Medicine,25*(3), 293–300.

Ham, L. S., Hope, D. A., White, C. S., & Rivers, P. C. (2002). Alcohol expectancies and drinking behavior in adults with social anxiety disorder and dysthymia. *Cognitive Therapy and Research, 26*(2), 275-288.

Holmbeck, G. N. (2002). Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *Journal of Pediatric Psychology, 27*, 87-96.

Hovens, J. G., Cantwell, D. P., & Kiriakos, R. (1994). Psychiatric comorbidity in hospitalized adolescent substance abusers. *Journal of the American Academy of Child & Adolescent Psychiatry, 33*(4), 476-483.

Hussong, A.M., Feagans Gould, L., & Hersh, M.A. (2008). Conduct problems moderate self-medication and mood-related drinking consequences in adolescents. *Journal of Studies on Alcohol and Drugs, 69*, 296-307.

Inderbitzen-Nolan, H.M. & Walters, K.S. (2000). Social Anxiety Scale for Adolescents: Normative data and further evidence of construct validity. *Journal of Clinical Child Psychology, 29*(3), 360-371.

Kandel, D. B., Johnson, J. G., Bird, H. R., & Canino, G. (1997). Psychiatric disorders associated with substance use among children and adolescents: Findings from the Methods for the Epidemiology of Child and Adolescent Mental Disorders (MECA) Study. *Journal of Abnormal Child Psychology, 25*(2), 121-132.

Khantzian, E. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry, 142*, 1259-1264.

Kidorf, M., & Lang, A. R. (1999). Effects of social anxiety and alcohol expectancies on stress-induced drinking. *Psychology of Addictive Behaviors, 13*(2), 134–142.

Killen, J.D., Hayward, C., Wilson, D.M., Haydel, K.F., Robinson, T.N., Hammer, L., Taylor, C.B., Varady, A. (1996). The role of expectancy and temperament in the prediction of drinking in a community sample of adolescents. *Addictive Behaviors*, *21*, 473-480.

Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: A review of major perspectives and findings. *Clinical Psychology Review, 20*(2), 149-171.

La Greca, A. M., & Lopez, N. (1998). Social anxiety among adolescents: Linkages with peer relations and friendships. *Journal of Abnormal Child Psychology, 26*(2), 83-94.

Marlatt, G.A. & Gordon, J.R. (1980). Determinants of relapse: Implications for the maintenance of behavior change. In P.O. Davidson & S.M. Davidson (Eds.) *Behavioral Medicine: Changing Health Lifestyles* (pp. 410–452). New York: Brunner/Mazel.

Mason, W. A., Hitch, J. E., & Spoth, R. L. (2009). Longitudinal relations among negative affect, substance use, and peer deviance during the transition from middle to late adolescence. *Substance Use and Misuse, 44*, 1142-1159.

Myers, M.G., Aarons, G.A., Tomlinson, K.L., & Stein, M.B. (2003). Social anxiety, negative affectivity, and substance use among high school students. *Psychology of Addictive Behaviors, 17*(4), 277-283.

Neighbors, B., Kempton, T., & Forehand, R. (1992). Co-occurrence of substance abuse with conduct, anxiety, and depression disorders in juvenile delinquents. *Addictive Behaviors, 17*(4), 379-386.

Palmer, R.H., Young, S.E., Hopfer, C.J., Corley, R.P., Stallings, M.C., Crowley, T.J., & Hewitt, J.K. (2009). Developmental epidemiology of drug use and abuse in adolescence and young adulthood: Evidence of generalized risk. *Drug and Alcohol Dependence, 102*(1-3), 78-87.

Petraitis, J., Flay, B. R., & Miller, T. Q. (1995). Reviewing theories of adolescent substance abuse: Organizing pieces of the puzzle. *Psychological Bulletin, 117*(1), 67-86.

Rabe-Hesketh, S., & Skrondal, A. (2005). *Multilevel and Longitudinal Modeling using Stata.* College Station, TX: Stata Press.

Read, J. P., & O'Connor, R. M. (2006). High- and low-dose expectancies as mediators of personality dimensions and alcohol involvement. *Journal of Studies on Alcohol, 67*, 204–214.

Reese, F. L., Chassin, L., & Molina, B. S. G. (1994). Alcohol expectancies in early adolescents: Predicting drinking behavior from alcohol expectancies and parental alcoholism. *Journal of Studies on Alcohol, 55*, 276-284.

Shedler, J. & Block, J. (1990). Adolescent drug use and psychological health: a longitudinal inquiry. *American Psychologist, 45*(5), 612-630.

Sher, K. J., & Trull, T. J. (1994). Personality and disinhibitory psychopathology:

Alcoholism and antisocial personality disorder. *Journal of Abnormal Psychology, 103*, 92–102.

Spence, S. H., Donovan, C., & Brechman-Toussaint, M. (1999). Social skills, social outcomes, and cognitive features of childhood social phobia. *Journal of Abnormal Psychology, 108*(2), 211-221.

Stice, E., Myers, M.G., & Brown, S.A. (1998). A longitudinal grouping analysis of adolescent substance use escalation and de-escalation. *Psychology of Addictive Behaviors, 12*(1), 14-27.

Tomlinson, K.L., Cummins, K., & Brown, S.A. (in press) Social anxiety and onset of drinking in early adolescence. *The Journal of Child and Adolescent Substance Abuse.*

Tran, G. Q., Haaga, D. A. F., & Chambless, D. L. (1997). Expecting that alcohol will reduce anxiety moderates the relation between social anxiety and alcohol consumption. *Cognitive Therapy and Research, 21,* 535-553.

Wu, P., Hoven, C. W., Okezie, N., Fuller, C. J., & Cohen, P. (2008). Alcohol abuse and depression in children and adolescents. *Journal of Child and Adolescent Substance Abuse, 17*, 51-69.

Zimmermann, P., Wittchen, H.U., Hofler, M., Pfister, H., Kessler, R.C., & Lieb, R. (2003). Primary anxiety disorders and the development of subsequent alcohol use disorders: a four-year community study of adolescents and young adults. *Psychological Medicine, 33*, 1211–1222.

Table 2.1

Sample characteristics of 8th graders reporting past month drinking (N=406).

Variable	Girls (n = 228) M (SD) or %	Boys (n = 178) M (SD) or %
Age, in years	13.6(0.7)	13.7(0.7)
Race		
African-American	3.5%	7.3%
American Indian	5.7%	3.9%
Asian-American	7.0%	5.6%
Hawaiian/Pacific Islander	5.3%	6.7%
Hispanic	19.3%	15.2%
White	46.5%	48.9%
Other/ Multi-Racial	12.7%	12.4%
Alcohol Use in Past Month		
Frequency		
1-2 drinking episodes	47.3%	48.5%
3-9 drinking episodes	25.8%	24.6%
10-19 drinking episodes	12.4%	11.2%
20 or more drinking episodes	14.5%	15.7%
Quantity		
Times drank 5 or more drinks/episode	2.3(3.6)	2.3(3.8)
Average drinks/episode	2.8(3.2)	3.0(3.5)
Maximum drinks/episode	3.9(3.8)	3.8(4.1)
Drinking Contexts		
Times drank alone	1.3(2.5)	1.4(2.6)
Times drank with opposite sex	2.2(3.2)	2.4(3.5)
Times drank at a party	2.3(3.3)	2.1(3.3)
Social Anxiety (range = 18-90)	38.9(14.3)	38.0(16.0)
Depression (range = 2-10)	4.5(2.3)	3.9(2.4)*
AEQ (range = 0-11)	5.7(2.8)	5.8(2.6)

*p<.05

Table 2.2
Prediction of drinking intensity in the past 30 days.

	Average drinks/ episode			*Most drinks per episode*			*Heavy episodic drinking*		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Sex	-.12	.15	.45	.02	.18	.92	-.10	.17	.58
Alcohol Exp. (AEQ)	**1.08**	**.16**	**.00**	**1.28**	**.18**	**.00**	**.89**	**.18**	**.00**
Soc Anx (SA)	-.33	.18	.07	**-.70**	**.21**	**.00**	**-.57**	**.20**	**.00**
Depression (DEP)	**.49**	**.19**	**.01**	**.83**	**.22**	**.00**	**.74**	**.21**	**.00**
AEQ * SA	**-.64**	**.18**	**.00**	**-.59**	**.21**	**.00**	**-.84**	**.21**	**.00**
AEQ * DEP	.21	.17	.22	.07	.20	.72	**.42**	**.20**	**.03**
SA * DEP	.14	.13	.28	**.30**	**.15**	**.05**	.22	.15	.13
Sex * AEQ	.11	.16	.47	.04	.07	.63	.12	.18	.49
Sex * SA	.23	.17	.18	.00	.18	.98	.22	.20	.28
Sex * DEP	-.28	.18	.11	-.27	.20	.19	**-.51**	**.20**	**.01**

Note: Significant parameters are highlighted in bold ($p<.05$). Coefficients listed are for standardized scales.

Table 2.3
Prediction of drinking contexts in the past 30 days.

	Alone			*At a party*			*With the opposite sex*		
Variable	*B*	*SE*	*p*	*B*	*SE*	*p*	*B*	*SE*	*p*
Sex	-.09	.12	.44	.12	.15	.45	-.06	.15	.69
Alcohol Exp. (AEQ)	**.55**	**.13**	**.00**	**1.07**	**.16**	**.00**	**1.13**	**.16**	**.00**
Soc Anx (SA)	-.12	.14	.39	**-.38**	**.18**	**.03**	-.30	.18	.09
Depression (DEP)	**.32**	**.15**	**.03**	.33	.19	.08	.28	.19	.13
AEQ * SA	**-.56**	**.15**	**.00**	**-.68**	**.18**	**.00**	**-.66**	**.18**	**.00**
AEQ * DEP	**.28**	**.14**	**.04**	.11	.17	.52	.22	.17	.19
SA * DEP	**.22**	**.10**	**.03**	.19	.13	.13	**.44**	**.13**	**.00**
Sex * AEQ	-.03	.13	.78	.12	.16	.45	.08	.15	.62
Sex * SA	-.16	.14	.26	-.26	.17	.14	-.26	.17	.13
Sex * DEP	.25	.14	.09	.01	.18	.96	-.03	.18	.84

Note: Significant parameters are highlighted in bold ($p<.05$). Coefficients listed are for standardized scales.

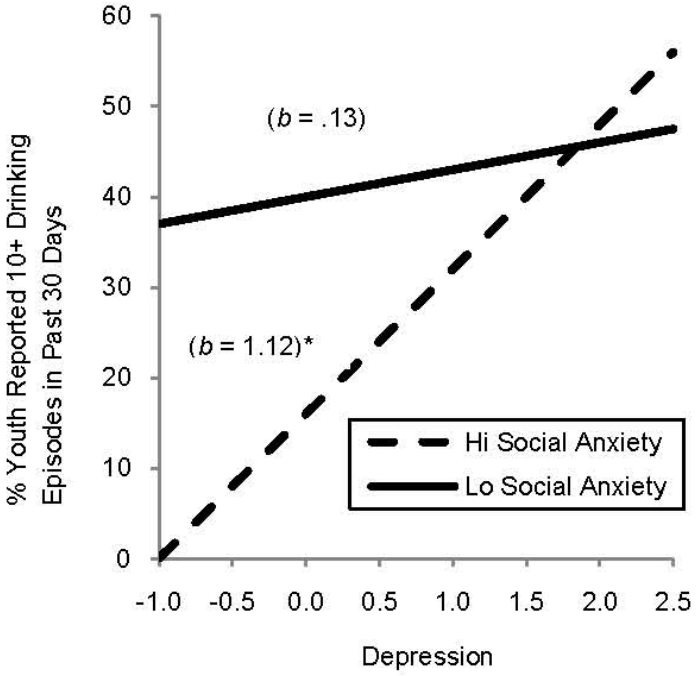

Figure 2.1: Regression lines for the interaction of social anxiety and depression on likelihood of drinking 10 or more times in the past 30 days.

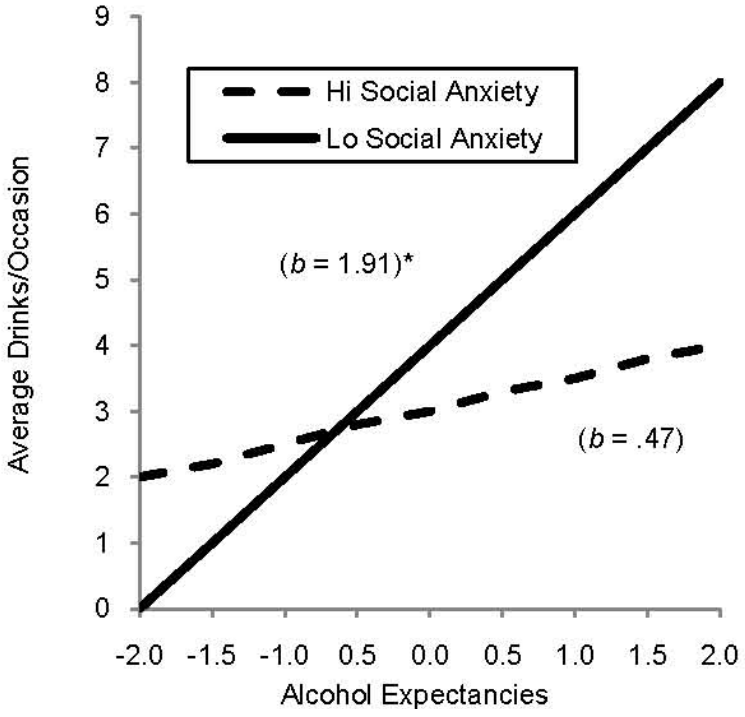

Figure 2.2: Regression lines for the interaction of social anxiety And alcohol expectancies on average drinks per episode (past 30 days).

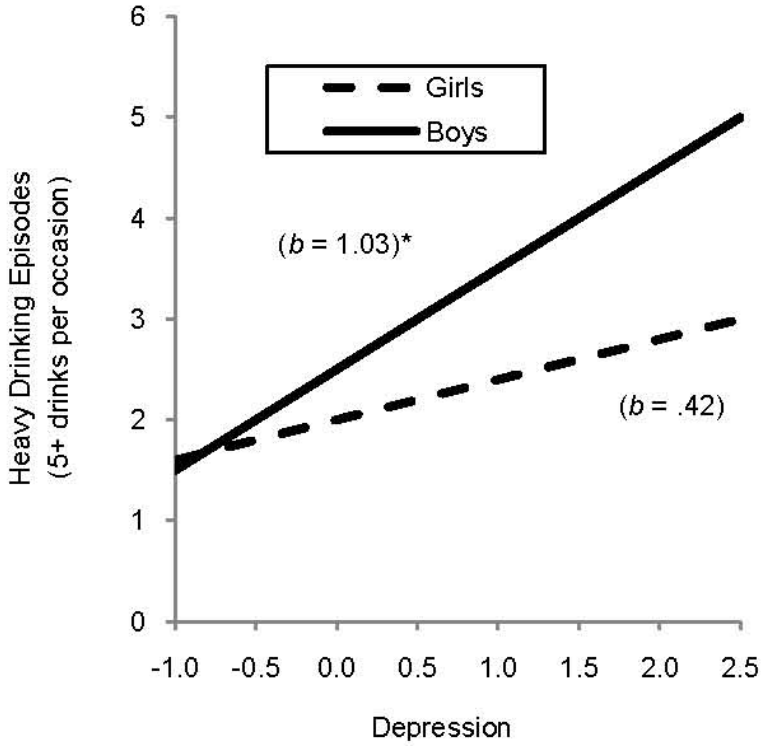

Figure 2.3: Regression lines for the interaction of sex and depression on number of heavy drinking episodes in the past 30 days.

Chapter 2, in full, has been submitted for publication of the material as it may appear in Self medication or social learning? A comparison of models to predict early adolescent drinking in *Addictive Behaviors.* Tomlinson, K.L. & Brown, S.A. (2011). The dissertation author was the primary investigator and author of this paper.

Chapter 3

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Psychiatric Comorbidity and Substance Use Treatment Outcomes of Adolescents

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Treatment outcomes of 126 adolescents (13–18 years old) with comorbid substance use disorders (SUDs) and Axis I psychiatric disorders (mood, anxiety, conduct, and attention-deficit/hyperactivity disorders) were compared to 81 SUD adolescents with no additional Axis I disorder. Participants completed structured interviews and symptom measures while participating in an adolescent treatment program and at 6 months following treatment. Results indicated that comorbid youth received more treatment during the outcome period; despite this, more comorbid SUD–Axis I disordered adolescents used substances following treatment than SUD-only youth, even after controlling for socioeconomic status and ethnicity. Among comorbid youth, internalizing disordered adolescents were less likely to use substances during the follow-up period, and externalizing disordered youth returned to substance use most rapidly after discharge from treatment.

Treatment outcome studies of adolescents with substance use disorders (SUDs) indicate alcohol and other drug relapse rates ranging from 35% to 75% during the year after treatment (S. A. Brown, Mott, & Myers, 1990; S. A. Brown, Vik, & Creamer, 1989; Cornelius, Maisto, et al., 2001; Kaminer, Burleson, & Goldberger, 2002; Newcomb & Bentler, 1989; Ralph & McMenamy, 1996). Youth who begin using early after treatment are at risk for returning to pretreatment levels of hazardous use. For example, 30% of adolescents interviewed 1 year after treatment in the Treatment Outcome Prospective Study still reported daily use of marijuana and heavy use of alcohol (Hubbard, Cavanaugh, Craddock, & Rachal, 1985). Similarly, the Drug Abuse Treatment Outcome Studies for Adolescents (DATOS–A) found that almost one half of youths reported weekly marijuana use, and one quarter reported heavy alcohol use, 1 year after treatment (Grella, Hser, Joshi, & Rounds-Bryant, 2001). The Drug Abuse Reporting Program for youth found favorable results for opioid use but no change in the use of marijuana and alcohol 4 to 6 years after substance abuse treatment (Sells & Simpson, 1979). Similarly, Brown and colleagues (S. A. Brown, D'Amico, McCarthy, & Tapert, 2001) found reduced prevalence for illicit substances but not for alcohol or nicotine in youth 4 years after alcohol and drug treatment.

Heterogeneity within substance-abusing samples including comorbid psychopathology may account for a portion of the variability in relapse rates (S. A. Brown et al., 1990). Alcohol- and drug-abusing youth entering treatment commonly present with pronounced psychiatric symptomatology (e.g., S. A. Brown, Gleghorn, Schuckit, Myers, & Mott, 1996; Crowley, Mikulich, MacDonald, Young, & Zerbe, 1998; Greenbaum, Foster-Johnson, & Petrila, 1996; Kaminer et al., 2002), which, among substance-abusing adults, has been associated with poorer treatment outcomes (e.g., Hesselbrock, Meyer, & Hesselbrock, 1992).

The detrimental effect of comorbid psychopathology on substance use treatment outcome is well documented among adults (e.g., Greenfield et al., 1998; Thomas, Melchert, & Banken, 1999; Tomasson & Vaglum, 1998). Prevalent disorders in treatment samples of substance abusers include Axis I mood and anxiety disorders as well as Axis II antisocial personality disorder (e.g., Brady, 2001; Hesselbrock et al., 1992; Regier et al., 1990). All of these disorders are linked to a poorer prognosis for adult substance use outcome following treatment. For example, a diagnosis of current major depressive disorder at the time of hospitalization is found to be associated with shorter time to first drink among both male and female alcoholics (Greenfield et al., 1998). In another treatment outcome study, agoraphobia, panic disorder, and generalized anxiety disorder all independently predicted more frequent readmission into detoxification facilities compared with alcoholic patients without comorbid psychopathology (Tomasson & Vaglum, 1998). Substance-abusing women with posttraumatic stress

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disorder relapse sooner after treatment than women without comorbid posttraumatic stress disorder (P. J. Brown, Stout, & Meuller, 1996). Likewise, antisocial personality disorder is also associated with poorer substance use outcomes, and in one instance was associated with a twofold prevalence of relapse within the 1st year after treatment, compared to substance-abusing adults without a personality disorder (Thomas et al., 1999).

Numerous studies have highlighted the elevated co-occurrence of psychiatric disorders and substance abuse in adolescent treatment samples (see Bukstein, 2001, for a review). Mood disorders; anxiety disorders; attention-deficit/hyperactivity disorder (ADHD); and conduct disorder (CD), which is the developmental precursor to adult antisocial personality disorder (American Psychiatric Association, 1994), all have very high rates of comorbidity with SUDs among adolescents in treatment (e.g., Abrantes, Brown, & Tomlinson, 2004; Clark & Neighbors, 1996; Rounds-Bryant, Kristiansen, Fairbank, & Hubbard, 1998; Stowell & Estroff, 1992; Wilens, Spencer, & Biederman, 2000; Zeitlin, 1999). However, to date, few studies have examined the relationship between specific types of comorbid psychopathology and treatment outcomes of adolescent substance abusers (S. A. Brown & D'Amico, 2001). The DATOS–A study recently found that adolescents with mental health disorders in addition to their alcohol or drug use disorder are more likely to use marijuana and hallucinogens during the 12 months after substance use treatment compared to substance-abusing youth without these disorders (Grella et al., 2001). Similarly, in a combined inpatient/wilderness treatment program for youth concurrent psychopathology was associated with higher rates of posttreatment substance use relapse (Kennedy & Minami, 1993).

CD, one of the most prevalent co-occurring disorders among substance-abusing youth, predicts poor substance use treatment outcomes for adolescents. S. A. Brown et al. (1996) found that a current diagnosis of CD assessed at admission into treatment based on behaviors occurring independent of alcohol and drug use was related to greater use by adolescents of both alcohol and drugs at 12 and 24 months after substance abuse treatment. Furthermore, early CD behaviors (predating substance involvement) predict elevated levels of alcohol involvement for youth in the 2 years after alcohol and drug treatment (S. A. Brown et al., 1996; Myers, Brown, & Mott, 1995). Crowley et al. (1998) also found poor substance use outcomes following treatment for SUD boys with concomitant CD; unfortunately, this study did not have a control group with which to compare outcome rates.

There is limited information available concerning the relationship between pretreatment diagnoses of ADHD, mood disorders, or anxiety disorders and substance abuse treatment outcomes for youth. The DATOS study (Grella et al., 2001) did not find any relationship between posttreatment substance use outcome and a diagnosis of ADHD at admission into treatment. However, Whitmore, Mikulich, Ehlers, and Crowley (2000) found that number of ADHD symptoms assessed at admission into psychiatric and substance abuse treatment predicted frequency of substance use in the year after treatment. Although depression at admission into treatment did not predict substance use treatment outcome in male or female adolescents in two studies (Crowley et al., 1998; Whitmore et al., 2000), a number of other studies indicate that depressive and anxious symptomatology is linked to poorer substance use outcomes for adolescents (S. A. Brown, Myers, Mott, & Vik, 1994; Dobkin, Chabot, Maliantovich, & Craig, 1998). These inconsistencies may be related to differences in diagnostic procedures, outcome measures, or pharmacological interventions across treatment studies. For example, Cornelius, Bukstein, et al. (2001) found that youth with comorbid depression and alcohol use disorder who were treated with fluoxetine experienced significant decreases in both depressive symptomatology and in frequency and quantity of drinking following treatment.

Mental health disorders may compromise adolescent posttreatment functioning in several ways. Direct and indirect effects of psychiatric comorbidity on substance use are hypothesized for youth (S. A. Brown & D'Amico, 2001; Myers et al., 1995). Psychiatric comorbidity arising during childhood and adolescence may directly compromise substance use treatment outcomes through self-medication of certain psychiatric symptoms (e.g., Clark & Neighbors, 1996; Kushner, Abrams, & Borchardt, 2000). Alternatively, youth with SUDs who also have certain comorbid disorders may have increased exposure and access to alcohol and other drugs through greater involvement with delinquent, substance-using peers (e.g., Barnes, Farrell, & Banerjee, 1994; Chassin, Pillow, Curran, Molina, & Barrera, 1993). Poorer coping skills and lower self-efficacy for stress or temptation situations, which are common among youth with mental health disorders, also place adolescents at risk for substance use relapse following treatment (Myers et al., 1993; Richter, Brown, & Mott, 1991).

In the present study, we examined substance use outcomes during the 6 months following treatment for two groups of substance-abusing adolescents. One group of youth had at least one current Axis I psychiatric diagnosis and an alcohol and/or drug use disorder. The second group had an alcohol and/or drug use disorder without a current Axis I disorder. Youth with a current Axis I disorder were predicted to have poorer substance use outcomes than substance-abusing youth without such disorders even when pretreatment differences were considered. Within the comorbidity group, youth were diagnosed with one or more of the following four Axis I psychiatric disorders: (a) mood disorders, (b) anxiety disorders, (c) conduct and/or oppositional defiant disorder (CD–ODD), and (d) ADHD.

Method

Sample

The sample consisted of youth (ages 13–17) admitted to one of five inpatient adolescent treatment programs in the San Diego, California, area. Youth were primarily Caucasian (79%) and Hispanic (14%). These treatment programs were abstinence focused, offered individual and group cognitive–behavioral therapy, and used a 12-step model of treatment. Length of time in treatment varied from 5 days to 3 weeks. Consecutive admissions with a parent/guardian were chart screened and interview screened for inclusion into one of two groups. One group of adolescents ($N = 81$) was included in the study if they met *Diagnostic and Statistical Manual of Mental Disorders* (3rd ed., rev.; *DSM–III–R*; American Psychiatric Association, 1987) criteria for alcohol and/or substance dependence, without evidence of a major psychiatric disorder (e.g., mood disorder, anxiety disorder) predating the onset of regular (weekly) alcohol or drug use and no current Axis I mental health disorder (SUD-only group). The second group of adolescents ($N = 126$) selected for the study met criteria for both a *DSM–III–R* Axis I disorder and an alcohol and/or substance use disorder (comorbidity group).

Youth living more than 50 miles away, who were unable to read English, who exhibited psychotic symptoms that prohibited their participation, or

who did not have a resource person to corroborate personal and family history information, were excluded from the study. Approximately 20% to 30% of youth admitted to the treatment centers were found to be appropriate for the study. See Table 1 for demographic characteristics of the participants, including age, gender, ethnicity, and socioeconomic status as measured by the Hollingshead Index (Hollingshead, 1965).

As shown in Table 2, both groups of youth reported extensive substance involvement prior to treatment. Youth reported recent use of multiple substances and withdrawal and dependence symptoms for both alcohol and other substances (marijuana, amphetamines, cocaine, inhalants, barbiturates, hallucinogens, and opiates). The most common substances with which youth had experience were alcohol (100%), marijuana (98%), and stimulants (amphetamines and/or cocaine; 82%).

Procedure

Adolescents were screened for participation in the project while they were in inpatient treatment facilities for substance use and mental health disorders. Parents/guardians and youth independently provided the University of California, San Diego, with approved informed consent. Separate confidential interviews were then conducted with each adolescent and parent/guardian pair while youth were still in treatment. The initial adolescent interview was conducted in a private setting at the treatment facility, and the parent/guardian interview was conducted over the phone. The structured research interviews with the adolescent and the parent/guardian were conducted by different trained interviewers, to minimize the occurrence of information being inadvertently revealed to the other party and to provide independent corroboration of data. The structure and administration of the interview were designed to maximize accurate reporting by the participants. For example, questions on substance use and problems and psychiatric symptomatology were administered after demographic and background information was gathered, to allow the participant and interviewer an opportunity to establish rapport, and the same interviewers were used within and across time points whenever possible. The follow-up assessment was conducted at 6 months following discharge from treatment to assess posttreatment alcohol and drug use outcomes. Follow-up adolescent interviews were completed in person at a research testing site or in the participant's home, and parent/guardian interviews were conducted over the phone. In addition, a random sample of 5% to 15% of participants completed urine toxicology screens to corroborate self-reports at outcome time points. Participants were not paid for their initial interview; however, youth and parents/guardians were paid for participating in the 6-month interview (youth received up to $160, and parents/guardians received up to $40, for participation in all interview measures).

Interviewers were trained bachelor's- and master's-level research associates, graduate students, and postdoctoral psychologists. All interviewers were trained to administer the interview in a standardized sequence, which included recognition and clarification of discrepant data obtained during the interview. Interviewers were observed administering practice interviews until consistent agreement was reached between the trainee and experienced interviewer. The interviews were reviewed to ensure accuracy and to prevent interviewer drift in weekly research meetings with the principal investigator of the study. Data were stored in locked file cabinets, and all identifying information (e.g., name, phone number) was stored separately from the interviews.

Of the 81 adolescents in the SUD-only group interviewed at intake into the study, 70 completed the 6-month follow-up interviews and all self-report measures (i.e., 86% follow-up rate). Of the 126 adolescents in the comorbidity group at intake, 88 completed the follow-up interview and assessment forms (i.e., 70% follow-up rate). Attrition analyses were run separately by group to rule out systematic bias. No differences were found between the followed youth and those who did not complete the posttreatment assessments in age, gender, socioeconomic status, ethnicity, or pretreatment substance involvement characteristics (e.g., type, frequency, duration).

Table 1
Background Characteristics of Substance-Abusing Adolescents

Characteristic	Substance use disorder only group	Substance use disorder + Axis I psychiatric disorder group
N	81	126
Age (*M*, *SD*)	15.9 years, 1.26	15.5 years, 1.23
Gender	47% female	54% female
Ethnicity*		
Caucasian	88.8%	72.1%
Hispanic	7.5%	18.0%
Other[a]	3.8%	9.8%
Hollingshead score** (*M*, *SD*)	30.4, 12.0	36.8, 14.2

Note. Ethnicity and Hollingshead score differed significantly between groups.
[a] Ethnic groups included in the "Other" category were African Americans, Native Americans, and Asian American/Pacific Islanders.
* $p < .05$. ** $p < .001$.

Measures

Background. Sociodemographic and other background information was gathered using the Structured Clinical Interview for Adolescents (SCI; S. A. Brown et al., 1989). Background questions included gender; ethnicity; socioeconomic status; age; grade; residence; and family characteristics, including family history of alcohol and drug use disorders. Comparable interviews were conducted with parents to confirm historical and diagnostic information.

Substance involvement. Substance use history, including age of onset of alcohol use and seven types of drugs (marijuana, amphetamines, cocaine, inhalants, barbiturates, hallucinogens, and opiates); quantity and frequency of alcohol use, as well as type and frequency of drug use in both lifetime and past 3 months; alcohol and drug withdrawal; and *DSM–III–R* and *DSM–IV* (American Psychiatric Association, 1994) dependence symptoms (lifetime and past 3 months) were initially assessed using the lifetime version of the Customary Drinking and Drug Use Record (S. A. Brown et al., 1998). This instrument incorporates a personalized calendar, Addiction Severity Index questions (McLellan, Luborsky, O'Brien, & Woody, 1980), and a composite ordinal categorization of current alcohol and drug use patterns (e.g., abstainer, infrequent drinker/user, problem drinker, etc.; Cisin & Cahalan, 1968). This measure has well-documented reliability and validity for youth (S. A. Brown et al., 1998). The most frequent drugs used by youth in the current study were marijuana and stimulants (amphetamines and/or cocaine); for this reason, lifetime and past 3-month use of these drugs are reported separately.

Posttreatment Substance Use Outcome Measures

To determine substance use outcomes, youth and their parents were interviewed again 6 months after treatment using the follow-up Structured Clinical Interview for Adolescents (S. A. Brown et al., 1994) and the past-3-month version of the Customary Drinking and Drug Use Record (S. A. Brown et al., 1998). The same substance use characteristics were assessed as at intake. In addition, the overall percentages of youth who used during the 6 months following treatment were determined for each group. The number of days to initial use episode was calculated, as was the percentage of youth in each group who had "major" and "minor" use episodes, using previously specified criteria for youth. A relapse was characterized as major if the youth had multiple alcohol and/or drug use

Table 2
Group Comparisons of Adolescent Alcohol Use and Drug Use Characteristics Pre- and Posttreatment: Separate Multivariate Analyses of Variance for Alcohol and Drug Use Characteristics

	Pretreatment					Posttreatment				
	SUD-only group (N = 81)		Comorbidity group (N = 126)			SUD-only group (N = 70)		Comorbidity group (N = 88)		
Characteristic	M	SE	M	SE	$F(1, 206)$	M	SE	M	SE	$F(1, 158)$
Alcohol use (past 3 months)										
1. Times/month drank	9.4	1.6	15.4	1.3	8.3**	3.4	0.9	3.2	0.8	0.0, *ns*
2. Drinks/month	67.5	17.7	138.0	14.6	9.5**	18.9	6.2	17.7	5.3	0.0, *ns*
3. *DSM–IV* dependence symptoms	3.2	0.2	3.4	0.2	0.2, *ns*	0.8	0.2	1.5	0.2	7.1**
4. Withdrawal symptoms	1.8	0.3	2.7	0.2	5.7*	0.3	0.2	0.8	0.2	5.2*
Drug use (past 3 months)										
1. Times/month used marijuana	15.6	1.4	16.1	1.1	0.1, *ns*	2.8	1.0	4.8	0.9	2.1, *ns*
2. Times/month used stimulants	16.7	1.4	8.7	1.1	20.2***	3.4	0.8	1.1	0.7	5.1*
3. *DSM–IV* dependence symptoms	5.2	0.2	4.7	0.1	8.1**	1.8	0.3	2.3	0.2	2.1, *ns*
4. Withdrawal symptoms	10.3	0.7	8.8	0.6	2.5, *ns*	3.0	0.7	2.5	0.6	0.4, *ns*
5. Total times used any substances/month	43.2	3.0	44.5	2.5	0.1, *ns*	11.8	2.3	10.2	2.0	0.3, *ns*

Note. SUD = substance use disorder; *DSM–IV* = *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.).
* $p < .05$. ** $p < .01$. *** $p < .001$.

episodes in the 6 months following treatment or reverted to the pretreatment pattern of abuse. Brief use episodes (lapses) that did not meet these criteria were considered minor (S. A. Brown et al., 1994; S. A. Brown et al., 1989).

Additional Treatment in the 6 Months Following Discharge From Initial Treatment

Participants reported whether they had been in additional treatment in the 6 months following discharge from the initial inpatient psychiatric treatment program. Three types of treatment were assessed: (a) participation in an *alcohol/drug treatment program* (outpatient, inpatient, or both), (b) receipt of *therapy* (not in a hospital) for emotional or psychiatric problems (and whether these problems were thought to be related to alcohol and/or drug use), and (c) *hospitalization* for emotional or psychiatric problems (and whether these problems were thought to be related to alcohol and/or drug use). Participants in the comorbidity group also reported whether they had received *pharmacological* treatment for emotional or psychiatric problems.

Axis I Disorders

We established *DSM–III–R* Axis I psychiatric diagnoses for the comorbidity group using the Diagnostic Interview Schedule for Children—Computerized Version (DISC–III–R; Piacentini et al., 1993). The DISC–III–R was separately administered to each adolescent and parent pair by different trained interviewers and subsequently composited using a standard protocol. Symptoms reported by either the adolescent or the parent/guardian were counted toward the diagnosis. This assessment procedure maximizes reliability of diagnoses (Breton, Bergeron, Valla, Berthiaume, & St-Georges, 1998). Although 100% of the comorbidity group had at least one disorder in addition to alcohol or drug dependence, 80% of these youth had two or more diagnoses. Sixty-five percent of the sample was diagnosed with current CD–ODD, 70% were diagnosed with a current mood disorder, 57% were diagnosed with a current anxiety disorder, and 29% were diagnosed with current ADHD. All of the youth with ADHD also met criteria for CD–ODD. Youth were then classified in two ways on the basis of these disorders. First, they were grouped according to number of diagnoses for which they met criteria. Second, they were classified into three groups: (a) internalizing disorder only (diagnosis of mood and/or anxiety without CD–ODD or ADHD), (b) externalizing disorder only (diagnosis of CD–ODD and/or ADHD without mood or anxiety), or (c) both internalizing and externalizing disorders.

Statistical Analyses

We conducted two sets of analyses to ascertain the impact of a mental health disorder on substance use outcomes of adolescents with SUDs following treatment. In the first set of analyses we compared comorbid adolescents to SUD-only adolescents on pre- and posttreatment substance use characteristics. We conducted the second set of analyses using the comorbidity group only, to assess potential differences in pre- and posttreatment substance use characteristics in relation to specific mental health disorders. The diagnostic group comparisons were: (a) number of psychiatric diagnoses (one through four) and (b) type of diagnosis (internalizing, externalizing, or both). We examined substance use outcomes using both cross-sectional and repeated measures analyses.

Cross-Sectional Analyses

We used cross-sectional analyses of substance use characteristics to understand group differences at two discrete time points: (a) immediately before and (b) 6 months after psychiatric treatment. Substance use variables (e.g., alcohol use frequency and alcohol dependence symptoms) tend to be highly correlated. To account for the covariance among outcome variables, we conducted two independent multivariate analyses of variance (MANOVAs) on the suites of both alcohol and drug variables at both pretreatment and posttreatment time points to compare substance use characteristics of diagnostic groups for continuous variables. We conducted chi-square analyses to compare the demographic, pretreatment, and posttreatment substance use characteristics of diagnostic groups for categorical variables. Within the comorbidity group, we used multivariate

regression analyses to assess the linear relationship of the suite of alcohol and drug variables with number of Axis I psychiatric diagnoses.

Longitudinal Analyses

We examined reductions in youths' alcohol and drug use from pretreatment (pre) to posttreatment (post) on continuous variables by creating a change score of the proportion of decrease for each continuous substance use variable. We created the change scores using the following equation: (pre − post) / pre. Scores ranged from −1 to 1, with negative scores indicating increased use or symptoms and positive scores indicating decreased use or symptoms. We created change scores on a case-by-case basis treating the individual participants as their own controls, thus eliminating the confound of the nonindependence of pretreatment scores to posttreatment scores. We then conducted MANOVAs with the change scores to evaluate whether groups differed in their reduction of substance use characteristics. Within the comorbidity group, we ran multivariate regression analyses with the change scores of the alcohol and drug use variables to assess the linear relationship of the proportion reduction in substance use characteristics with number of Axis I psychiatric diagnoses. Time to relapse was modeled using Cox regression survival analysis. Comorbid and SUD-only groups were compared using the Mantel–Haenzsel chi-square test.

Although numerous statistical tests were conducted on the sample, a significance level of .05 was used. The rationale behind not adjusting for multiple comparisons was twofold. First, the sample size is relatively modest, making it difficult to achieve very high significance levels. Second, because the goal of the current study was to examine group differences in overall substance use of youth before and after treatment, and the variables are correlated with one another, individual variable comparisons (e.g., alcohol use days per month, drug dependence symptoms) were presented to provide a more qualitative picture of youth substance use characteristics. Therefore, it is less critical to use a highly stringent criterion for determining significance of the individual tests, because the tests should be interpreted as different ways of examining a single construct.

As is typical in studies of this type, use data were skewed. However, skewness was not severe, and variables were skewed in the same direction (right). The skewness was most attributable to a preponderance of zeros in the data, and no transformations would adjust for the distributional properties (e.g., [log + 1] or square root). Mann–Whitney *U* tests were conducted on skewed variables, and yielded similar results.

Results

Pretreatment Characteristics

The comorbidity and SUD-only groups were comparable in age and gender; however, the comorbidity group reported lower socioeconomic status, as measured by Hollingshead's socioeconomic status index (36.81 vs. 30.36), $t(1,198) = 3.34, p < .01$. This group was also found to have more Hispanic individuals (18.0% vs. 7.5%) and fewer Caucasians (72.1% vs. 88.8%), $\chi^2(2, N = 207) = 7.97, p < .05$. All alcohol use variables were highly correlated (rs = .42–.88), and drug use variables were correlated as well (rs = .15–.63). MANOVAs (run separately for alcohol and drug variables) that compared pretreatment alcohol and drug use characteristics are presented in Table 2. Comorbid adolescents used alcohol more days per month, consumed more alcoholic drinks per month, and reported more alcohol withdrawal symptoms in the 3 months before treatment compared to the SUD-only group. SUD-only adolescents used stimulants more days per month and reported more drug dependence symptoms in the 3 months prior to treatment. There were no differences in the age at which adolescents in the two groups initiated regular use of alcohol, marijuana, or other substances.

Additional Treatment

The comorbidity group was more likely to receive alcohol and/or drug treatment in the 6-month follow-up period compared to the SUD-only group (49.5% vs. 29.4%), $\chi^2(1, N = 158) = 12.43, p < .01$. The comorbidity group was also more likely to have seen a therapist (not in hospital; 70.0% vs. 35.8%), $\chi^2(1, N = 158) = 36.02, p < .001$, and to have been hospitalized (27.7% vs. 6.2%), $\chi^2(1, N = 158) = 13.90, p < .001$, for emotional or psychological problems. Only 7.4% of youth in the SUD-only group reported receiving therapy for emotional or psychiatric problems that were not related to their substance abuse, and 2.5% of SUD-only youth reported being hospitalized for emotional or psychiatric problems that were not related to their substance abuse.

Posttreatment Substance Use

Both the comorbidity group and the SUD-only group showed significant reductions across the two assessment time points. The comorbidity group decreased substance use episodes per month by 79%, and the SUD-only group decreased use by 73%. There were no differences between groups in the point prevalence of alcohol or marijuana use during the follow-up period; however, more individuals in the SUD-only group used stimulants at least once following treatment (27.5% vs. 15.3%), $\chi^2(1, N = 158) = 3.74, p < .05$. The MANOVAs (run separately for alcohol and drug variables) comparing posttreatment substance use characteristics are presented in Table 2. Comorbid youth reported more alcohol dependence and withdrawal symptoms compared to the SUD-only group in the 6 months following treatment, and SUD-only youth used stimulants more days per month compared to comorbid youth.

The MANOVAs (run separately with the suites of alcohol and drug variables) comparing the proportion reduction in substance use in the 6 months following treatment are presented in Table 3. SUD-only youth had proportionally larger reductions in alcohol withdrawal symptoms, frequency of stimulant use, and drug dependence symptoms compared to comorbidity youth.

Adolescents with a comorbid psychiatric disorder were more likely to return to alcohol or drug use in the 6 months following treatment compared to adolescents without a psychiatric disorder (87% vs. 74%), $\chi^2(1, N = 158) = 5.88, p < .01$. As shown in Figure 1, comorbid adolescents also returned to substance use more rapidly after discharge from treatment (M = 61.44 days of initial abstinence vs. 82.78 days), Mantel–Haenzsel $\chi^2(1, N = 158) = 5.72, p < .05$. Among the comorbidity group, 74% drank or used in the first 3 months, compared to 64% in the SUD-only group. Among youth who relapsed, there were no differences between groups in the percentage of major versus minor relapsers. Youth who returned to use following treatment were more likely to be major relapsers (83%) than minor relapsers (17%). Major relapsers in both groups returned to substance use more rapidly than minor relapsers (M = 38.08 days of initial abstinence vs. 67.80 days), $t(1,145) = 3.01, p < .01$.

The above comparisons were repeated controlling for socioeconomic status (Hollingshead score) and ethnicity to determine the

Table 3
Proportion of Reduction in Youths' Substance Use From Pre- to Posttreatment: Separate Multivariate Analyses of Variance for Alcohol and Drug Use Characteristics

Characteristic	SUD-only group (N = 70) M	SE[a]	Comorbidity group (N = 88) M	SE	$F(1, 158)$
Alcohol use (past 3 months)					
1. Times/month drank	.47	.08	.56	.07	0.81, *ns*
2. Drinks/month	.51	.08	.60	.07	0.58, *ns*
3. *DSM–IV* dependence symptoms	.59	.07	.43	.06	2.52, *ns*
4. Withdrawal symptoms	.59	.08	.35	.07	5.53*
Drug use (past 3 months)					
1. Times/month used marijuana	.61	.08	.52	.07	0.74, *ns*
2. Times/month used stimulants	.69	.07	.47	.06	6.69*
3. *DSM–IV* dependence symptoms	.67	.05	.50	.05	5.68*
4. Withdrawal symptoms	.62	.07	.60	.06	0.06, *ns*
5. Total times used any substances/month	.69	.06	.68	.05	0.03, *ns*

Note. SUD = substance use disorder; *DSM–IV* = *Diagnostic and Statistical Manual of Mental Disorders*.
[a] Means and standard errors of the proportion of the reduction in alcohol and drug use characteristics from pretreatment to posttreatment (higher scores represent a higher reduction in use).
* $p < .05$.

extent to which significant differences evidenced between the groups on socioeconomic status and ethnicity influence the group differences found in substance use. Hollingshead score and ethnicity did not alter the observed group differences; all pretreatment and posttreatment substance use differences remained significant.

Substance Use Outcome and Psychiatric Comorbidity

To explore the extent to which characteristics of comorbidity related to posttreatment alcohol and drug involvement, we conducted two comparisons within the comorbidity group: (a) number of psychiatric diagnoses and (b) type of diagnosis (internalizing, externalizing, or both). Sample sizes in these group comparisons were small, and power analyses indicated that both baseline and 6-month analyses were lacking in sufficient power, with a range of .05 to .4 for nonsignificant tests. Consequently, results that yielded probabilities ≤.15 are reported not as significant results but as descriptive information to illustrate possible patterns of substance use characteristics in comorbid youth.

Number of Axis I Psychiatric Diagnoses

The number of Axis I diagnoses in addition to an SUD ranged from 1 to 4. Fifteen percent (n = 19) of youth had a single diagnosis, 33% (n = 41) had two diagnoses, 33% (n = 42) had three diagnoses, and 19% (n = 24) had four diagnoses. Of the 88 youth who completed the 6-month follow-up interview, 14 had a single diagnosis (16%), 25 had two diagnoses (28%), 30 had three diagnoses (34%), and 19 had four diagnoses (22%), with follow-up rates ranging from 61% to 79% across groups.

Regression analysis revealed that socioeconomic status was negatively associated with number of Axis I diagnoses, $t(1,118) = 2.72$, $p < .01$. Specifically, socioeconomic status decreased by 3.52 units per additional Axis I psychiatric diagnosis. Multivariate regression analyses indicated that number of psychiatric diagnoses was positively related to four pretreatment substance use variables: (a) *DSM–IV* alcohol dependence symptoms, $t(1) = 2.63$, $p < .01$; (b) frequency of stimulant use, $t(1,118) = 1.86$, $p = .07$; (c) *DSM–IV* drug dependence symptoms, $t(1,118) = 2.76$, $p < .01$; and (d) drug withdrawal symptoms, $t(1,118) = 3.21$, $p < .05$. Specifically, number of alcohol dependence symptoms increased by 0.48 units, frequency of stimulant use increased by 2.10 units, number of drug dependence symptoms increased by 0.40 units, and number of drug withdrawal symptoms increased by 1.28 units, per additional Axis I psychiatric diagnosis.

Number of Axis I diagnoses was not associated with receiving alcohol or drug treatment, therapy for emotional problems, or hospitalization for emotional problems in the 6 months following discharge from treatment. However, logistic regression analysis indicated that number of diagnoses was significantly associated with receiving pharmacological treatment (e.g., antidepressants, mood stabilizers), $\chi^2(1, N = 88) = 4.58$, $p < .05$. More specifically, the odds of receiving pharmacological treatment per additional diagnosis was 1.57, $t(1) = 4.38$, $p < .05$.

Number of diagnoses was significantly associated with likelihood of relapsing in the 6 months following treatment, $\chi^2(1, N = 88) = 3.86$, $p < .05$. The odds of relapsing per additional diagnosis was 1.75, $t(1) = 3.62$, $p = .06$. Positive associations with number of diagnoses were found for the following posttreatment substance use variables: alcohol dependence symptoms, $t(1, 87) = 2.35$, $p < .05$; alcohol withdrawal symptoms, $t(1, 87) = 1.71$, $p = .09$; and

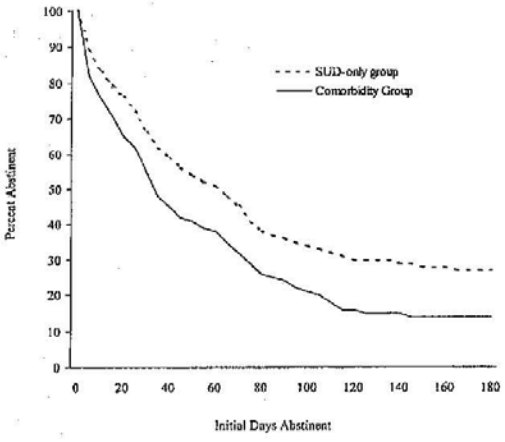

Figure 1. Substance use survival rates for youth: Comorbid group versus substance use disorder (SUD)-only group. The figure depicts number of days to first use of any substance following treatment.

drug dependence symptoms, $t(1, 87) = 2.02, p < .05$. Number of diagnoses was not found to be associated with proportion reduction in either alcohol or drug variables.

We repeated the above comparisons controlling for socioeconomic status and pharmacological treatment in the follow-up period. Neither socioeconomic status nor pharmacological treatment altered the observed group differences.

Type of Diagnosis

The majority of youth in the comorbid group had both internalizing (e.g., mood, anxiety) and externalizing (e.g., CD–ODD, ADHD) disorders in addition to an SUD. Seventeen youth (13%) had only externalizing disorders (E), 12 youth (10%) had only internalizing disorders (I), and 97 (77%) had both (B). Of youth who completed the 6-month follow-up interview, 13 were in the E group (15%), 9 were in the I group (10%), and 66 were in the B group (75%).

There were no demographic differences, and few baseline substance use differences, among the three groups: alcohol dependence symptoms, $F(2, 115) = 2.75, p = .07$; days per month used stimulants, $F(2, 115) = 3.61, p < .05$; days per month used all substances, $F(2, 115) = 2.39, p = .10$; and drug withdrawal symptoms, $F(2, 114) = 2.26, p = .10$. Tukey post hoc comparisons indicated that youth in the I group had fewer alcohol dependence symptoms ($Ms = 2.18$ vs. $3.59, p = .07$) and fewer days per month they used all substances ($Ms = 30.45$ vs. $47.58, p = .15$) compared to youth in the B group. Youth in the E group had fewer stimulant use days per month ($Ms = 2.35$ vs. $10.19, p < .05$), and fewer drug dependence symptoms ($Ms = 5.65$ vs. $9.35, p = .09$), compared to youth in the B group.

Type of diagnosis was not associated with receiving alcohol or drug treatment, therapy for emotional problems, hospitalization for emotional problems, or pharmacological treatment in the 6 months following discharge from treatment.

All groups reduced their substance use substantially across the two assessment time points: The E group had a 66% reduction, the I group had a 79% reduction, and the B group had an 81% reduction. There were no differences among groups on their reduction in frequency of use or number of dependence and withdrawal symptoms. Youth in the I group were less likely to relapse compared to the other two groups (I = 67% relapsed, E = 88% relapsed, B = 90% relapsed), $\chi^2(2, N = 88) = 5.12, p = .08$. Among youth who relapsed, there were no differences between groups in the percentage of major versus minor relapsers. Youth were more likely to be major relapsers (83%) than minor relapsers (17%). However, among the major relapsers there was a difference between groups in the length of time between discharge from treatment and first substance use, $F(2, 73) = 2.76, p = .07$. A Tukey post hoc comparison indicated that youth in the E group returned to use more rapidly than youth in the B group ($Ms = 11.00$ days vs. 41.09 days, $p = .06$). Differences were found in the proportion of the reduction in frequency of marijuana use, $F(2, 78) = 2.15, p = .12$, and stimulant use, $F(2, 78) = 3.14, p < .05$. Tukey post hoc comparisons indicated that youth in the B group had greater proportional reductions in both marijuana (.60 vs. .20; $p = .11$) and stimulant use (.56 vs. .22, $p = .12$) compared to youth in the E group.

Discussion

In the present study we compared the substance use outcomes of alcohol- and drug-abusing adolescents with and without an Axis I mental health disorder. In general, co-occurring mental health disorders were associated with a higher rate and more rapid return to substance involvement among youth following treatment for an SUD. Within the comorbidity group, number of diagnoses was associated with poorer substance use outcomes, indicating that there may be an additive adverse effect of mental health disorders among alcohol- and drug-dependent youth.

There were substantial decreases in substance involvement in the 6 months after inpatient treatment for both diagnostic groups. These findings parallel those of the DATOS–A study, which found that adolescents in all types of treatment modalities, with and without comorbidity, significantly decreased substance use after treatment (Grella et al., 2001). However, there was a high rate of return to substance use in both groups in the 6 months following treatment (87% in the comorbidity group and 74% in the substance use only group). These relapse rates are comparable to other adolescent treatment outcome studies (e.g., S. A. Brown, 1999; S. A. Brown et al., 1989; Hser et al., 2001; Hubbard et al., 1985; Latimer, Newcomb, Winters, & Stinchfield, 2000).

One contribution of the present study to the comorbidity literature is its detailed examination of substance outcomes. Although there were no differences between groups in alcohol use after treatment, comorbid adolescents experienced more alcohol withdrawal symptoms following treatment. In contrast, adolescents with an SUD but without another Axis I disorder used stimulants more frequently after treatment yet exhibited proportionally greater *decreases* in *DSM–IV* drug dependence symptoms compared to comorbid youth. This pattern is interesting to note, because comorbid youth experienced more substance-related psychiatric problems (e.g., dependence and withdrawal symptoms), even though their posttreatment use was similar to SUD-only youth for alcohol and lower for other drugs. One possible implication is that having a comorbid mental health disorder may lead youth to experience or report more severe substance-related problems at lower levels of use than abusing teens without a major mental health problem. Alternatively, comorbid youth may use substances more sporadically but intensely, resulting in greater withdrawal and psychological symptoms. Of note is that comorbid youth were involved in more treatment and were rehospitalized more often for substance abuse and emotional or psychological problems in the 6 months following discharge from the original treatment compared to SUD-only youth. Thus, the poorer substance use outcomes displayed by comorbid youth occurred despite higher receipt of therapeutic intervention and spending more time in inpatient treatment settings, where it is very unlikely that youth were able to use.

Among youth with comorbid Axis I psychopathology, those who met criteria for a larger number of disorders were more likely to relapse than those with fewer disorders, and had more alcohol and drug dependence symptoms both before and after treatment. It is interesting that youth with more mental health disorders were also more likely to be receiving psychotropic medication in the 6-month follow-up period. When the use of psychotropic medication was controlled for, number of disorders still heightened risk for relapse, as well as for alcohol and drug dependence symptoms. This indicates that, among youth in the current study, taking

psychotropic medication did not appear to improve substance use outcome. This finding is in contrast to the results of Cornelius, Bukstein, et al. (2001), who found that treatment with fluoxetine significantly decreased alcohol use in youth with comorbid depression and alcohol use disorder.

The majority (77%) of adolescents in the comorbidity group had both externalizing (CD, ODD, or ADHD) and internalizing (mood, anxiety) disorders. This made it difficult to determine differences in substance use outcomes by specific type of disorder. For this reason, we made comparisons between youth who had only internalizing diagnoses, only externalizing diagnoses, or both. At the 6-month follow-up, youth with internalizing disorders were found to be less likely to relapse compared to adolescents with both disorders. These data parallel findings in the adult literature that indicate that mood disorders do not always increase the risk for relapse following substance use treatment (O'Sullivan, Rynne, Miller, & O'Sullivan, 1988; Tsuang, Irwin, Smith, & Schuckit, 1991) and that depressive or anxiety symptoms, which are common during treatment, may not always be prognostic of poorer short-term outcomes (e.g., S. A. Brown & Schuckit, 1988; Schuckit, Irwin, & Brown, 1990).

Among major relapsers, youth with externalizing disorders relapsed most rapidly after treatment. This pattern of results is consistent with other adolescent treatment outcome studies (e.g., Crowley et al., 1998; Myers, Brown, & Mott, 1995), suggesting the prognostic significance of co-occurring CD for alcohol- and drug-abusing youth. Poorer outcomes may reflect core intrapersonal characteristics of these disorders (e.g., sensation seeking and behavioral disinhibition) or associated risk factors (e.g., lower motivation for abstinence, social skills deficits, or cognitive processing deficits). Similarly, interpersonal risk factors linked to CD, such as peer modeling of substance involvement and increased access and exposure to substances, are also associated with poorer outcomes among youth (e.g., S. A. Brown et al., 1996).

A limitation to the current study is that the large co-occurrence of internalizing and externalizing disorders in youth in the comorbidity sample made it impossible to examine each type of disorder individually. Furthermore, the sample sizes of the internalizing and externalizing only groups were small, which caused statistical difficulties (e.g., a lack of adequate power); for this reason, results (including the failure to find statistically significant differences) from the comparisons should be interpreted cautiously. Future studies need to be conducted with larger sample sizes of comorbid youth with a variety of types of psychopathology so that potential diagnostic group differences in substance abuse treatment outcome can be examined.

The present study underscores the need to assess mental health symptoms among adolescent substance-abusing treatment samples. For youth, having a psychiatric disorder in addition to an SUD generally increases the risk of poorer substance use outcomes after treatment. There is also some evidence that similar levels of alcohol use in comorbid adolescents may be associated with more impairment (e.g., withdrawal and dependency symptoms) or greater perceived problems than are evident among youth who do not have such psychiatric comorbidity.

These findings parallel those of the DATOS–A project, which included substance-abusing adolescents with and without comorbid psychopathology. In general, the youth with Axis I disorders in the present sample had lower socioeconomic status compared to SUD-only youth, which is consistent with previous literature (e.g., Johnson, Cohen, Dohrenwend, Link, & Brook, 1999; Ritsher, Warner, Johnson, & Dohrenwend, 2001; Steiner & Dunne, 1997). Furthermore, as the number of Axis I disorders increased, socioeconomic status decreased. Although controlling for socioeconomic status did not change the observed group differences in substance use outcome, it is likely that socioeconomic difficulties and related stressful life events are experienced more often by the comorbid youth in the present sample and that they influence quality of life and functional levels. The relationship between socioeconomic status and severity of psychopathology may reflect the more complex matrix of risk factors common to alcohol- and drug-abusing youth (e.g., family history of SUDs, unstable home environment; Zucker, Chermack, & Curran, 2000). This difference notwithstanding, substance-abusing adolescents with comorbid psychopathology have worse treatment outcomes.

Treating the psychiatric disorders in conjunction with the SUDs of youth, and understanding the distinct risk of relapse in this population, may help to improve the quality of treatment for adolescents. Future studies are needed to evaluate the processes by which psychopathology impairs substance treatment outcome, the circumstances under which comorbid adolescents are at distinct risk for a return to substance involvement following treatment, and factors associated with short- and long-term success for these troubled youth.

References

Abrantes, A. M., Brown, S. A., & Tomlinson, K. L. (2004). Psychiatric comorbidity among inpatient substance abusing adolescents. *Journal of Child and Adolescent Substance Abuse, 13*(2), 83–101.

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Barnes, G. M., Farrell, M. P., & Banerjee, S. (1994). Family influences on alcohol abuse and other problem behaviors among Black and White adolescents in a general population sample. *Journal of Research on Adolescence, 4*, 183–201.

Brady, K. T. (2001). Comorbid posttraumatic stress disorder and substance use disorders. *Psychiatric Annals, 31*, 313–319.

Breton, J., Bergeron, L., Valla, J., Berthiaume, C., & St-Georges, M. (1998). Diagnostic Interview Schedule for Children (DISC 2.25) in Quebec: Reliability findings in light of the MECA study. *Journal of the American Academy of Child and Adolescent Psychiatry, 37*, 1167–1174.

Brown, P. J., Stout, R. L., & Meuller, T. (1996). Posttraumatic stress disorder and substance abuse relapse among women: A pilot study. *Psychology of Addictive Behaviors, 10*, 124–128.

Brown, S. A. (1999). Treatment of adolescent alcohol problems: Research review and appraisal. In *NIAAA Extramural Scientific Advisory Board: Treatment* (pp. 1–26). Rockville, MD: National Institute on Alcohol Abuse and Alcoholism.

Brown, S. A., & D'Amico, E. J. (2001). Outcomes for alcohol treatment for adolescents. In M. Galanter (Ed.), *Recent developments in alcoholism: Vol. XVI. Selected treatment topics* (pp. 307–327). New York: Plenum.

Brown, S. A., D'Amico, E. J., McCarthy, D. M., & Tapert, S. F. (2001). Four-year outcomes from adolescent alcohol and drug treatment. *Journal of Studies on Alcohol, 63*, 381–388.

Brown, S. A., Gleghorn, A., Schuckit, M. A., Myers, M. G., & Mott, M. A. (1996). Conduct disorder among adolescent alcohol and drug abusers. *Journal of Studies on Alcohol, 57*, 314–324.

Brown, S. A., Mott, M. A., & Myers, M. G. (1990). Adolescent alcohol and drug treatment outcome. In R. R. Watson (Ed.), *Drug and alcohol abuse prevention* (pp. 373–403). Clifton, NJ: Humana Press.

Brown, S. A., Myers, M. G., Lippke, L., Tapert, S. F., Stewart, D. G., & Vik, P. W. (1998). Psychometric evaluation of the Customary Drinking and Drug Use Record (CDDR): A measure of adolescent alcohol and drug involvement. *Journal of Studies on Alcohol, 59*, 427–438.

Brown, S. A., Myers, M. G., Mott, M. A., & Vik, P. W. (1994). Correlates of success following treatment for adolescent substance abuse. *Applied and Preventive Psychology, 3*, 61–73.

Brown, S. A., & Schuckit, M. A. (1988). Changes in depression among abstinent alcoholics. *Journal of Studies on Alcohol, 49*, 412–417.

Brown, S. A., Vik, P. W., & Creamer, V. A. (1989). Characteristics of relapse following adolescent substance abuse treatment. *Addictive Behaviors, 14*, 291–300.

Bukstein, O. G. (2001). Comorbidity and adolescent substance abuse. In T. W. Estroff (Ed.), *Manual of adolescent substance abuse treatment* (pp. 69–90). Washington, DC: American Psychiatric Publishing.

Chassin, L., Pillow, D. R., Curran, P. J., Molina, B. S., & Barrera, M. (1993). Relation of parental alcoholism to early adolescent substance use: A test of three mediating mechanisms. *Journal of Abnormal Psychology, 102*, 3–19.

Cisin, I. H., & Cahalan, D. (1968). Comparison of abstainers and heavy drinkers in a national survey. *Psychiatric Research Reports, 24*, 10–22.

Clark, D. B., & Neighbors, B. (1996). Adolescent substance abuse and internalizing disorders. *Child and Adolescent Psychiatric Clinics of North America, 5*, 45–57.

Cornelius, J. R., Bukstein, O. G., Birmaher, B., Salloum, I. M., Lynch, K., Pollock, N. K., et al. (2001). Fluoxetine in adolescents with major depression and an alcohol use disorder: An open-label trial. *Addictive Behaviors, 26*, 735–739.

Cornelius, J. R., Maisto, S. A., Pollock, N. K., Martin, C. S., Salloum, I. M., Lynch, K. G., & Clark, D. B. (2001). Rapid relapse generally follows treatment for substance use disorders among adolescents. *Addictive Behaviors, 27*, 1–6.

Crowley, T. J., Mikulich, S. K., MacDonald, M., Young, S. E., & Zerbe, G. O. (1998). Substance-dependent, conduct-disordered adolescent males: Severity of diagnosis predicts 2-year outcome. *Drug and Alcohol Dependence, 49*, 225–237.

Dobkin, P. L., Chabot, L., Maliantovich, K., & Craig, W. (1998). Predictors of outcome in drug treatment of adolescent inpatients. *Psychological Reports, 83*, 175–186.

Greenbaum, P. E., Foster-Johnson, L., & Petrila, A. (1996). Co-occurring addictive and mental disorders among adolescents: Prevalence research and future directions. *American Journal of Orthopsychiatry, 66*, 52–60.

Greenfield, S. F., Weiss, R. D., Muenz, L. R., Vagge, L. M., Kelly, J. F., Bello, L. R., & Michael, J. (1998). The effect of depression on return to drinking: A prospective study. *Archives of General Psychiatry, 55*, 259–265.

Grella, C. E., Hser, Y., Joshi, V., & Rounds-Bryant, J. (2001). Drug treatment outcomes for adolescents with comorbid mental and substance use disorders. *Journal of Nervous and Mental Disease, 189*, 384–392.

Hesselbrock, V., Meyer, R., & Hesselbrock, M. (1992). Psychopathology and addictive disorders: The specific case of antisocial personality disorder. In C. P. O'Brien & J. H. Jaffe (Eds.), *Addictive states* (pp. 179–191). New York: Raven Press.

Hollingshead, A. B. (1965). *Two-factor index of social position*. New Haven, CT: Yale University Press.

Hser, Y., Grella, C. E., Hubbard, R. L., Hsieh, S., Fletcher, B. W., Brown, B. S., & Anglin, M. D. (2001). An evaluation of drug treatments for adolescents in four U.S. cities. *Archives of General Psychiatry, 58*, 689–695.

Hubbard, R. L., Cavanaugh, E. R., Craddock, S. G., & Rachal, J. V. (1985). Characteristics, behaviors, and outcomes for youth in TOPS study (report submitted to the National Institute on Drug Abuse, Contract No. 271-79-3611). Research Triangle Park, NC: Research Triangle.

Johnson, J. G., Cohen, P., Dohrenwend, B. P., Link, B. G., & Brook, J. S. (1999). A longitudinal investigation of social causation and social selection processes involved in the association between socioeconomic status and psychiatric disorders. *Journal of Abnormal Psychology, 108*, 490–499.

Kaminer, Y., Burleson, J. A., & Goldberger, R. (2002). Cognitive–behavioral coping skills and psychoeducation therapies for adolescent substance abuse. *Journal of Nervous and Mental Disease, 190*, 737–745.

Kennedy, B. P., & Minami, M. (1993). The Beech Hill Hospital/Outward Bound adolescent chemical dependency treatment program. *Journal of Substance Abuse Treatment, 10*, 395–406.

Kushner, M. G., Abrams, K., & Borchardt, C. (2000). The relationship between anxiety disorders and alcohol use disorders: A review of major perspectives and findings. *Clinical Psychology Review, 20*, 149–171.

Latimer, W. W., Newcomb, M., Winters, K. C., & Stinchfield, R. D. (2000). Adolescent substance abuse treatment outcome: The role of substance abuse problem severity, psychosocial, and treatment factors. *Journal of Consulting and Clinical Psychology, 68*, 684–696.

McClellan, A. T., Luborsky, L., O'Brien, C. P., & Woody, G. E. (1980). An improved diagnostic instrument for substance abuse patients: The Addiction Severity Index. *Journal of Nervous and Mental Disease, 168*, 26–33.

Myers, M. G., Brown, S. A., & Mott, M. A. (1993). Coping as a predictor of adolescent substance abuse treatment outcome. *Journal of Substance Abuse, 5*, 15–29.

Myers, M. G., Brown, S. A., & Mott, M. A. (1995). Preadolescent conduct disorder behaviors predict relapse and progression of addiction for adolescent alcohol and drug abusers. *Alcoholism: Clinical and Experimental Research, 19*, 1528–1536.

Newcomb, M. D., & Bentler, P. M. (1989). Substance use and abuse among children and teenagers. *American Psychologist, 44*, 242–248.

O'Sullivan, K., Rynne, C., Miller, J., & O'Sullivan, S. (1988). A follow-up study on alcoholics with and without co-existing affective disorder. *British Journal of Psychiatry, 152*, 813–819.

Piancentini, J., Shaffer, D., Fisher, P. W., Schwab-Stone, M., Davies, M., Gioia, P., et al. (1993). The Diagnostic Interview Schedule for Children—Revised Version (DISC–R): III. Concurrent criterion validity. *Journal of the American Academy of Child and Adolescent Psychiatry, 32*, 658–665.

Ralph, N., & McMenamy, C. (1996). Treatment outcomes in an adolescent chemical dependency program. *Adolescence, 31*, 91–107.

Regier, D. A., Farmer, M. E., Rae, D. S., Locke, B. Z., Keith, S. J., Judd, L. L., & Goodwin, F. K. (1990). Comorbidity of mental disorders with alcohol and other drug abuse: Results from the Epidemiologic Catchment Area (ECA) Study. *Journal of the American Medical Association, 264*, 2511–2518.

Richter, S. S., Brown, S. A., & Mott, M. A. (1991). The impact of social support and self-esteem on adolescent substance abuse treatment outcome. *Journal of Substance Abuse, 3*, 371–385.

Ritsher, J. E. B., Warner, V., Johnson, J. G., & Dohrenwend, B. P. (2001). Inter-generational longitudinal study of social class and depression: A test of social causation and social selection models. *British Journal of Psychiatry, 178*(Suppl. 40), S84–S90.

Rounds-Bryant, J. L., Kristiansen, P. L., Fairbank, J. A., & Hubbard, R. L. (1998). Substance use, mental disorders, abuse, and crime: Gender comparisons among a national sample of adolescent drug treatment clients. *Journal of Child and Adolescent Substance Abuse, 7*, 19–34.

Schuckit, M. A., Irwin, M., & Brown, S. A. (1990). The history of anxiety symptoms among 171 primary alcoholics. *Journal of Studies on Alcohol, 51*, 34–41.

Sells, S. B., & Simpson, D. D. (1979). Evaluation of the treatment outcome for youths in the Drug Abuse Reporting Program (DARP): A follow-up

study. In G. Beschner & A. S. Friedman (Eds.), *Youth drug abuse: Problems, issues, and treatment* (pp. 571–628). Lexington, MA: D.C. Heath.

Steiner, H., & Dunne, J. E. (1997). Summary of the practice parameters for the assessment and treatment of children and adolescents with conduct disorder. *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 1482–1485.

Stowell, R. J., & Estroff, T. W. (1992). Psychiatric disorders in substance-abusing adolescent inpatients: A pilot study. *Journal of the American Academy of Child and Adolescent Psychiatry, 31,* 1036–1040.

Thomas, V. H., Melchert, T. P., & Banken, J. A. (1999). Substance dependence and personality disorders: Comorbidity and treatment outcome in an inpatient treatment population. *Journal of Studies on Alcohol, 60,* 271–277.

Tomasson, K., & Vaglum, P. (1998). The role of psychiatric comorbidity in the prediction of readmission for detoxification. *Comprehensive Psychiatry, 39,* 129–136.

Tsuang, J. W., Irwin, M. R., Smith, T., & Schuckit, M. A. (1991). Clinical characteristics of primary alcoholics with secondary diagnoses. *Annals of Clinical Psychiatry, 3,* 305–310.

Whitmore, E. A., Mikulich, S. K., Ehlers, K. M., & Crowley, T. J. (2000). One-year outcome of adolescent females referred for conduct disorder and substance abuse/dependence. *Drug and Alcohol Dependence, 59,* 131–141.

Wilens, T. E., Spencer, T. J., & Biederman, J. (2000). Attention-deficit/hyperactivity disorder with substance use disorders. In T. E. Brown (Ed.), *Attention-deficit disorders and comorbidities in children, adolescents, and adults* (pp. 319–339). Washington, DC: American Psychiatric Press.

Zeitlin, H. (1999). Psychiatric comorbidity with substance misuse in children and teenagers. *Drug and Alcohol Dependence, 55,* 225–234.

Zucker, R. A., Chermack, S. T., & Curran, G. M. (2000). Alcoholism: A lifespan perspective on etiology and course. In A. J. Sameroff & M. Lewis (Eds.), *Handbook of developmental psychopathology* (2nd ed., pp. 569–587). New York: Plenum.

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Chapter 4

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Relapse in Alcohol- and Drug-Disordered Adolescents With Comorbid Psychopathology: Changes in Psychiatric Symptoms

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This study examined reciprocal relationships between posttreatment substance use and psychiatric symptoms in adolescents with both a substance use disorder and an Axis I mental health disorder. Participants (13–18 years old) were recruited from inpatient treatment centers and interviewed during treatment and monthly for 6 months. Participants who relapsed (N = 103; 48% female) reported the incidence and severity of psychiatric symptoms experienced before and after their 1st posttreatment substance use. The number of symptoms and depression symptoms experienced were related to use of stimulants and other drugs during relapse. There was evidence for both self-medication (symptom reduction) and rebound (symptom exacerbation) effects of substance use on symptom severity. These results demonstrate that, for adolescents with both substance use and mental health disorders, psychiatric symptoms are 1 factor influencing posttreatment substance use.

Treatment outcome studies of adolescents with alcohol and drug disorders indicate a high incidence of relapse during the year following treatment (e.g., Brown & D'Amico, 2001; Catalano, Hawkins, Wells, Miller, & Brewer, 1990). There is also evidence that adolescents with a comorbid psychiatric disorder besides substance abuse have even poorer posttreatment outcomes (Grella, Hser, Joshi, & Rounds-Bryant, 2001; Kennedy & Minami, 1993; Tomlinson, Brown, & Abrantes, 2004), although results are mixed (Brown, Myers, Mott, & Vik, 1994; Friedman & Glickman, 1987). Little is known, however, about the potential relations between psychiatric disorders, specific psychiatric symptoms, and substance use relapse in adolescence.

Among adults, posttreatment risk for reoccurrence of substance involvement has been found to be influenced by a number of factors (Brownell, Marlatt, Lichtenstein, & Wilson, 1986; Marlatt & Gordon, 1985), such as negative emotions (e.g., Brown, 1985; Hodgins, el-Guebaly, & Armstrong, 1995; Litman, Eiser, Rawson, & Oppenheim, 1979) and stress-related coping skills (e.g., Brown, Vik, Patterson, Grant, & Schuckit, 1995; Miller, Westerberg, Harris, & Tonigan, 1996). Concomitant psychopathology (e.g., anxiety, depression, schizophrenia) has also been shown to influence substance abuse treatment outcome in adults (Brown, 1985; Connors, Maisto, & Zywiak, 1996; Curran, Flynn, Kirchner, & Booth, 2000; Greenfield et al., 1998; Miller et al., 1996; V. H. Thomas, Melchert, & Banken, 1999; Svanum & McAdoo, 1989; Swofford, Kasckow, Scheller-Gilkey, & Inderbitzin, 1996; H. Thomas, 1993; Tomasson & Vaglum, 1998). However, these findings are not conclusive; some treatment studies have not found depression or anxiety to elevate risk of substance relapse (e.g., Hodgins, el-Guebaly, Armstrong, & Dufour, 1999; Sellman & Joyce, 1996; Strowig, 2000).

Studies of adolescent substance use relapse indicate that precursors to relapse differ for youth compared with adults. Social factors, including social pressure to use and exposure to substance-using peers, are the strongest predictors of adolescent relapse (Brown, Vik, & Creamer, 1989; Latimer, Newcomb, Winters, & Stinchfield, 2000). Several studies have found adolescents with comorbid psychopathology to be at increased risk for relapse (Grella et al., 2001; Kennedy & Minami, 1993; Tomlinson et al., 2004). However, others have found that depression, anxiety, and borderline psychotic symptomatology were associated with lower posttreatment substance involvement (Brown et al., 1994; Friedman & Glickman, 1987). These findings suggest that psychiatric symptoms may play a different role in posttreatment substance use for adolescents.

Substance Use, Psychiatric Symptoms, and Self-Medication

One model whereby psychiatric symptoms may influence substance use following treatment is self-medication (Khantzian,

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1985). According to the self-medication hypothesis (SMH), individuals are motivated to use alcohol and other drugs in an attempt to alleviate distressing symptoms. This theory has implications for individuals dually diagnosed with both substance use and other psychiatric disorders, as they experience greater frequency and intensity of distressing emotional symptoms and may become conditioned to drink or use to cope with these states.

Additionally, the SMH predicts that drug selection is influenced by specific symptoms experienced. For example, alcohol may be used to treat symptoms of social anxiety or negative symptoms of schizophrenia, whereas cocaine or other stimulants may be selected when experiencing depression (Khantzian, 1997). Within this framework, increases in symptomatology would be expected to increase risk for relapse with specific substances. Thus, substance-dependent youth with comorbid psychiatric disorders would be at heightened risk for relapse to substance involvement, particularly when experiencing distressing emotional states. Certain substances may also be selected to alleviate specific symptoms, and substance use would be expected to diminish symptoms (at least temporarily) following use.

Little adolescent research has examined the SMH model, and support for this model among adults is mixed. Studies have found that substance abusers self-report being motivated to use drugs in order to relieve depressive and psychotic symptoms (Castaneda, 1994; Weiss, Griffin, & Mirin, 1992). Anxiety symptoms have been found to be more likely to occur before the onset of alcohol abuse (Swendsen et al., 1998). Chutaupe and de Wit (1995) also found that anxious participants used diazepam more than nonanxious participants. Severe stress has been found to substantially elevate risk for relapse (Brown et al., 1995). Abuse of specific drugs has been found to vary across psychiatric groups (Blume, Schmaling, & Marlatt, 2000). In contrast, a number of studies have failed to find evidence for the validity of the SMH, suggesting that type of substance used initially following treatment may be due to factors other than mental health symptomatology (e.g., Greene, Adyanthaya, Morse, & Davis, 1993; Schinka, Curtiss, & Mulloy, 1994).

Few studies to date have directly assessed the validity of the SMH in adolescents. As with adults, youth have been found to use alcohol in order to reduce tension and relieve negative affect (e.g., Cooper, Frone, Russell, & Mudar, 1995; Hussong, Hicks, Levy, & Curran, 2001). In a community sample of adolescents, psychological distress was found to predict later drug use (Damphousse & Kaplan, 1998). However, the distress and substance use relationship was fully mediated by deviant disposition and association with deviant peers (Damphousse & Kaplan, 1998).

The SMH asserts that psychiatric symptoms influence selection of specific substances to reduce problematic mental health symptoms. By contrast, Blume et al. (2000) argued that both biological and behavioral processes provoke a "rebound effect," in which substance use may produce or increase psychiatric symptoms. In fact, protracted use of substances can lead to temporary elevations in levels of depression and anxiety (e.g., Brown & Schuckit, 1988) as well as substance-induced disorders (*DSM–IV*; American Psychiatric Association, 1994).

Present Study

The current study examines both the SMH and possible rebound effects by testing the relationship between psychiatric symptoms prior to and following relapse and first substance use by adolescents with both mental health and substance use disorders following treatment. To test for specific effects of individual symptoms, we measured psychiatric symptomatology in two ways: through psychiatric diagnoses obtained at treatment intake and self-report of specific acute and protracted symptoms before and following a relapse to alcohol or other drug use.

According to the SMH, we first hypothesized that a portion of youth with substance use disorders and comorbid Axis I mental health disorders would experience increased psychiatric symptoms prior to relapse. Second, we hypothesized that symptoms prior to relapse would be related to specific substances used during the initial relapse episode. Finally, consonant with the SMH hypothesis, youth with exacerbations in psychiatric symptoms prior to relapse were expected to experience reductions in symptoms following their initial posttreatment use episode. Alternatively, if adolescent substance use produces a rebound effect on mental health problems, symptoms should increase following relapse episodes. If specific behavioral or biological qualities of drugs produce symptom change, then symptom change should vary as a function of both symptom type and drug used.

Method

Participants

The original sample consisted of 234 adolescents admitted to inpatient treatment for both a psychiatric and alcohol or other substance use disorder. The present analyses focused on that portion of the total sample (n = 103) who used one or more substances in the first 6 months following abstinence-oriented treatment and who reported on their psychiatric symptoms before and after a posttreatment relapse. Youth who relapsed were not different from the remainder of the clinical sample in gender, $\chi^2(1, N = 234) = .66$, *ns*; age, $t(232) = .80$, *ns*; grade, $t(232) = .73$, *ns*; ethnicity, $\chi^2(5, N = 234) = 4.38$, *ns*; or socioeconomic status, Hollingshead score (Hollingshead, 1965), $t(232) = .92$, *ns*. Demographics, baseline substance use, and mental health diagnoses for relapsers are presented in Table 1.

Adolescents who had a history of head trauma with loss of consciousness for 2 min or more were excluded from the study because of potential memory problems. Also, youth who lived more than 50 miles from the research facility were excluded. Each participant was required to have a resource person (typically, a biological parent at intake or someone they lived with, at follow-up) to provide corroborative information and consent to random drug screens. Youth with active psychotic symptomatology prohibiting understanding of or participation in the protocol were also excluded.

Procedure

Parents or guardians provided authorization for medical chart screening at admission to three inpatient psychiatric facilities in the community. Research assistants screened files of all youth, age 13–18 years, admitted to the units. Participants were selected on the basis of evidence of both an alcohol or substance use disorder and an Axis I mental health disorder. Informed written consent for participation in the research project was obtained from the parent or legal guardian of eligible youth (90%), and separate assent was obtained from youth (100%). The consent procedure was approved by the University of California, San Diego, Institutional Review Board and each youth facility. Resource persons were interviewed independently by separate interviewers to corroborate adolescent functioning and to facilitate self-disclosure both during treatment and at the follow-up time points. The interviews were reviewed to ensure accuracy

Table 1
Demographic Characteristics, Substance Use, and Mental Health Disorders of Adolescent Relapsing Within 6 Months Following Treatment

Characteristic	%
Gender	
Male	52
Female	48
Ethnicity	
Caucasian	75
Hispanic	18
African American	4
Other	3
Age	15.98 (1.25)[a]
Hollingshead score (SES)	35.03 (13.20)[a]
Grade	8.74 (1.22)[a]
Substance use diagnosis	
Drug dependence	20
Alcohol dependence	8
Alcohol and drug dependence	72
Mental health diagnosis	
Internalizing and disruptive	75
Disruptive only	15
Internalizing only	10
Drug of choice	
Marijuana	44
Stimulants	28
Alcohol	18
Other drugs	10

Note. Data presented are for participants who reported a relapse (N = 103).
[a] Values for age, grade, and SES are sample means, with standard deviations in parentheses. SES = socioeconomic status.

and to prevent interviewer drift in weekly research meetings with the principal investigator of the study. All participants were informed that a portion of the youth would provide urine samples for toxicology screens on a random basis (10% of sample). In no case did youth fail to report use of substances when toxicology screens were positive. In one case, a participant reported marijuana use within the prior 2 weeks, but this was not identified on the toxicology screen.

Measures

Structured clinical interview. Adolescents and resource persons were administered a 90-min, confidential structured interview (Brown et al., 1989) conducted by a trained interviewer within 4 days of admission to the hospital at intake and at each follow-up time point. Demographic information for the present study was taken from this interview.

Psychopathology. Adolescent *DSM–III–R* (American Psychiatric Association, 1987) Axis I disorders were assessed using the well-standardized Diagnostic Interview Schedule for Children—Computerized Version (DISC–III–R; Piancentini et al., 1993), supplemented by age of symptom onset questions. The DISC was separately administered to the adolescents and their parents by different trained interviewers. Subsequently, the two interviews were integrated using a standard scoring algorithm to composite diagnoses. This procedure maximizes validity of youth diagnoses (Breton, Bergeron, Valla, Berthiaume, & St-Georges, 1998).

In addition to substance use and individual mental health diagnoses, these alcohol- and substance-use disordered youth were classified into three broad diagnostic categories: those meeting *DSM–III–R* criteria for an Axis I internalizing psychiatric disorder (e.g., generalized anxiety disorder, major depression), those meeting criteria for an Axis I disruptive disorder (i.e., oppositional defiant disorder, conduct disorder, attention-deficit/hyperactivity disorder), and those meeting criteria for both kinds of disorders.

Relapse review. Participants were assessed once per month for the first 6 months after treatment. At time points where substance use was reported, a structured interview was conducted to provide verbatim descriptions of use and to assess interpersonal, intrapersonal, and contextual information (Contextual Cue Assessment; Marlatt & Gordon, 1985) concerning the relapse episode (Brown et al., 1989, 1994). Data for the present study use information from the relapse review of the first substance use episode after treatment.

In addition to situational features, the relapse review assessed a participant's retrospective report of the type, number, and sequence of substances used during relapse and whether the individual's drug of choice (identified at time of treatment) was involved. Further, 12 types of mental health symptoms were assessed. The interview included presence/absence of each symptom prior to relapse, severity of symptoms experienced during the 2 weeks before and immediately before relapse, and the severity of each symptom immediately after use and during the 2 weeks after relapse.

Symptoms were grouped into three factor analytically confirmed content domains: Depression, Anxiety, and Psychotic symptoms. Confirmatory factor analyses of dichotomous symptom variables were conducted using Mplus (Muthén & Muthén, 2001). The three-factor solution fit the data well, $\chi^2(19, N = 103) = 131.39$, $p < .001$; comparative fit index = .97; Tucker–Lewis fit index = .97. Depressed mood, sleep difficulties, appetite/somatic complaints, and memory/concentration problems constituted Depression symptoms. The Anxiety factor included symptoms of anxious mood, irritability, fear/avoidance, and repetitive thoughts/behaviors. Hallucinations, flashbacks, psychotic cognitions, and paranoia were categorized as Psychotic symptoms. Symptom counts were calculated for each domain (range 0–4), as well as for total number of psychiatric symptoms (range 0–12).

Symptom change across relapse was assessed through both self-report and interviewer ratings. Changes in symptoms were rated separately for both short term (immediately before, that day) and immediately after relapse (that day, following morning) and longer term (2 weeks before and 2 weeks after relapse). At the end of the relapse assessment, interviewers provided global ratings of symptom change (range = 1 [*major decrease*], 50 [*no change*], 100 [*major increase*]), considering all information from the follow-up assessment. For self-report measures of symptom change, classification variables were calculated for each symptom on the basis of self-reported severity before and after relapse. For each symptom, participants were classified as (1) never having the symptom (before or after relapse), (2) having the symptom and reporting improvement after relapse, (3) having the symptom and reporting no change in severity after relapse, and (4) reporting symptom onset or an increase in severity after relapse. In addition, two count variables were calculated for total symptoms and each symptom domain, one reflecting the number of symptoms (0–12 total, 0–4 for each domain) for which an increase in severity after relapse was reported and one reflecting the number of symptoms for which an improvement was reported. All variables were calculated separately for short term (immediately before and after relapse) and longer term (2 weeks before and after relapse). Self-reported counts of symptom increases/decreases were highly correlated with interviewer ratings (average r = .49). This categorical method does result in some loss of information regarding symptom severity. However, this method allows for the inclusion of those who did not report a symptom either before or after relapse and allows for a more direct assessment of the SMH and rebound effect models.

Results

Relapse Characteristics

The majority of the comorbid youth reported using either alcohol (38%) or marijuana (42%) first during their initial posttreat-

ment substance use. Eleven percent reported stimulants as the first drug used, and 9% reported using another drug (opiates, inhalant, benzodiazepines). Thirty percent of youth reported using more than one substance during their first posttreatment episode, 53% used the substance they identified as their substance of choice during their initial relapse, while 49% indicated that their substance of choice was the first drug used during relapse. When all substances used during relapse are taken into account, 48% of youth reported using alcohol, 49% reported using marijuana, 15% reported using stimulants, and 10% reported using other drugs.

Table 2 lists the percentage of youth reporting the presence of each type of psychiatric symptom prior to relapse. The most frequently reported symptoms preceding relapse were all depression symptoms (depressed mood, sleep difficulties, appetite/somatic complaints, and memory/concentration), as well as irritability and anxious mood. Mean symptom counts indicated that youth averaged slightly more than four symptoms prior to relapse (M = 4.22, SD = 2.39). Depression symptoms (M = 2.17, SD = 1.21) and Anxiety (M = 1.60, SD = 1.07) were more common than Psychotic (M = .45, SD = .89) symptoms.

Psychiatric Diagnoses, Prerelapse Psychiatric Symptoms, and Substance Choice

We first tested the SMH by examining whether intake diagnostic groups differed in their symptom reports prior to relapse and whether they differed in their use of drugs during relapse. Analyses of variance indicated that symptom counts for Anxiety, Depression, Psychotic symptoms, and total symptoms were not significantly different across diagnostic groups. Chi-square analyses also indicated that the diagnostic groups were not different in their use of alcohol, marijuana, stimulants, or other drugs in their initial posttreatment substance use episode.

We next assessed the relationship between prerelapse symptom counts and drug choice during relapse. Chi-square analyses indicated that symptoms preceding relapse did not differ across the intake drugs of choice, reported use of drug of choice during relapse, or substance used first during relapse. Logistic regression analyses were then used to test whether symptom counts for each domain predicted alcohol, marijuana, stimulants, or other drug use during relapse. Both total symptoms—$\chi^2(1, N = 103) = 4.13, p < .05$, odds ratio (OR) = 1.26; Ms = 5.40 (used) versus 4.02 (did not use)—and Depression symptoms—$\chi^2(1, N = 103) = 3.89, p < .05$, OR = 1.62; Ms = 2.73 versus 2.08—predicted stimulant use. Use of other drugs was also predicted by total symptom count, $\chi^2(1, N = 103) = 6.13, p < .05$, OR = 1.51; Ms = 6.67 versus 4.07, and Depression symptoms, $\chi^2(1, N = 103) = 4.72, p < .05$, OR = 2.38; Ms = 3.17 versus 2.11. Symptom counts did not predict alcohol or marijuana use.

Change in Psychiatric Symptoms After Relapse

Table 2 presents the percentage of participants reporting increases (worse), decreases (better), or no change in the severity of symptoms following any substance use after treatment. Substantial portions of youth reported improvement in depressed mood, sleep difficulties, anxious mood, and irritability symptoms after relapse. For most symptoms, the percentage reporting improvement was comparable with those reporting increased severity in that symptom. Interviewers' ratings indicated a lower proportion (one-fifth) with decreased symptom severity after relapse, whereas two thirds were rated as having increasing symptom severity following relapse.

We then compared counts of decreases and increases in symptom severity for each content domain (i.e., Depression, Anxiety, and Psychotic) across intake diagnoses and drug of choice. Anal-

Table 2
Mental Health Symptom Prevalence Before Relapse and Change After Relapse

		Short term			Longer term		
Symptom	Prevalence	Worse	Better	No change	Worse	Better	No change
Depression							
Depressed mood	85	34	27	39	22	39	39
Sleep difficulties	56	21	23	56	21	23	56
Appetite/somatic	34	23	13	64	21	15	64
Memory/concentration	43	27	7	66	23	19	58
Anxiety							
Anxious mood	55	19	27	54	17	26	57
Irritability	77	25	28	47	10	46	44
Fear/avoidance	15	8	5	87	8	6	86
Repetitive thoughts	17	9	7	84	11	6	83
Psychotic							
Hallucinations/delusions	11	9	1	90	6	2	92
Flashbacks	14	8	8	84	9	7	84
Psychotic cognitions	8	6	4	90	5	3	92
Paranoia	13	5	3	90	5	5	90
Global rating		66	21	13	68	20	12

Note. Values are percentages of the total sample reporting each symptom (prevalence) and those reporting an increase (worse), decrease (better), or no change in symptom severity either immediately after (short term) or in the 2 weeks after (longer term) relapse. Data for specific symptoms are based on self-report ratings. Global ratings are from interviewer ratings.

yses of variance indicated that intake diagnoses and drug of choice were not related to postrelapse counts of symptom decreases or increases in any domain. However, regardless of drug of choice, youth reporting first use of other drugs during relapse experienced a greater number of improved Anxiety symptoms, $F(3, 99) = 2.94$, $p < .05$, during the 2 weeks following relapse. Post hoc comparisons indicated that those who reported first use of other drugs experienced more improved Anxiety symptoms than either those who reported first use of alcohol or marijuana. Youth reporting first use of other drugs during relapse also experienced increased severity of Psychotic symptoms both immediately, $F(3, 99) = 3.86$, $p < .01$, and during the 2 weeks after relapse, $F(3, 99) = 3.70$, $p < .01$. Post hoc comparisons indicated an increase in Psychotic symptoms for youth who used other drugs first compared with those who used marijuana.

Logistic regression analyses were used to test self-medication effects, assessing whether decreases in symptom severity were related to any use of alcohol, marijuana, stimulants, or other drugs. Analyses were run separately for each substance (dichotomous used/not used) and tested whether these were related to the number of improved symptoms in each domain (Depression, Anxiety, Psychotic). As with prerelapse symptom counts, these analyses indicated that symptom decreases were not related to use of alcohol or marijuana. However, other drug use was related to a higher number of improved Anxiety symptoms 2 weeks after relapse, $\chi^2(1, N = 103) = 3.81$, $p < .05$, OR = 2.46, and more improved Psychotic symptoms both immediately after, $\chi^2(1, N = 103) = 3.95$, $p < .05$, OR = 4.39, and 2 weeks after relapse, $\chi^2(1, N = 103) = 6.26$, $p < .01$, OR = 5.26.

Finally, logistic regression analyses were used to test for rebound effects, assessing increases in symptom severity as a function of use of alcohol, marijuana, stimulants, or other drugs. Symptom increases were not related to use of alcohol or marijuana. Stimulant use was related to increases in the severity of Depression symptoms immediately following relapse, $\chi^2(1, N = 103) = 4.62$, $p < .05$, OR = 1.72. Use of other drugs was related to increases in total symptom severity, $\chi^2(1, N = 103) = 5.38$, $p < .05$, OR = 1.75, and Psychotic symptom severity, $\chi^2(1, N = 103) = 3.67$, $p < .05$, OR = 2.63, immediately after relapse.

Discussion

The present study explored relations between psychiatric diagnoses, specific psychiatric symptoms, and substance use during relapse in a sample of adolescents with both alcohol or other substance use disorders and Axis I mental health disorders. This study represents the first test of the self-medication hypothesis in a clinical sample of this population. By focusing on substance abusers with concurrent Axis I psychopathology, we were able to test self-medication as a function of both psychiatric diagnosis and specific symptoms. Consistent with the SMH, symptoms prior to relapse were related to type of drug used during relapse, whereas the psychiatric diagnostic group was not. Further, we were able to test for both self-medication and rebound consequences of substance use. We found partial evidence for both processes following relapse.

We found mixed support for self-medication as an influence on drug choice during relapse. In particular, higher levels of overall symptoms and depression symptoms prior to relapse were related to use of both stimulants and other drugs in the relapse episode but not alcohol or marijuana. This result may indicate that adolescents experiencing the greatest distress may seek out stimulants or other drugs to relieve certain symptoms but may relapse to alcohol or marijuana for reasons other than intrapersonal distress (e.g., peer use, easier access, or availability).

We found evidence for both self-medication effects and rebound effects, with a relatively high percentage of participants reporting changes in mental health symptoms after relapse. A substantial proportion of youth reported improvement in symptoms following substance use. Despite this, a greater proportion of comorbid youth demonstrated exacerbations of their mental health symptoms after relapse, both in global interviewer ratings and for several specific symptoms. Similar to prerelapse symptoms, the pattern of post relapse symptom change was related to use of stimulants and other drugs but not alcohol or marijuana use. Not surprisingly, youth who used stimulants were more likely to report increases in depression symptoms immediately following relapse. Findings for other drug use were mixed. Although their use was related to increased psychotic symptoms immediately after relapse, there was also evidence for improvement in both anxiety and psychotic symptoms after relapse for those using these substances.

Results for stimulants are consistent with the type of rebound effect that would be anticipated from the pharmacology of these drugs. Depression-like symptoms, such as appetite and sleep disturbances, are typical aftereffects of stimulant use (*DSM–IV*; American Psychiatric Association, 1994). Mental health consequences for other drugs may also reflect the specific pharmacological impact of these drugs. The fact that this was the only substance group related to both symptom improvement and symptom exacerbation may be due to the heterogeneity of the substances in this category. For example, benzodiazapenes may be useful in producing short-term reductions in anxiety or psychotic symptoms. Others, such as opiates, may lead to increases in depression, whereas hallucinogens may produce psychotic symptoms. The low base rate of use of specific substances in this category prevented separate analyses for each substance type. Results of this study identify these drugs as particularly important for further research on the effect of specific substances on mental health symptoms.

Psychiatric diagnoses were not related to either specific symptoms experienced before relapse or substance used during relapse. It may be that these classifications made at intake are too general and too distal from the relapse episode to reflect mental health state prior to substance use. Further, the present sample had a high rate of multiple psychiatric diagnoses, which may have limited our ability to test for specific effects of individual disorders.

There are several limitations to the present study. This is the first study to examine these processes in a clinical sample of adolescents. The present sample experienced a wide range of psychiatric symptoms prior to relapse, allowing us to test hypotheses about specific symptoms. Nevertheless, some symptoms, particularly psychotic symptoms, were infrequently reported. The low base rate of these symptoms, as well as the low base rate for some substances (e.g., stimulants, other drugs) may have affected results. Several results were significant for the composite measures of psychotic symptoms. It remains unclear whether specific symptoms, such as hallucinations or flashbacks, have specific relationships to drug choice and symptom change. Further, the majority of

youth in this sample had been prescribed medications for their Axis I disorders, although youth were inconsistent in their medication compliance. The role of prescribed medication in relapse drug selection or postrelapse psychiatric symptom changes was not assessed. Further, the sample was selected on the basis of the presence of both a substance use disorder and another psychiatric disorder. Because of this, results may not generalize to either the larger population of substance-using adolescents or that of adolescents with Axis I disorders who do not meet criteria for substance use disorders.

This study was a naturalistic follow-up of adolescents with comorbid psychopathology. A previous study using this sample (Tomlinson et al., 2004) found that youth with externalizing disorders were more likely to relapse than those with other Axis I disorders. However, data on symptom change were collected only from that portion of the sample that relapsed during the first 6 months following treatment. The design of the present study did not allow for testing whether symptom exacerbation functioned as a precipitant of relapse, which is also part of the self-medication hypothesis. Further, we were not able to compare symptom change across relapse in this sample with symptom change across a similar time span that did not include relapse. Future research using a nonrelapsing comparison group can test what portion of the symptom change is part of the natural course of psychiatric symptoms and what is more directly attributable to relapse and specific drug effects.

The present study demonstrated that psychiatric symptoms are one factor influencing substance choice in posttreatment relapse for adolescent substance abusers with comorbid mental health disorders. Results also indicated that certain youth report positive self-medication effects after a return to substance use, whereas for others, mental health symptoms rebound to higher levels (e.g., Blume et al., 2000). However, a variety of factors are influential in determining substance use in adolescents, including availability, peer use, and environmental contingencies surrounding use. It may be that psychiatric symptoms are more likely to precipitate relapse in conjunction with environmental stressors (peer use, social pressure to use). Psychiatric symptoms may also interact with individual difference variables in influencing relapse risk. For example, expectations that alcohol or drugs will reduce stress and tension may increase relapse risk for adolescents experiencing psychiatric symptoms. Future research with this population should focus on psychiatric symptoms as part of a multivariate process influencing adolescent substance use and behavior change following treatment.

References

American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Blume, A. W., Schmaling, K. B., & Marlatt, G. A. (2000). Revisiting the self-medication hypothesis from a behavioral perspective. *Cognitive and Behavioral Practice, 7,* 379–384.

Breton, J., Bergeron, L., Valla, J., Berthiaume, C., & St-Georges, M. (1998). Diagnostic Interview Schedule for Children (DISC 2.25) in Quebec: Reliability findings in light of the MECA study. *Journal of the American Academy of Child and Adolescent Psychiatry, 37,* 1167–1174.

Brown, S. A. (1985). Reinforcement expectancies and alcoholism treatment outcome after a one-year follow-up. *Journal of Studies on Alcohol, 46,* 304–308.

Brown, S. A., & D'Amico, E. J. (2001). Outcomes of alcohol treatment for adolescents. *Recent Developments in Alcoholism Research, 15,* 307–327.

Brown, S. A., Myers, M. G., Mott, M. A., & Vik, P. W. (1994). Correlates of success following treatment for adolescent substance abuse. *Applied and Preventive Psychology, 3*(2), 61–73.

Brown, S. A., & Schuckit, M. A. (1988). Changes in depression among abstinent alcoholics. *Journal of Studies on Alcohol, 49,* 412–417.

Brown, S. A., Vik, P. W., & Creamer, V. A. (1989). Characteristics of relapse following adolescent substance abuse treatment. *Addictive Behaviors, 14,* 291–300.

Brown, S. A., Vik, P. W., Patterson, T. L., Grant, I., & Schuckit, M. A. (1995). Stress, vulnerability and adult alcohol relapse. *Journal of Studies on Alcohol, 56,* 538–545.

Brownell, K. D., Marlatt, G. A., Lichtenstein, E., & Wilson, G. T. (1986). Understanding and preventing relapse. *American Psychologist, 41,* 765–782.

Castaneda, R. (1994). Empirical assessment of the self-medication hypothesis among dually diagnosed inpatients. *Comprehensive Psychiatry, 35,* 180–184.

Catalano, R. F., Hawkins, J. D., Wells, E. A., Miller, J., & Brewer, D. (1990). Evaluation of the effectiveness of adolescent drug abuse treatment, assessment of risks for relapse, and promising approaches for relapse prevention. *International Journal on Addictions, 25,* 1085–1140.

Chutuape, M. D., & de Wit, H. (1995). Preferences for ethanol and diazepam in anxious individuals: An evaluation of the self-medication hypothesis. *Psychopharmacologia, 121,* 91–103.

Connors, G. J., Maisto, S. A., & Zywiak, W. H. (1996). Understanding relapse in the broader context of post-treatment functioning. *Addiction, 91* (Suppl.), S173–S189.

Cooper, M. L., Frone, M. R., Russell, M., & Mudar, P. (1995). Drinking to regulate positive and negative emotions: A motivational model of alcohol use. *Journal of Personality and Social Psychology, 69,* 990–1005.

Curran, G. M., Flynn, H. A., Kirchner, J., & Booth, B. M. (2000). Depression after alcohol treatment as a risk factor for relapse among male veterans. *Journal of Substance Abuse Treatment, 19,* 259–265.

Damphousse, K., & Kaplan, H. B. (1998). Intervening processes between adolescent drug use and psychological distress: An examination of the self-medication hypothesis. *Social Behavior and Personality, 26*(2), 115–130.

Friedman, A. S., & Glickman, N. W. (1987). Effects of psychiatric symptomatology on treatment outcome for adolescent male drug abusers. *Journal of Nervous and Mental Disease, 175,* 425–430.

Greene, R. L., Adyanthaya, A. E., Morse, R. M., & Davis, L. J., Jr. (1993). Personality variables in cocaine- and marijuana-dependent patients. *Journal of Personality Assessment, 61,* 224–230.

Greenfield, S. F., Weiss, R. D., Muenz, L. R., Vagge, L. M., Kelly, J. F., Bello, L. R., et al. (1998). The effect of depression on return to drinking: A prospective study. *Archives of General Psychiatry, 55,* 259–265.

Grella, C. E., Hser, Y. I., Joshi, V., & Rounds-Bryant, J. (2001). Drug treatment outcomes for adolescents with comorbid mental and substance use disorders. *Journal of Nervous and Mental Disease, 189,* 384–392.

Hodgins, D. C., el-Guebaly, N., & Armstrong, S. (1995). Prospective and retrospective reports of mood states before relapse to substance use. *Journal of Consulting and Clinical Psychology, 63,* 400–407.

Hodgins, D. C., el-Guebaly, N., Armstrong, S., & Dufour, M. (1999). Implications of depression on outcome from alcohol dependence: A 3-year prospective follow-up. *Alcohol: Clinical and Experimental Research, 23,* 151–157.

Hollingshead, A. B. (1965). *Two-factor index of social position.* New Haven, CT: Yale University Press.

Hussong, A. M., Hicks, R. E., Levy, S. A., & Curran, P. J. (2001). Specifying the relations between affect and heavy alcohol use among young adults. *Journal of Abnormal Psychology, 110,* 449–461.

Kennedy, B. P., & Minami, M. (1993). The Beech Hill Hospital/Outward Bound Adolescent Chemical Dependency Treatment Program. *Journal of Substance Abuse Treatment, 10,* 395–406.

Khantzian, E. J. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry, 142,* 1259–1264.

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4,* 231–244.

Latimer, W. W., Newcomb, M., Winters, K. C., & Stinchfield, R. D. (2000). Adolescent substance abuse treatment outcome: The role of substance abuse problem severity, psychosocial, and treatment factors. *Journal of Consulting and Clinical Psychology, 68,* 684–696.

Litman, G. K., Eiser, J. R., Rawson, N. S., & Oppenheim, A. N. (1979). Differences in relapse precipitants and coping behaviour between alcohol relapsers and survivors. *Behavior Research and Therapy, 17,* 89–94.

Marlatt, G. A., & Gordon, J. R. (Eds.). (1985). *Relapse prevention: Maintenance strategies in the treatment of addictive behaviors.* New York: Guilford Press.

Miller, W. R., Westerberg, V. S., Harris, R. J., & Tonigan, J. S. (1996). What predicts relapse? Prospective testing of antecedent models. *Addiction, 91* (Suppl.), S155–S172.

Muthén, L. K., & Muthén, B. O. (2001). *Mplus user's guide* (2nd ed.). Los Angeles: Muthén & Muthén.

Piancentini, J., Shaffer, D., Fisher, P. W., Schwab-Stone, M., Davies, M., & Gioia, P. (1993). The Diagnostic Interview Schedule for Children—Revised Version (DISC–III–R): Concurrent criterion validity. *Journal of the American Academy of Child and Adolescent Psychiatry, 32,* 658–665.

Schinka, J. A., Curtiss, G., & Mulloy, J. M. (1994). Personality variables and self-medication in substance abuse. *Journal of Personality Assessment, 63,* 413–422.

Sellman, J. D., & Joyce, P. R. (1996). Does depression predict relapse in the 6 months following treatment for men with alcohol dependence? *Australian and New Zealand Journal of Psychiatry, 30,* 573–578.

Strowig, A. B. (2000). Relapse determinants reported by men treated for alcohol addiction: The prominence of depressed mood. *Journal of Substance Abuse Treatment, 19,* 469–474.

Svanum, S., & McAdoo, W. G. (1989). Predicting rapid relapse following treatment for chemical dependence: A matched-subjects design. *Journal of Consulting and Clinical Psychology, 57,* 222–226.

Swendsen, J. D., Merikangas, K. R., Canino, G. J., Kessler, R. C., Rubio-Stipec, M., & Angst, J. (1998). The comorbidity of alcoholism with anxiety and depressive disorders in four geographic communities. *Comprehensive Psychiatry, 39,* 176–184.

Swofford, C. D., Kasckow, J. W., Scheller-Gilkey, G., & Inderbitzin, L. B. (1996). Substance use: A powerful predictor of relapse in schizophrenia. *Schizophrenia Research, 20,* 145–151.

Thomas, H. (1993). Cannabis and the PSE. *British Journal of Psychiatry, 162,* 271–272.

Thomas, V. H., Melchert, T. P., & Banken, J. A. (1999). Substance dependence and personality disorders: Comorbidity and treatment outcome in an inpatient treatment population. *Journal of Studies on Alcohol, 60,* 271–277.

Tomasson, K., & Vaglum, P. (1998). The role of psychiatric comorbidity in the prediction of readmission for detoxification. *Comprehensive Psychiatry, 39,* 129–136.

Tomlinson, K. L., Brown, S. A., & Abrantes, A. (2004). Psychiatric comorbidity and substance use treatment outcomes of adolescents. *Psychology of Addictive Behaviors, 18,* 160–169.

Weiss, R. D., Griffin, M. L., & Mirin, S. M. (1992). Drug abuse and self-medication for depression: An empirical study. *American Journal of Drug and Alcohol Abuse, 18,* 121–129.

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Chapter 5

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An examination of self-medication and rebound effects: Psychiatric symptomatology before and after alcohol or drug relapse

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Abstract

This study evaluated psychiatric symptoms preceding and following initial posttreatment substance use episodes. 125 veterans meeting DSM-IV criteria for alcohol, cannabis, and/or stimulant dependence at treatment entry were followed with quarterly interviews for one year. Approximately half of the sample met criteria for substance use disorders only ($n=65$; SUD-only) and half additionally met criteria for an independent non-substance related Axis I disorder ($n=60$; SUD–PSY). SUD–PSY adults reported more psychiatric symptoms preceding and following substance use compared to SUD-only adults. Depression and anxiety symptoms were commonly reported by both groups. Symptoms typically did not change or worsened after substance use, with depression worsening more than anxiety or psychotic symptoms. Findings are discussed in relation to the Self-Medication Hypothesis and the Rebound Hypothesis.

Keywords: Relapse; Alcohol dependence; Psychiatric symptoms

1. Introduction

Comorbid psychopathology is frequently associated with poorer substance use disorder (SUD) treatment outcomes (e.g., Greenfield et al., 1998; Thomas, Melchert, & Banken, 1999; Tomassun & Vaglum, 1998).

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Mood, anxiety, and psychotic symptoms have all been found to predict relapse to substance use after treatment. High levels of negative emotionality have been shown to pose significant risk for post-treatment alcohol and drug relapse in numerous studies (e.g., Brown, 1985; Hodgins, el-Guebaly, & Armstrong, 1995; Litman, Eiser, Rawson, & Oppenheim, 1979; Miller, Westerberg, Harris, & Tonigan, 1996; Strowig, 2000; Svanum & McAdoo, 1989). However, mood symptoms have failed to differentiate relapsers from abstainers following addiction treatment in other studies (Hall, Havassy, & Wasserman, 1990; Sellman & Joyce, 1996; Tempesta, Janiri, Bignamini, Chabac, & Potgieter, 2000). Anxiety symptoms have also been associated with substance use relapse in SUD adults (Brown, 1985; Connors, Maisto, & Zywiak, 1996; Svanum & McAdoo, 1989; Willinger et al., 2002). Again, findings were not conclusive as other studies found no association between anxiety and risk of relapse (Litman et al., 1979; Strowig, 2000; Tempesta et al., 2000).

Results are also mixed regarding the prognostic significance of a diagnosis of major depression on risk of relapse. Weiss, Griffin, and Mirin (1992) found that among patients hospitalized for drug abuse, men diagnosed with concomitant major depression were more likely to report using drugs to relieve depressive symptoms than men without a depression diagnosis. Another study found that the onset of a depressive episode significantly predicted first use of alcohol or other drugs later in the same week among treatment-seeking alcohol dependent adults (Hodgins, el-Guebaly, Armstrong, & Dufour, 1999). However, other studies have documented that current depressive symptomatology increased risk for substance use relapse, whereas a history of a major depressive disorder diagnosis was not predictive of return to substance use (Curran, Flynn, Kirchner, & Booth, 2000; Hodgins et al., 1995).

Bi-directional relations between psychiatric disorders and substance relapse after treatment have been suggested. Prior to relapse, coping with persistent psychiatric symptomatology and particularly, increases in the severity of symptomatology, may impact the risk of substance use relapse. Furthermore, relapse risk may differ by the types of psychiatric symptoms that are experienced. Additionally, the return to substance use after treatment can influence psychiatric symptomatology in a number of ways. The pharmacological effects of certain substances may alter specific psychiatric symptoms (e.g., cocaine intoxication may increase irritability, alcohol intoxication may reduce social anxiety). Substance use relapse can also lead to environmental stressors, including conflicts with family members or legal consequences that may exacerbate psychiatric symptoms.

Several theories have been proposed to delineate the relationship between psychopathology and risk of substance use relapse. The self-medication hypothesis (SMH; Khantzian, 1985) proposes that individuals are motivated to use drugs for their pharmacological effects to alleviate distressing emotional states. Within this framework, the presence of a concomitant psychiatric disorder will influence relapse through the negative emotions that these individuals commonly experience (e.g., depressed mood, social anxiety). Furthermore, *increases* in psychiatric symptomatology producing negative affect would be expected to increase risk of substance use relapse. Thus, SUD adults with comorbid mood, anxiety, or psychotic disorders may be at heightened risk for alcohol or drug relapse because of the increased likelihood, intensity, duration, and chronicity of psychiatric symptomatology, and related aversive emotional states inherent to mental health disorders (Riehman, Iguchi, & Anglin, 2002; Tate, Brown, Unrod, & Ramo, 2004).

Less research has specifically focused on the impact of substance use relapse on post-relapse psychiatric symptomatology. According to SMH, substance use that occurs in an attempt to self-medicate psychiatric symptoms (e.g., depressed mood, irritability) is expected to diminish the severity of psychiatric symptoms (or the perception of severity of symptoms), at least temporarily. Hospitalized drug abusers reported improvements in mood subsequent to drug use in one study (Weiss, Griffin, &

Mirin, 1992), but the majority of research fails to support improvements in psychiatric symptomatology following post-treatment alcohol and drug involvement (e.g., Greene, Adyanthaya, Morse, & Davis, 1993; Schinka, Curtiss, & Mulloy, 1994). Hodgins et al. (1999) found that a return to alcohol use was significantly more likely to occur right before the onset of a depressive episode. Blume, Schmaling, and Marlatt (2000) argued that both biological and behavioral processes provoke a "rebound effect", where substance use may produce or increase psychiatric symptoms. In fact, protracted use of substances can lead to elevations in levels of depression and anxiety (Brown & Schuckit, 1988) as well as substance induced disorders (DSM-IV; American Psychiatric Association, 1994). A number of studies have documented that individuals dually diagnosed with schizophrenia and a SUD who relapse on alcohol or other drugs are more likely to be rehospitalized for psychotic episodes (Cuffel & Chase, 1994; Hunt, Bergen, & Bashir, 2002; Swofford, Kasckow, Scheller-Gilkey, & Inderbitzen, 1996).

Given the inconsistencies in the literature about how psychiatric disorders and psychiatric symptomatology impact clinical course as well as how relapse influences subsequent psychopathology, the need for further investigation is critically important. The current study explores possible reciprocal relationships between Axis I psychiatric disorders, psychiatric symptomatology, and substance use relapse in SUD adults during the year following treatment for alcohol and/or drug dependence. The characteristics of the sample allowed for the unique opportunity to directly compare SUD adults with and without a comorbid Axis I psychiatric disorder at the time of treatment (diagnoses included mood disorders, anxiety disorders, and schizophrenia). Acute and protracted symptoms experienced before a relapse to alcohol or other drugs and changes in symptoms following the relapse were examined.

Based on previous research, we hypothesized that among substance use disordered adults: 1) the types of psychiatric symptoms endorsed prior to relapse would vary as a function of Axis I diagnosis, and 2) consistent with the rebound hypothesis, relapse would exacerbate psychiatric symptomatology in most SUD individuals regardless of other mental health disorders. Additionally, we will assess for indications that relapse was related to attempts to self-medicate psychiatric symptoms by examining the following: 1) whether individuals' substance of choice was used during the relapse episode, 2) whether the substance used during relapse varied as a function of either comorbid psychopathology or psychiatric symptomatology experienced prior to relapse, and 3) whether symptom improvement occurred following relapse.

2. Method

2.1. Participants

Participants were drawn from consecutive admissions to abstinence-based alcohol and drug treatment and mental health programs at the San Diego Veteran's Administration Healthcare System, including inpatient alcohol and drug treatment (77%), inpatient mental health (11%), and outpatient alcohol and drug or dual diagnosis treatment (12%). All inpatients were enrolled in outpatient groups for substance abuse following discharge. Outpatient interventions were delivered in a one hour group format, either once or twice weekly. Additionally, Twelve Step community meeting attendance is prescribed for all patients. Pharmacotherapy evaluation was provided for those with substance-independent mental health disorders, and 80.3% of SUD–PSY participants were prescribed psychotropic medication.

Potential participants were provided a complete description of the study and written informed consent was obtained. Participants were included in the study if they met DSM-IV (American Psychiatric Association, 1994) lifetime criteria for alcohol, marijuana, or stimulant dependence, had recent (prior 3 months) alcohol or other drug use, and endorsed the goal of future abstinence. Men and women were excluded if they (a) lived too far from the medical center (50 miles) to reasonably complete follow-up procedures; (b) had no post-treatment contact information (i.e., homeless unless provision was made for residing in a recovery home upon discharge, planned to leave the area prior to one year following treatment); (c) had memory difficulties that would impair accurate recall; or (d) met criteria for current opiate dependence with intravenous administration. Participants agreed to: (a) monthly telephone interviews (months 1, 2, 4, and 5) and in person interviews 3, 6, 9, and 12 months following treatment, (b) random toxicology screen at interviews, and (c) collateral contact with a person he/she lived with or had regular contact with to verify information and substance use.

A total of 264 veterans met study criteria and of these, 30 (11.4%) were dropped from the study prior to completion of the intake assessment. Dropped participants were individuals who left the treatment program early against medical advice (3.0%), were discharged from an inpatient treatment program due to evidence of intoxication (1.1%), or consented to participate but later refused/withdrew consent prior to completion of the intake assessment (7.2%). The dropout rates and demographic characteristics of our sample are representative of veterans treated in these programs (e.g.,Granholm, Anthenelli, Monteiro, Sevcik, & Stoler, 2003; Smith, Volpe, Hashima, & Schuckit, 1999).

Of the 234 participants who completed the intake assessment, ten participants did not provide any follow-up interview information (3 refused, 4 lost to follow-up, 3 deceased), resulting in a total sample of 224 participants. This study focused on the portion of the sample (67.9%; $n=152$) who used alcohol or drugs on at least one occasion in the year following treatment. Twenty-seven of these participants were excluded from analyses due to incomplete ($n=22$) or inconsistent follow-up information (5 with discrepancies between participant self-report and verification), yielding a final sample of 125 participants. The majority of the participants were male (90.6%), Caucasian (61.9%), and not currently married (83.5%). Participants in this sample who resumed substance use did not differ from those who remained abstinent on gender, age, ethnicity, marital status, or comorbidity status (SUD-only versus SUD–PSY. Demographics, substance use, and mental health diagnoses for the study sample are presented in Table 1.

2.2. Procedures

While receiving treatment (approximately two weeks after last alcohol or drug use), eligible and consenting patients completed a series of structured interviews to assess sociodemographic characteristics, lifetime and current alcohol and other drug involvement and diagnoses, and non-substance psychiatric diagnoses. Participants were then contacted by phone at 1, 2, 4, and 5 months posttreatment to assess current drinking and substance use. In person follow-up interviews at 3, 6, 9 and 12 months posttreatment assessed in detail quantity and frequency of alcohol and drug use and more detailed information regarding contextual features and symptoms associated with initial substance use episodes (see Contextual Cue Assessment description). Participants received $30 for each quarterly follow-up interview. A separate interviewer independently assessed the collateral contact identified by the participant to confirm background information and obtain data regarding the participant's recent use of alcohol or other substances.

Table 1
Participant demographics and diagnostic characteristics for substance abusers with and without concomitant mental health diagnoses ($N=125$)

	SUD-only ($n=65$)	SUD–PSY ($n=60$)
Gender (% male)	96.9%	90.0%
Mean age (years)	43.8	44.9
(SD)	(9.6)	(7.5)
Marital status		
Married	18.5%	18.3%
Divorced, widowed, or separated	49.2%	63.4%
Never married	32.3%	18.3%
Education (years)	13.3	12.8
(SD)	(2.0)	(1.9)
Currently employed	15.4%	10.0%
Ethnicity		
Caucasian	70.8%	49.2%
Hispanic	3.1%	20.3%
African-American	20.0%	27.1%
Others	6.1%	3.4%
Alcohol dependence	83.1%	93.2%
Alcohol abuse	3.1%	0
Cannabis dependence	13.8%	18.3%
Cannabis abuse	6.2%	8.3%
Stimulant dependence	43.1%	30.0%
Stimulant abuse	1.5%	1.7%
Depressive disorders		33.3%
Bipolar disorder		10.0%
Posttraumatic stress disorder		53.3%
Other anxiety disorders		6.7%
Schizophrenia, schizoaffective disorder		15.0%

SUD-only=Substance Use Disorders without any concomitant non-substance related Axis I disorder; SUD–PSY=Substance Use Disorders with one or more concomitant non-substance related Axis I disorder(s). SUD-only and SUD–PSY groups did not statistically differ on any demographic variables or substance diagnoses.

2.3. Measures

2.3.1. Semi Structured Assessment for the Genetics of Alcoholism, lifetime version (SSAGA)

This comprehensive psychiatric interview was developed by the Collaborative Study on the Genetics of Alcoholism (COGA) to assess alcohol and drug abuse/dependence and other mental health disorders and has demonstrated good psychometric properties (Bucholz et al., 1994; Hesselbrock, Easton, Bucholz, Schuckit & Hesselbrock, 1999). The SSAGA was developed to assess both substance induced and substance independent symptoms, providing for accurate assessment of mental health disorders independent of substance use. In the current study, participants were classified as comorbid only if they met criteria for a non-substance related Axis I mental health disorder that was not solely substance induced (e.g., lifetime diagnosis during abstinence periods with current symptoms at intake, current diagnosis not explained by substance use). The SSAGA was administered at the intake interview to establish lifetime and current DSM-IV diagnoses and to provide demographics. All information obtained

from the SSAGA was reviewed with a clinical psychologist, blind to recruitment setting, who confirmed DSM-IV Axis I diagnoses.

2.3.2. Contextual cue assessment

Detailed descriptions of initial posttreatment substance use episodes were obtained using the Contextual Cue Assessment (Marlatt & Gordon, 1985) with modifications in response to subsequent research providing for identification of multiple precursors of substance use (e.g., Heather, Stallard, & Tebbutt, 1991; Longabaugh, Rubin, Stout, Zywiak, & Lowman, 1996). To ascertain participant commitment to stopping substance use and clearly distinguish between on-going substance use and a "relapse" episode, we designated a minimum 30 day period of abstinence from all substance use prior to assessment of the contextual features of a posttreatment substance use episode. As previously noted, seven participants were excluded due to lack of contextual data (two participants who did not meet the "abstinence window" criteria, never attaining 30 days of abstinence, were not assessed, and five participants denied substance use that was reported by the collateral interview).

Open-ended descriptions of initial substance use episodes were first elicited from participants, followed by a structured interview that included information regarding the type, number and sequence of substances used, contextual features (e.g., location, time of day, duration) of use episode, and 12 psychiatric symptoms. The presence/absence and severity of each psychiatric symptom was assessed for periods immediately before, immediately after, two weeks before, and two weeks after initial substance use. Participants rated the severity of symptoms on a 5 point scale (1 = a lot less severe, 3 = usual amount, 5 = a lot more severe). Based on these self-reported ratings, participants were classified for each symptom as: 1) never having the symptom (before or after relapse), 2) having the symptom and reporting improvement after relapse, 3) having the symptom and reporting no change in severity after relapse, and 4) reporting symptom onset or an increase in severity after relapse. In addition to self-report ratings of symptom severity, interviewers provided a global rating of short term (immediately after relapse) and long term (two weeks after relapse) symptom change ranging from 1 = major decrease to 100 = major increase. Interviewer global ratings were assigned based on participant's verbal descriptions in the symptom assessment as well as to a semi-structured portion of the contextual cue assessment describing emotional states, social contexts, life stress, conflicts, and substance related factors (e.g., urges, cravings, trivializing use, testing abstinence).

Three rationally derived psychiatric symptom domains were created for Depression (depressed mood, sleep difficulties, appetite/somatic complaints, and memory/concentration problems), Anxiety (anxious mood, irritability, fear/avoidance, and repetitive thoughts/behaviors) and Psychotic Symptoms (hallucinations, flashbacks, psychotic cognitions, and paranoia). Confirmatory factor analyses of dichotomous symptom domains were conducted using MPlus (Muthén & Muthén, 2002). The three-factor model demonstrated good fit to the data (χ^2 (20, N = 125) = 388.40, CFI = .96, TLI = .96). Summed composites were created for each symptom domain (range: 0–4) and for total symptoms (range: 0–12).

3. Results

3.1. Characteristics of use episodes

Table 2 presents the type of substances used during the initial post-treatment use episode, as well as the first substance used. For both SUD-only and SUD–PSY groups, alcohol was the most frequently

Table 2
Relapse characteristics for adults who use within one year following treatment

	SUD–PSY (%)	SUD-only (%)
Substance used in relapse		
Alcohol	80.0	87.7
Marijuana	20.0	7.7
Cocaine	6.7	6.2
Stimulants	3.3	15.4
Opiates	1.7	0
Others	1.7	0
First substance used		
Alcohol	76.7	80.0
Marijuana	13.3	3.1
Cocaine	5.0	6.2
Stimulants	1.7	10.8
Opiates	1.7	0
Others	1.7	0
DOC used	81.7	76.9

used substance during the first post-treatment use episode. The first substance used variable and type of substance used variable were collapsed into two categories (alcohol versus drugs) for all subsequent analyses due to the low base rate and variation in drug type used in the sample. The majority of patients in both groups used only one substance during relapse (SUD–PSY: 83.1%; SUD-only: 88.3%), and it tended to be their drug of choice (DOC). Groups did not differ in the use of alcohol versus drugs, the number of substances used, nor whether DOC was used in the relapse.

Within the comorbid group, an examination of the influence of lifetime psychiatric diagnosis (depression, bipolar, schizophrenia and PTSD) on type(s) of substances used indicated no significant differences between diagnostic groups on use of DOC, the type of substance used (alcohol versus drugs), or the first substance used during relapse.

3.2. Psychiatric symptoms prior to first use episode

Table 3 lists the percentage of adults reporting the presence of each type of psychiatric symptom prior to relapse. As predicted, the SUD–PSY group reported significantly higher levels of symptoms in all three symptom domains (depression, anxiety or psychotic symptoms; F values ranged from 15.67 to 63.55, all p values less than .005) and all 12 psychiatric symptoms prior to relapse than the SUD-only group (χ^2 values ranged from 7.94 to 9.26, all p values $<.005$)[1]. Of note, the relative prevalence of these symptom domains and pattern of individual symptoms were the same for both groups; the depression symptoms were the most frequently reported symptom domain and depressed mood, anxious mood and irritability were the most frequently reported individual psychiatric symptoms in both groups.

Mean symptom counts indicated that SUD–PSY patients averaged more than five symptoms prior to relapse ($M=5.58$, $SD=2.60$) compared to more than two ($M=2.62$, $SD=1.44$) for the SUD-only group

[1] Due to the infrequency of psychotic symptoms within the SUD–PSY group, chi-square analyses were not conducted to examine group differences on the prevalence of psychotic symptoms prior to relapse.

Table 3
Mental health symptoms prevalence before relapse and change after relapse in comorbid (SUD–PSY) and SUD-only groups

Symptom	Prevalence	Immediately after			Two weeks after		
		Worse	Better	No change	Worse	Better	No change
SUD–PSY group							
Depression	93*						
Depressed mood	83*	25	0	75	30	0	70
Sleep difficulties	65*	23	0	77	23	0	77
Appetite/somatic	45*	15	0	85	23	0	77
Memory/concentration	62*	33	0	67	18	0	82
Anxiety	97*						
Anxious mood	82*	15	0	85	32	0	68
Irritability	85*	18	0	82	18	0	82*
Fear/avoidance	27*	17	0	83	15	0	85
Repetitive thoughts	28*	7	0	93	7	0	93
Psychotic	47^						
Hallucinations/delusions	18	5	0	95	8	0	92
Flashbacks	27	10	0	90	13	0	87
Psychotic cognitions	13	8	0	92	12	0	88
Paranoia	23	8	0	92	15	0	85
Global rating		63	28	6	72	12	17
SUD–only group							
Depression	75*						
Depressed mood	59*	40	0	60	40	0	60
Sleep difficulties	32*	23	2	75	22	0	79
Appetite/somatic	23*	22	0	79	17	0	83
Memory/concentration	17*	19	0	82	15	0	85
Anxiety	82*						
Anxious mood	59*	11	5	85	15	2	83
Irritability	62*	31	0	69	35	0	65*
Fear/avoidance	5*	6	0	94	8	0	92
Repetitive thoughts	3*	0	2	99	2	0	99
Psychotic	3^						
Hallucinations/delusions	0	0	0	100	0	0	100
Flashbacks	2	2	0	99	0	0	100
Psychotic cognitions	0	0	0	100	0	0	100
Paranoia	2	2	0	99	2	0	99
Global rating		62	20	19	65	8	28

Values are percentages of the group sample reporting each symptom (Prevalence), and those reporting an increase (Worse), decrease (Better), or no change in symptom severity either immediately after (Short Term) or in the two weeks after (Longer Term) relapse. Data for specific symptoms are based on self-report ratings. Global ratings are from interviewer ratings. Values are rounded to the nearest whole percent. *Significant difference between SUD–PSY and SUD-only group (χ^2 difference test; $p < .05$). ^ Due to the infrequency of these symptoms within the SUD-only group, chi-square analyses were not conducted.

($t(1,123) = 7.97$, $p < .0001$). In both groups, depressive and anxiety symptoms were more frequent than psychotic symptoms.

In addition to self-report ratings, interviewer ratings of symptoms were examined. Compared to the SUD-only group, the SUD–PSY group symptoms were rated as more severe both immediately before

(SUD–PSY: $M=75.92$, $SD=21.51$; SUD-only: $M=63.54$, $SD=16.84$; $t(1,122)=3.59$; $p<.0001$) and two weeks before (SUD–PSY: $M=75.25$, $SD=14.58$; SUD-only: $M=63.38$, $SD=13.25$; $t(1,123)=5.17$; $p<.0001$) the use episode.

Within the SUD–PSY group, the relation of lifetime diagnosis and symptom domains as well as individual psychiatric symptoms prior to the use episode was examined. The diagnosis of depression or PTSD was associated with fewer hallucinations (depression: $F[1,59]=4.97$, $p<.05$; PTSD: $F[1,59]=6.50$, $p<.01$). Patients with schizophrenia were more likely to report repetitive thoughts ($F[1,59]=5.63$, $p<.05$), hallucinations ($F[1,59]=56.08$, $p<.0001$), psychotic cognitions ($F[1,59]=12.65$, $p<.001$) and paranoia ($F[1,59]=8.82$, $p<.005$) than those without schizophrenia.

3.3. Pre-relapse psychiatric symptoms, psychiatric diagnosis and substance choice

We tested the SMH by examining the associations between the symptom counts reported before relapse in the depression, anxiety, and psychotic symptom domains and the characteristics of the substance(s) used in the relapse. ANOVAs were used to determine whether symptom counts in each psychiatric domain differed by comorbid status, use of DOC, and first substance used (alcohol vs. drug). DOC use was related to psychotic symptom counts ($F[1,125]=4.19$, $p<.05$) such that individuals using DOC were more likely to experience these symptoms. Neither comorbid status nor the first substance used was significantly related to pre-relapse symptom counts. Logistic regression analyses were then used to test whether psychiatric domain symptom counts predicted any alcohol versus drug use during relapse for each group. In neither group did pre-relapse symptoms relate to the substance used during the first use post-treatment use episode.

3.4. Change in psychiatric symptoms after use episode

Table 3 presents the percentage of participants in each group with increases (Worse), decreases (Better) or no change in the severity of individual symptoms following any substance use after treatment.[2] Interviewer ratings of global functioning suggest that immediately after the use episode over one-quarter (28%) of SUD–PSY participants displayed improvement and almost two-thirds (63%) displayed a worsening in psychiatric symptoms. In the two weeks following relapse the patients showing symptom improvement decreased to 12% and those demonstrating symptom exacerbation increased to 72%. In contrast to interviewer ratings, none of the SUD–PSY participants self-reported psychiatric symptom improvement after use. The vast majority of SUD–PSY adults stated that their symptoms were unchanged after the use episode, while a smaller percentage (range 7% to 33%) indicated a worsening of specific symptoms.

Interviewer ratings of global functioning show that one-fifth of SUD-only patients were seen to improve immediately after use while the majority (62%) were perceived to have had a worsening of their psychiatric symptoms. In the two weeks following relapse the proportion showing improvement decreased to 8%, while the proportion whose symptoms worsened stayed the same. Self-reports of SUD-only adults indicated 2% to 5% had a few symptoms improve, 2% to 40% experienced exacerbation of

[2] In cases where participants indicated symptoms getting better, getting worse or staying the same, analyses had a $df=2$. However, in the analyses reported above, participants only reported symptoms getting worse or staying the same resulting in a chi-square $df=1$.

symptoms, and the majority reported no change in symptoms immediately following relapse. Long-term self-report ratings (2 weeks after use) follow a similar pattern.

The impact of substance relapse on psychiatric symptom domains and specific symptoms was compared between groups. SUD–PSY adults reported more exacerbation of symptoms in the psychotic domain, both short and long term, than the SUD-only group (short term: $F[1,124]=8.18$, $p<.005$; long term: $F[1,124]=19.05$, $p<.0001$). Specifically, the SUD–PSY group reported long-term worsening of hallucinations ($\chi^2[1,N=125]=5.64$, $p<.05$), flashbacks ($\chi^2[1,N=125]=9.26$, $p<.01$), psychotic cognitions ($\chi^2[1,N=125]=8.03$, $p<.01$) and paranoia ($\chi^2[1,N=125]=7.68$, $p<.01$). Ratings of long-term irritability were worse for the SUD-only group ($\chi^2[1,N=125]=4.58$, $p<.05$). Interviewer ratings of global change in functioning were not significantly different between groups.

For the SUD–PSY group, the influence of lifetime psychiatric diagnosis (depression, bipolar, schizophrenia and PTSD) on symptom change post-use was examined. Bipolar disorder was related to exacerbation of post relapse depression over the short-($F[1,59]=4.99$, $p<.05$) and long-term ($F[1,59]=7.09$, $p<.01$). Similarly, this diagnosis was related to worsening of the anxiety domain in the short-($F[1,59]=4.87$, $p<.05$) and long-term ($F[1,59]=5.24$, $p<.05$). Schizophrenia predicted increased psychotic symptoms in both the short-($F[1,59]=10.01$, $p<.01$) and long-term ($F[1,59]=17.04$, $p<.001$) following relapse. No psychiatric diagnosis was related to symptom improvement at either post relapse time point.

Logistic regression analyses were conducted to assess whether changes in symptom severity were related to substance characteristics (alcohol vs. drug use, substance first used, and DOC use) using interviewer global severity ratings. There was no evidence of self-medication or rebound effects for either group: substances used were not predictive of improvement or exacerbation in psychiatric symptom severity.

4. Discussion

The present study examined reciprocal relationships between Axis I psychopathology, psychiatric symptomatology, and substance use relapse in a treated adult substance use disordered (SUD) sample with and without comorbid Axis I psychopathology. Not surprisingly, SUD individuals with comorbid Axis I disorders exhibited greater psychiatric symptomatology prior to relapse compared to SUD individuals without concomitant psychopathology. Although these findings confirm what would be expected by diagnostic status, we checked this assumption because symptoms may resolve as a result of interventions received (e.g., pharmacotherapy, psychotherapy). Consistent with other research with adults (Litman et al., 1979; Miller et al., 1996; Strowig, 2000; Svanum & McAdoo, 1989) and adolescents (McCarthy, Tomlinson, Anderson, Brown, & Marlatt, 2005), depression was the most commonly reported symptom domain and depressed mood, anxious mood, irritability, and sleep difficulties were the most common specific symptoms prior to substance use relapse after treatment.

Modest support was found for the first hypothesis, that the types of psychiatric symptoms endorsed prior to relapse would vary as a function of Axis I diagnosis in the comorbid group. Although comorbid subjects in all diagnostic groups reported more depression and anxiety symptoms than psychotic symptoms, patients with schizophrenia were more likely to report psychotic symptomatology (i.e., hallucinations, psychotic cognitions, paranoia) than patients with depression or PTSD.

The current study found support for the rebound hypothesis (Blume et al., 2000). Specifically, interviewer ratings indicated that psychiatric symptoms typically worsened following alcohol or

drug relapse with approximately two-thirds of participants experiencing a worsening of their symptoms immediately and in the two weeks after relapse. Depression symptoms were reported to worsen more than anxiety or psychotic symptoms by all participants. Since the majority of the current sample relapsed on alcohol, this finding is consistent with Hodgins et al. (1999) study on alcoholics which found alcohol relapse to predict the onset of a depressive episode. It is possible that substance abusers attempting to abstain will almost always experience depression following relapse associated with feelings of failure or guilt. In our study, a minority of participants reported no change in their symptoms following relapse, and notably, almost no one in either group reported an improvement in symptoms following relapse.

There were noteworthy differences in post-relapse symptoms between individuals in the comorbid group. Comorbid adults were more likely to experience post-relapse exacerbation in symptoms that were related to their specific lifetime diagnosis. Individuals with bipolar disorder had more depression and anxiety exacerbation after relapse, and those with schizophrenia experienced more exacerbation in psychotic symptoms. Of note, it was possible that bipolar individuals were entering a manic phase and this precipitated the relapse as well as the exacerbation of symptomatology after the relapse episode. In order to explore this possible explanation for the relationship between relapse and change in symptom severity in bipolar participants, change scores from the month before the relapse on state measures of depression and anxiety were examined for extreme fluctuations in mood and affect prior to relapse. No evidence was found to indicate that bipolar individuals were entering a manic phase before their relapse.

The analyses examining the self-medication hypothesis (SMH) found mixed results. According to the self-medication hypothesis (Khantzian, 1985), 1) individuals will use specific types of substances in an attempt to alleviate psychiatric symptomatology, and 2) symptomatology should improve following substance use. Consistent with the first part of the theory, the majority of participants in both diagnostic groups reported experiencing significant psychiatric symptoms prior to their relapse. There was no evidence that the type of substance used in the relapse (alcohol versus drugs) was related to specific psychiatric symptoms prior to the relapse episode. However, we were limited in our ability to examine whether specific substance types were associated with preceding psychiatric symptoms by our sample's substance use characteristics. Because of low base rates, we collapsed cross drug types (cocaine, amphetamines, marijuana, opiates), dichotomizing alcohol versus other drug use, and this likely does not provide an optimal test of the self-medication hypothesis. Despite this limitation, we did find that the majority of individuals (~80%) in both groups used their drug of choice in the initial relapse episode. It is possible that SUD adults narrow their selection of a drug of choice based at least in part on their personal history of symptoms and experiences with a variety of substances. The current data suggest that the second part of the theory (symptomatology will improve following substance use) fits only a small minority of SUD participants. As previously noted, very few participants reported improvement in symptoms either immediately after or in the two weeks following relapse. In contrast, approximately 25% of the sample was rated by interviewers as improving in overall global functioning immediately after relapsing. The interviewer ratings are consistent with findings in SUD adolescents with comorbid psychiatric disorders in which approximately 1/5 of youth were evaluated as experiencing an improvement in symptomatology after relapse (McCarthy et al., 2005). Discrepancies between self-report and interviewer evaluation of symptomatology have also been noted in prior research conducted on similar populations, documenting that patients tend to report no change in severity over time (Weber, 1996). We caution readers that perceived self-medication benefits associated with substance use may occur only *during* substance use, and the timeframe selected for assessment of symptoms (immediately

after substance use) does not fit well with the positive effects experienced *during* intoxication rather than after. Therefore, our study is preliminary and cannot be considered a definitive test of the self-medication hypothesis. Additionally, bias may be introduced by the retrospective nature of the assessments.

This is the first study to examine psychiatric symptom severity following a relapse in SUD adults with and without comorbid psychiatric disorders, and it provides valuable evidence about the nature of the interaction between relapse and psychopathology. Although SUD participants with concomitant psychiatric diagnoses reported a larger number of mental health symptoms prior to substance relapse than SUD-only participants, substance relapse appears to similarly exacerbate depression, anxiety, or psychotic symptoms for those with and without an additional Axis I diagnosis.

There are several limitations to the current study. First, the sample only includes individuals who relapsed to examine changes in psychiatric symptomatology after a return to substance use. In future studies it would be useful to include SUD–PSY and SUD-only adults who do not relapse to assess possible differences in the type or amount of symptoms reported. Given the fluctuating clinical course of many mental health disorders, repeated assessment of psychiatric symptoms over time prior to relapse would be beneficial in clarifying whether comorbid adults consistently report more symptoms than SUD-only adults and whether the patterns of change in symptoms prior to substance use episodes are similar for the two groups.

In order to more directly test whether the motivation to self-medicate psychiatric symptomatology with psychoactive substances is a factor in participants' relapse after treatment, it is important to assess expectations of symptom change due to use of alcohol or drugs. Additionally, since the intoxication and withdrawal effects of different types of substances of abuse are associated with different symptomatology (e.g., alcohol withdrawal may induce anxiety; cocaine withdrawal may induce depressed mood), it is important to test whether exacerbation of symptoms varies by type of substance used during relapse. Unfortunately, due to modest sample size, the use of alcohol by the majority of participants, and the use of multiple substances during relapse by a portion of the sample, it was impossible to separate groups by the type of substance used during relapse. Finally, the under-representation of women in the current veteran sample restricts the ability to generalize these findings to a more diverse population.

The present study demonstrated that in SUD populations, psychiatric symptomatology (e.g., depression, anxiety, psychotic cognitions) is a common problem after treatment for an SUD, whether or not diagnostic criteria for a comorbid mental health disorder is met. Furthermore, current findings provide evidence that salient psychiatric symptoms experienced immediately prior to relapse are altered in their severity after the relapse. In a minority of subjects, symptomatology was considered to be somewhat ameliorated immediately post-relapse; these individuals may have benefited from medicating effects of the ingested psychotropic substance. However, a larger portion of the sample experienced an exacerbation in psychiatric symptomatology after relapse with alcohol or other drugs, and this exacerbation in symptom severity persisted over the two weeks following the use episode. This finding supports the rebound relationship hypothesis which posits that the use of alcohol and other drugs are more likely to cause, and unlikely to improve, significant problems in the life of an individual with an SUD. Ensuing substance use-related problems may increase negative cognitive states including guilt and self-blame and decrease self-efficacy to deal with life's stressors, all of which may both aggravate related psychiatric symptomatology and increase the risk for continued substance involvement after the initial relapse episode (Brown & Ramo, 2004).

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

Blume, A. W., Schmaling, K. B., & Marlatt, G. A. (2000). Revisiting the self-medication hypothesis from a behavioral perspective. *Cognitive and Behavioral Practice*, *7*(4), 379–384.

Brown, S. A. (1985). Reinforcement expectancies and alcoholism treatment outcome after a one-year follow-up. *Journal of Studies on Alcohol*, *46*(4), 304–308.

Brown, S. A., & Schuckit, M. A. (1988). Changes in depression among abstinent alcoholics. *Journal of Studies on Alcohol*, *49*(5), 412–417.

Brown, S. A., & Ramo, D. E. (2004). Clinical course of youth following treatment for alcohol and drug problems. In H. Liddle, & C. Rowe (Eds.), *Treating Adolescent Substance Abuse: State of the Science*. Cambridge, UK: Cambridge University Press.

Bucholz, K. K., Cadoret, R., Cloninger, C. R., Dinwiddie, S. H., Hesselbrock, V. M., Numberger, J. I., et al. (1994). A new, semi-structured psychiatric interview for use in genetic linkage studies: A report on the reliability of the SSAGA. *Journal of Studies on Alcohol*, *55*, 149–158.

Connors, G. J., Maisto, S. A., & Zywiak, W. H. (1996). Understanding relapse in the broader context of post-treatment functioning. *Addiction*, *91*, S173–S189.

Cuffel, B.J, & Chase, P. (1994). Remission and relapse of substance use disorders in schizophrenia: Results from a one-year prospective study. *Journal of Nervous and Mental Disease*, *182*(6), 342–348.

Curran, G. M., Flynn, H. A., Kirchner, J., & Booth, B. M. (2000). Depression after alcohol treatment as a risk factor for relapse among male veterans. *Journal of Substance Abuse Treatment*, *19*(3), 259–265.

Granholm, E., Anthenelli, R., Monteiro, R., Sevcik, J., & Stoler, M. (2003). Brief integrated outpatient dual-diagnosis treatment reduces psychiatric hospitalizations. *American Journal of Addictions*, *12*(4), 306–313.

Greene, R. L., Adyanthaya, A. E., Morse, R. M., & Davis, L. J., Jr. (1993). Personality variables in cocaine-and marijuana-dependent patients. *Journal of Personality Assessment*, *61*(2), 224–230.

Greenfield, S. F., Weiss, R. D., Muenz, L. R., Vagge, L. M., Kelly, J. F., Bello, L. R., et al. (1998). The effect of depression on return to drinking: A prospective study. *Archives of General Psychiatry*, *55*(3), 259–265.

Hall, S. M., Havassy, B. E., & Wasserman, D. A. (1990). Commitment to abstinence and acute stress in relapse to alcohol, opiates, and nicotine. *Journal of Consulting and Clinical Psychology*, *58*(2), 175–181.

Heather, N., Stallard, A., & Tebbutt, J. (1991). Importance of substance cues in relapse among heroin users: Comparison of two methods of investigation. *Addictive Behaviors*, *16*, 41–49.

Hesselbrock, M. N., Easton, C., Bucholz, K. K., Schuckit, M., & Hesselbrock, V. (1999). A validity study of the SSAGA: A comparison with the SCAN. *Addiction*, *94*, 1361–1370.

Hodgins, D. C., el-Guebaly, N., & Armstrong, S. (1995). Prospective and retrospective reports of mood states before relapse to substance use. *Journal of Consulting and Clinical Psychology*, *63*(3), 400–407.

Hodgins, D. C., el-Guebaly, N., Armstrong, S., & Dufour, M. (1999). Implications of depression on outcome from alcohol dependence: A 3-year prospective follow-up. *Alcoholism, Clinical and Experimental Research*, *23*(1), 151–157.

Hunt, G. E., Bergen, J., & Bashir, M. (2002). Medication compliance and comorbid substance abuse in schizophrenia: Impact on community survival 4 years after a relapse. *Schizophrenia Research*, *54*(3), 253–264.

Khantzian, E. J. (1985). The self-medication hypothesis of addictive disorders: Focus on heroin and cocaine dependence. *American Journal of Psychiatry*, *142*(11), 1259–1264.

Litman, G. K., Eiser, J. R., Rawson, N. S., & Oppenheim, A. N. (1979). Differences in relapse precipitants and coping behaviour between alcohol relapsers and survivors. *Behaviour Research and Therapy*, *17*(2), 89–94.

Longabaugh, R., Rubin, A., Stout, R. L., Zywiak, W. H., & Lowman, C. (1996). The reliability of Marlatt's taxonomy for classifying relapses. *Addiction*, *91*, S73–S88 (Supplement).

Marlatt, G. A., & Gordon, J. R. (Eds.). (1985). *Relapse Prevention: Maintenance Strategies in the Treatment of Addictive Behaviors*. New York: Guilford Press.

McCarthy, D.M., Tomlinson, K.L., Anderson, K.G., Marlatt, G.A., & Brown, S.A. (2005). Relapse in alcohol- and drug-disordered adolescents with comorbid psychopathology: Changes in psychiatric symptoms. *Psychology of Addictive Behaviors*, *19*(1), 28–34.

Miller, W. R., Westerberg, V. S., Harris, R. J., & Tonigan, J. S. (1996). What predicts relapse? Prospective testing of antecedent models. *Addiction, 9*, S155–S172.

Muthen, B. O., & Muthen, L. K. (2002). *Mplus user's guide* (second ed.). Los Angeles, CA: Muthen and Muthen.

Riehman, K. S., Iguchi, M. Y., & Anglin, M. D. (2002). Depressive symptoms among amphetamine and cocaine users before and after substance abuse treatment. *Psychology of Addictive Behaviors, 16*(4), 333–337.

Schinka, J. A., Curtiss, G., & Mulloy, J. M. (1994). Personality variables and self-medication in substance abuse. *Journal of Personality Assessment, 63*(3), 413–422.

Sellman, J. D., & Joyce, P. R. (1996). Does depression predict relapse in the 6 months following treatment for men with alcohol dependence? *Australian and New Zealand Journal of Psychiatry, 30*(5), 573–578.

Smith, T. L., Volpe, F. R., Hashima, J. N., & Schuckit, M. A. (1999). Impact of a stimulant-focused enhanced program on the outcome of alcohol-and/or stimulant-dependent men. *Alcoholism, Clinical and Experimental Research, 23*, 1772–1779.

Strowig, A. B. (2000). Relapse determinants reported by men treated for alcohol addiction: The prominence of depressed mood. *Journal of Substance Abuse Treatment, 19*(4), 469–474.

Svanum, S., & McAdoo, W. G. (1989). Predicting rapid relapse following treatment for chemical dependence: A matched-subjects design. *Journal of Consulting and Clinical Psychology, 57*(2), 222–226.

Swofford, C. D., Kasckow, J. W., Scheller-Gilkey, G., & Inderbitzin, L. B. (1996). Substance use: A powerful predictor of relapse in schizophrenia. *Schizophrenia Research, 20*(1–2), 145–151.

Tate, S. R., Brown, S. A., Unrod, M., & Ramo, D. E. (2004). Context of relapse for substance-dependent adults with and without comorbid psychiatric disorders. *Addictive Behaviors, 29*, 1707–1724.

Tempesta, E., Janiri, L., Bignamini, A., Chabac, S., & Potgieter, A. (2000). Acamprosate and relapse prevention in the treatment of alcohol dependence: A placebo-controlled study. *Alcohol and Alcoholism, 35*(2), 202–209.

Thomas, V. H., Melchert, T. P., & Banken, J. A. (1999). Substance dependence and personality disorders: Comorbidity and treatment outcome in an inpatient treatment population. *Journal of Studies on Alcohol, 60*(2), 271–277.

Tomasson, K., & Vaglum, P. (1998). The role of psychiatric comorbidity in the prediction of readmission for detoxification. *Comprehensive Psychiatry, 39*(3), 129–136.

Weber, K. (1996). Patient–clinician differences in depression symptom ratings. *Dissertation Abstracts International. B. The Sciences and Engineering, 57*(6-B), 4046.

Weiss, R. D., Griffin, M. L., & Mirin, S. M. (1992). Drug abuse and self-medication for depression: An empirical study. *American Journal of Drug and Alcohol Abuse, 18*(2), 121–129.

Willinger, U., Lenzinger, E., Hornik, K., Fischer, G., Schoenbeck, G., Aschauer, H. N., et al. (2002). Anxiety as a predictor of relapse in detoxified alcohol-dependent patients. *Alcohol and Alcoholism, 37*(6), 609–612.

Chapter 5, in full, is a reprint of the material as it appears in An examination of self-medication and rebound effects: Psychiatric symptomatology before and after alcohol or drug use relapse. *Addictive Behaviors*, 31, 461-474. Tomlinson, K.L., Tate, S.R., Anderson, K.G., McCarthy, D.M., & Brown, S.A. (2006). The dissertation author was the primary investigator and author of this paper.

GENERAL DISCUSSION

This body of work examined the relationship between anxiety and alcohol and drug involvement in populations with varying levels of experiences with and problems related to substance use. Our findings underscore the fact that anxiety has the potential to influence onset of alcohol use, early drinking behavior, and treatment outcomes in individuals with substance use disorders. However, the nature of the relationship between anxiety and substance involvement varies depending on a number of factors in addition to level of experience with alcohol and drugs. For example, we found sex differences in the association between social anxiety and risk for early onset of drinking. Additionally, developmental processes may have influenced differences in the way adolescents and adults perceived changes in anxiety symptoms after relapse. Furthermore, our studies support research indicating that although they are both forms of "negative affect", anxiety and depression symptoms may play unique roles in alcohol and drug use (e.g., Bekman, Cummins, & Brown, 2010).

We chose to focus on the impact of social anxiety on the initiation of alcohol use and drinking patterns in an early adolescent community sample. Social anxiety increases in early adolescence (Vernberg, Abwender, Ewell, & Beery, 1992; Inderbitzen, Walters, & Bukowski, 1997), and it is during this developmental period that many early adolescents also experiment with alcohol use, with approximately 40% of 8th graders reporting lifetime use in a national

survey (Johnston, O'Malley, Bachman, & Schulenberg, 2008). In chapter 1 we found that high levels of fear of negative evaluation predicted drinking. This parallels findings from studies of college students and adults (Lewis & O'Neill, 2000; Stewart, Morris, Mellings, & Komar, 2006). However, experiencing at least some social avoidance and distress in new situations protected girls from starting to drink. Our study was the first to examine the relationship between specific types of social anxiety and drinking onset, and we were able to distinguish between social anxiety symptoms that increase risk for drinking and those that protect against early onset alcohol use.

In our next study we explored the relationship between social anxiety, alcohol expectancies, and drinking behavior and compared this association to that between depression and drinking in early adolescents. We found that depression and alcohol expectancies both predicted more frequent, heavier drinking, while social anxiety predicted less frequent, lighter drinking. Moreover, social anxiety moderated the relationship between expectancies and alcohol use, such that as social anxiety increased, the correlation between alcohol expectancies and drinking behavior decreased. This suggests that among socially anxious youth, alcohol-related cognitions do not yet correspond to actual drinking behavior. This may be due to less frequent drinking in contexts during which social learning occurs. This notion was supported by the findings that social anxiety predicted less frequent drinking at parties, and there was a trend toward lower rates of drinking with members of the opposite sex, but social anxiety was not

significantly associated with drinking in isolation. We concluded that social anxiety may buffer against social drinking in early adolescence simply because these youth were more likely to be absent from the social situation. Future studies should collect information about the extracurricular social lives of socially anxious youth to determine whether social isolation/avoidance fully mediates the relationship between social anxiety and drinking behavior in early adolescents.

Chapters 3 and 4 examined alcohol and drug use relapse characteristics in an adolescent substance use disordered treatment sample. In chapter 3 we compared the six month treatment outcomes of substance use disordered youth with and without comorbid Axis I psychiatric diagnoses. Psychiatric comorbidity was associated with poorer outcomes, including more alcohol dependence and withdrawal symptoms even though the two groups drank comparable amounts in the six months following treatment. This is interesting to note, as it may indicate that having a comorbid mental health disorder can lead youth to experience or report more severe alcohol-related problems at lower levels than alcohol-abusing youth without a major mental health disorder. Unfortunately, due to the high rates of youth with more than one psychiatric disorder we were unable to test the specific impact of anxiety disorders on treatment outcomes. However, we were able find that adolescents with only internalizing disorders were less likely to relapse than youth with an externalizing disorder, which is consistent with other adolescent treatment outcome studies (e.g., Crowley, et al., 1998; Myers, Brown, & Mott, 1995). In order to investigate the role of anxiety disorders in adolescent

post-treatment outcomes future studies should collect information on a larger sample of comorbid youth with a variety of types of psychopathology.

In our fourth study we tested reciprocal relationships between anxiety, mood, and psychotic symptoms and substance use relapse. Our study was the first of its kind to directly test the self-medication hypothesis in a clinical sample of youth with comorbid substance use and psychiatric disorders. We found that depressed mood, sleep difficulties, anxious mood, and irritability were the most commonly reported symptoms prior to the first relapse after treatment. Anxiety symptoms were more likely reported to improve than worsen immediately after relapse and in the two weeks following the relapse episode, indicating support for the self-medication hypothesis. The use of "other drugs" (not alcohol, marijuana, or stimulants) was particularly associated with an improvement in anxiety symptoms. This is interesting to note, because the "other drug" category included benzodiazepines, which are anxiolytic drugs frequently abused by adolescents. In contrast, depression symptoms worsened in youth who relapsed with stimulants, which is consistent with the rebound effect that would be predicted by the pharmacology of these drugs (DSM-IV; American Psychiatric Association, 1994). As in chapter 2, we found differences in the way anxiety and depression symptoms related to substance use. The design of the present study did not allow us to compare symptom change across a similar time span that did not include relapse. A follow-up study that assessed symptom change over a period of time in

which relapse did not occur would further our understanding of how psychiatric symptoms are influenced by relapse and vice versa.

In the final chapter we replicated our study described in chapter 4 with adult veterans post-treatment for substance use disorders, with and without comorbid psychopathology. Many of the results of this study mirrored the findings of our study described in chapter 4. Depressed mood, anxious mood, and irritability were the most commonly reported symptoms in both studies, and depression symptoms were reported to worsen after relapse more often than anxiety symptoms. There were differences between the two studies as well. The majority of individuals in the adult sample relapsed on alcohol, while youth were equally likely to relapse on marijuana or alcohol. Unlike in the adolescent sample, almost no adults reported improvements in any psychiatric symptoms following relapse. A major difference between the adolescent and adult treatment samples is that the majority of adolescents were admitted into treatment by their caregiver, or in some instances by law enforcement and many were there against their will. In contrast, the majority of adults in the current study admitted themselves into treatment. It may be that adults attempting to abstain from substance use will almost always experience depression or anxiety following relapse that is associated with feelings of failure or guilt.

Within the adult sample, although the comorbid group reported more psychiatric symptoms and rated their symptoms as more severe, the relative rates of the types of symptoms did not differ between groups. The comorbid group had

a rate of individuals diagnosed with post traumatic stress disorder; however this diagnosis was not associated with elevated anxiety symptomatology before or after relapse compared to other types of psychopathology. In future studies it would be useful to include adults with a variety of anxiety disorders to compare self-medication and rebound effects across the anxiety spectrum.

In summary, our studies suggest that the relationship between anxiety and alcohol and drug use is complex and dependent on a number of factors including type of anxiety, developmental stage of the individual, level of experience with alcohol and drug use, sex of the individual, and the presence or absence of psychiatric comorbidity. Furthermore, the reciprocal relationship between anxiety and substance involvement is unique and should not be generalized to other types of negative affect, such as depression. Together, our findings provide a framework for the development of research that will further understanding of the anxiety-substance use relationship.

REFERENCES

American Psychiatric Association. (1994). *Diagnostic and statistical manual for mental disorders, 4th ed. (DSM-IV).* Washington, D.C.: American Psychiatric Association.

Bekman, N.M., Cummins, K., & Brown, S.A. (2010). Affective and personality risk and cognitive mediators of initial adolescent alcohol use. *Journal of Studies on Alcohol and Drugs, 71*, 570-580.

Crowley TJ, Mikulich SK, Macdonald M, Young SE, Zerbe GO. Substance-dependent, conduct- disordered adolescent males: severity of diagnosis predicts two-year outcome. *Drug and Alcohol Dependence*, 49, 225-237, 1998.

Inderbitzen, H. M., Walters, K. S., & Bukowski, A. L. (1997). The role of social anxiety in adolescent peer relations: Differences among sociometric status groups and rejected subgroups. *Journal of Clinical Child Psychology, 26*(4), 338-348.

Johnston, L.D., O'Malley, P.M., Bachman, J.G., & Schulenberg, J.E. (2008). *Monitoring the Future National Survey on Drug Use, 1975-2007. Volume I: Secondary School Students* (NIH Publication No. 08-6418A). Bethesda, MD: National Institute on Drug Abuse.

Lewis, B. & O'Neill, k. (2000). Alcohol expectancies and social deficits relating to problem drinking among college students. *Addictive Behaviors, 25*, 295-299.

Myers, M.G., Brown, S.A., Mott, M.A. (1995). Preadolescent conduct disorder behaviors predict relapse and progression of addiction for adolescent alcohol and drug abusers. *Alcoholism: Clinical and Experimental Research, 19*, 1528-36.

Stewart, S.H., Morris, E., Mellings, T., & Komar, J. (2006). Relations of social anxiety variables to drinking motives, drinking quantity and frequency, and alcohol-related problems in undergraduates. *Journal of Mental Health, 15*(6), 671-682.

Vernberg, E.M., Abwender, D.A., Ewell, K.K., & Beery, S.H. (1992). Social anxiety and peer relationships in early adolescence: a prospective analysis. *Journal of Clinical Child Psychology, 21*(2), 189-196.