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Adolescent co-occurring disorders: factors related to mental health problems among substance using adolescents

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ADOLESCENT CO-OCCURRING DISORDERS: FACTORS RELATED TO MENTAL HEALTH PROBLEMS AMONG SUBSTANCE USING ADOLESCENTS

by

Amanda Rose Reedy

An Abstract

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ABSTRACT

Substance use disorders (SUD) and mental health disorders are often thought of as completely separate problems even though these disorders commonly co-occur. Among adolescents who seek treatment for substance use problems, co-occurring mental health problems (MHP) are common. This is concerning because co-occurring disorders among adults have been associated with more severe MHPs, relapsing to substance use sooner, being less likely to maintain abstinence, and other problems. Despite the awareness that co-occurring disorders are problematic for adolescents, few studies have been conducted to understand these problems with an adolescent sample.

The purpose of this study was to understand if factors commonly related to co-occurring disorders among adults were the same for adolescents and to examine two measurement models for the dependent variable, substance use. This secondary analysis of data first examined characteristics that are related to MHPs among a sample of adolescents (N=801) who use substances. Factors in three domains were examined: demographics, substance use, social factors. The results indicated that among these adolescents, MHPs were common. Two key factors related to having a MHP were gender and the severity of the SUD. Females and adolescents with more severe SUDs, like dependence, were more likely to have MHPs. Furthermore, severity of the SUD partially mediated the relationship between several of the other factors and MHPs. The type of substance an adolescent reported using was also important. In addition, adolescents who had more peers and more family members who participated in deviant activities had more severe substance use problems and were more likely to have a MHP.

In addition to examining the factors related to mental health problems among a substance using population, this study modeled the dependent variable in two different ways which had not been done before and allowed for variance in the measure to be accounted for in the model. MHPs were measured both continuously and categorically.

The results of the comparison indicated that there were not major differences between the two models. Implications for social work practice, policy and research are discussed.

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Graduate College
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CERTIFICATE OF APPROVAL

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PH.D. THESIS

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CHAPTER 1: INTRODUCTION

History of Co-occurring Disorders

Co-occurring substance use disorders (SUD) and mental health disorders (MHD) among adults have been well documented. However, this remains a relatively new area of focus for research and practice. Practitioners first recognized co-occurring disorders in the late 1970s. In the 1980s and 1990s researchers began studying co-occurring disorders in treatment settings and found high rates of co-occurring disorders in both mental health and substance use disorder treatment settings.

Researchers first investigated the national prevalence of co-occurring disorders in 1990 in the Epidemiologic Catchment Area Study which involved 20,000 adults age 18 and over (Reiger et al., 1990). Their results suggested that co-occurring disorders were common. Using the Diagnostic and Statistical Manual III criteria, the researchers found that among adults with an alcohol related SUD, 37% had a co-occurring MHD. Among adults with a drug disorder, 53% had a co-occurring MHD. Later prevalence studies found similar results (Conway, Compton, Stinson, & Grant, 2006; Grant et al., 2004; Kessler et al., 1997; Kessler, Chiu, Demler, & Walters, 2005; Kessler et al., 2006). The more recent studies, such as the National Epidemiological Survey on Alcohol and Related Conditions (Conway et al., 2006; Grant et al., 2004) and the National Comorbidity Survey Replication (Kessler et al., 2005; Kessler et al., 2006), used the Diagnostic and Statistical Manual IV (DSM-IV) criteria for MHDs and SUDs and found a similar prevalence of co-occurring disorders in the general population.

The results of national prevalence studies have demonstrated that co-occurring disorders affect between 7 and 10 million adults (Kessler et al., 1997; Regier et al., 1990). According to a 2002 report from the Substance Abuse and Mental Health Services Administration (SAMHSA), adults who suffer from a SUD are almost three times more likely to have a MHD than those without a SUD. This is a concern because people who

suffer from co-occurring problems tend to have more severe mental health problems (MHPs), relapse sooner, may be less likely to maintain abstinence, experience more mental health hospitalizations, and may be at a greater risk of suicide (Bobo et al., 2004; Hall, Vaughan-Sarrazin, Reedy, & Huber 2008; Price, Risk, Haden, Lewis, & Spitznagel, 2004; Ritsher, Moos, & Finney, 2002).

Although knowledge has been developing on co-occurring disorders among adults, less is known about adolescents. Among the small number of studies completed, it is apparent that substance use and mental health disorders are prevalent in this younger population. Data from the 2007 Monitoring the Future study (Johnston, O'Malley, Bachman, & Schulenberg, 2008), which include annual interviews with 8th, 10th, and 12th graders, indicate that drug and alcohol use is prevalent among adolescents. Nearly one-half (46.8%) of 12th graders report having used illicit drugs, and a majority (72.2%) of adolescents in the study report having used alcohol by the 12th grade.

Among adolescents who seek treatment for substance use problems, co-occurring MHPs are common. Diamond and his colleagues (2006) found that among adolescent marijuana users in treatment, 72% reported two or more symptoms of a mental health disorder. Attention deficit hyperactivity disorder (ADHD) and conduct disorder problems were most common among this sample; however, depression and anxiety disorders were also frequently found among these adolescents. In a study of adolescents in outpatient substance use disorder treatment, Chan, Dennis, and Funk (2008) found that two-thirds of adolescents had a co-occurring disorder. While conduct disorder and ADHD were again the disorders that occurred most frequently, problems with depression and anxiety were also common. Further, older adolescents reported more problems with depression and anxiety and fewer problems with conduct disorder and ADHD than younger adolescents.

The prevalence of substance use and MHPs among adolescents is a concern because substance use in adolescence and young adulthood has been associated with

problems later in life. For example, Fergusson and Boden (2008) found that more frequent cannabis use at ages 14 to 21 was associated with various problems by age 25. These problems included lower levels of education, lower income, more unemployment, and lower levels of life and relationship satisfaction. Kandel and Chen (2000) found that adolescents who had early-onset heavy cannabis use were more likely to have a psychiatric problem. Similarly, Brook, Brook, Zhang, Cohen, and Whiteman (2002) found that early use of alcohol, marijuana, and other illicit drugs predicted major depressive disorder and SUDs when the participants were in their late 20s.

Substance use during adolescence has also been associated with changes in the brain. Researchers have identified that alcohol use and other illicit drug use during adolescence can affect brain development (Monti et al., 2005; Moore et al., 2007). In an article that combined information from a symposium on this topic, Monti and colleagues concluded that

> Many serious adult mental disorders have onset in childhood and are risk factors for heavy alcohol involvement…These same disorders also seem to be disorders of abnormal brain development, and the nature and the extent of alcohol's effects on the neurodevelopmental and clinical aspects of these disorders is clearly an extremely high priority for those who are interested in both adolescent alcohol use and severe mental illness (p.217).

These results suggest that substance use in childhood and adolescence may affect the way the brain develops. Further, these authors seem to be acknowledging the potential overlap of MHDs and substance use problems.

Despite the awareness that co-occurring disorders are problematic for adolescent development and well-being, little is known about the etiology of co-occurring mental health and substance use problems among adolescents. On one hand, experimentation with substance use by adolescents is considered a normal part of development (Canbor & Millman, 1996). On the other hand, substance use by adolescents may lead to problems with substance use and may be related to MHDs and to other problems. Why it becomes problematic only for some adolescents in not understood.

Many studies that have addressed adolescent SUDs and MHDs have been completed with adults. For example, in some studies researchers ask adult participants with either a current SUD or MHD about their mental health and substance use problems during adolescence (Abraham & Fava, 1999; Goldstein, Asarnow, Jaycox, Soptaw, & Murray, 2007; Westermeyer & Thuras, 2005; Westermeyer, Thuras, & Carlson, 2005). This may be problematic because these reports about SUDs and MHDs rely on retrospective recall and may be affected by the participant's current mental health (e.g. Livner, Berger, Karlsson, & Backman, 2008; Sutherland & Bryant, 2007; Teasdale, Taylor, & Fogarty cited in Macleod, Mathews, & Tata, 1986). Thus, studies that ask adults to recall their substance use and MHDs during adolescence may not be the best way to research co-occurring disorders among adolescents.

The adult literature has indicated that adults with certain characteristics of SUDs and MHDs may be more likely to have a co-occurring disorder. For example, adults who suffer from MHDs that are associated with impulsivity, such as bipolar disorder, are more likely to have a co-occurring substance use disorder (Grunebaum et al., 2006; Swann et al., 2007). Similarly, certain characteristics of a SUD may be associated with having a co-occurring MHD. Adults who have more severe substance use problems may be more likely to have a co-occurring MHD (Bonn-Miller, Bernstein, Sachs-Ericsson, Schmidt, & Zvolensky, 2007; de Graaf, Bijl, ten Have, Beekman, & Vollebergh, 2004; Forsyth, Parker, & Finlay, 2003; Goldstein et al., 2007; Lyons et al., 2006). Researchers have also found that adults who meet criteria for dependence and adults who suffer from withdrawal from their substance use may be more likely to experience a MHD (Bonn-Miller et al., 2007; Enoch, 2008).

Although characteristics like SUD severity and impulsivity have been researched in the adult population, less is known about whether these characteristics are associated with adolescents having a co-occurring disorder. In addition, adolescents may suffer from different MHPs than adults, like ADHD and conduct disorder. Because these

disorders are not usually addressed in adult studies, little is known about how they relate to co-occurring disorders among adolescents. This gap in the literature affects substance abuse treatment and mental health treatment for this population. Furthermore, much of what is known about co-occurring disorders among adolescents is based on retrospective reports from adults. Therefore, examining the relation between substance use, MHPs, and other characteristics among adolescents is a needed area of research. Thus, adolescents are an appropriate group to investigate co-occurring mental health and substance use problems. This study examined these relationships using a dataset from a sample of adolescents who have used substances.

Purpose and Research Questions

The purpose of this study was to understand which characteristics are associated with mental health disorders among adolescents who use substances. The following research questions were examined:

RQ1. Among adolescents who use substances, how is the severity of the SUD related to having a MHP?

RQ2. Among adolescents who use substances, how is age at first use related to having a MHP?

RQ3. Among adolescents who use substances, how is the type of substance used related to having a MHP?

RQ4. Among adolescents who use substances, how are the behaviors of peers related to having a MHP?

RQ5. Among adolescents who use substances, how are the behaviors of family members related to having a MHP?

Specifically, I examined the relation between MHPs among adolescents and the severity of SUDs (abuse, dependence, tolerance and withdrawal), other characteristics of

substance use (age at first use, type of substance used), environmental risk for substance use (substance use and other deviant behaviors by peers and family), and MHPs among adolescents who use substances. Table 3 in chapter three summarizes the major variables that were included in this analysis.

I will examine these research questions using data from the Strengthening Communities for Youth (SCY) Project Iowa. The SCY dataset contains a large number of adolescents who were referred for concerns about substance use and who presented with a range of severity of problems. These data provide an excellent opportunity to examine MHPs among adolescents who use substances and the characteristics associated with having both a SUD and a MHP. Therefore, a secondary analysis of these data was conducted.

In the original SCY study, adolescents were referred by various agencies for a comprehensive assessment at a centralized intake site in Iowa City called the Adolescent Health and Resource Center. Research assistants used a standardized, semi-structured instrument, the Global Appraisal of Individual Needs (GAIN) to assess eight domains of the adolescent's life (Dennis, Scott, Godley, & Funk, 1999; Dennis, Titus, White, Unsicker, & Hodgkins, 2003). The domains included background, substance use, physical health, mental health, environment, risk behaviors, legal, and vocational. The GAIN was developed for both research and clinical settings (diagnosis, treatment planning, and outcome monitoring). It was designed to map on to American Society of Addiction Medicine (ASAM) and the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (American Psychiatric Association, 2000) criteria for diagnoses of substance abuse and dependence. The GAIN's mental health section, also designed to map on to the DSM-IV, assesses for problems with conduct disorder, ADHD, depression, anxiety, and traumatic stress. Although the mental health section does not collect all of the criteria needed for a formal DSM-IV diagnosis, the mental health scales have been found to accurately predict psychiatrists' diagnoses of these disorders (Jasiukaitis &

Shane, 2001). Because the GAIN does not provide a formal diagnosis of MHDs, in the current study, the term *mental health problem* (MHP) was used instead of disorder.

For the secondary data analysis of this cross-sectional data, the sample was limited to adolescents who report using substances at least once in the past 12 months. Thus, I examined the characteristics associated with having MHPs among adolescents who use substances.

Each of these areas may be associated with an adolescent having a co-occurring MHP. However, it is unclear which areas have the strongest relationship to having a MHP. For example, adolescents with more severe problems associated with substance use may be more likely to have a MHP. That is, adolescents who are dependent on a substance may be more likely to have a co-occurring disorder than adolescents who abuse or use a substance. The age of first use may also have direct and indirect effects on adolescent mental health. Adolescents who begin using substances at a younger age may be more likely to have a MHP than adolescents who begin using at an older age. It could also be that the effect is indirect and adolescents with a younger age of first use may experience more problems with substance use, such as tolerance and withdrawal, that may be associated with having mental health problems. In addition, adolescents who live in an environment where peers or family members use substances may be more likely to have a SUD and mental health problems. Figure A1 (in Appendix A) is a conceptual diagram of the proposed relationships among the variables.

Although MHPs are presented as an outcome, it may be that substance use problems are actually an outcome of having a MHP. I decided to model the relationships with MHPs as the outcome because most of the adolescents who were assessed at the Adolescent Health and Resource Center presented with concerns about substance use. Therefore, I excluded the adolescents who did not report any substance use during the assessment and included adolescents who have used substances in the past 12 months. Due to the nature of this secondary analysis, precise measures of some of the variables

described are not available. Thus, this analysis focused on key variables that have more precise measures. These variables included MHPs, severity of substance use disorder variables, and the environmental risk variables.

Importance and Relevance to the Field of Co-occurring Disorders

Importance of the Study to Knowledge Development

This study provides two primary contributions to the knowledge development in the area of co-occurring disorders: (1) this study focused on an adolescent substance using population and (2) examined the role of tolerance and withdrawal. Examining mental health problems among adolescents is an important contribution because much of the literature on co-occurring disorders focuses on adults. While there is some research that addresses co-occurring disorders among adolescents, much of this is completed with a population of adolescents who have severe mental health or substance use problems. This study included adolescents with a range of severity. By focusing on adolescents, this study examined a population at a developmental stage when they are experimenting with and beginning to use substances. Examining how various factors are related to these MHPs before an individual has suffered from a disorder for a number of years or received a lot of treatment for a MHP may help researchers understand the emergence of SUDs and MHPs and see how they are related. This study provided an opportunity to examine how certain characteristics of substance use are related to MHPs before the individual has been using substances for a number of years and developed a possibly traumatic drug using lifestyle. Further, adolescents are at a stage when many mental health problems may be emerging. Although many adolescents may have been suffering from symptoms of ADHD or conduct disorder for a number of years, others may just be experiencing depression or anxiety symptoms for the first time.

The second primary contribution is that this study specifically examined the role of the dependence symptoms tolerance and withdrawal in mental health problems among adolescents. Much of the adult research indicates that substance dependence is associated with having a MHD (Bonn-Miller et al., 2007; de Graaf et al., 2004; Forsyth et al., 2003; Goldstein et al., 2007; Lyons et al., 2006), however, few researchers have examined which types of dependence symptoms are related to having a MHD. It may be that meeting criteria for any substance dependence diagnosis is related to having a co-occurring disorder. However, it may be that certain symptoms of dependence, like tolerance and withdrawal, are associated with having MHD.

In addition to deconstructing symptoms of SUDs, I also examined the relation among peer and family behaviors and adolescent MHPs. By including these environmental factors as well as SUD characteristics, I was able to examine which factors have the strongest relationship with having a co-occurring MHP. I was also able to examine the relation between characteristics of substance use and environmental factors. This research identified areas for future research that should be examined using larger and more racially diverse samples.

These contributions are strengthened by the methods of this study. Other studies have based SUD diagnoses on screening instruments or have not used trained interviewers to collect information. By using a standardized instrument that was administered by trained interviewers, this research will add to the knowledge base. The data used in this secondary analysis were collected using a semi-structured, comprehensive research tool. As previously mentioned, the GAIN provides DSM-IV-TR diagnoses for substance abuse and dependence. It also provides good measures of MHPs like ADHD, conduct disorder, depression, and anxiety based on DSM-IV-TR criteria. Furthermore, interviews were conducted by trained research assistants who would follow-up with participants on any inconsistencies with the participant's responses.

Measures used in this study were scale level data that will allow for continuous measures of substance use problems. Most researchers who study SUDs and MHDs measure the problems dichotomously. That is, if a person meets the minimum DSM-IV criteria for a disorder, then they are coded as having the disorder. For example, to be categorized as having depression, a person must report five or more of the nine symptoms of depression. This categorization may be problematic when researchers are trying to understand how people with depression differ from those without depression. A person with four symptoms of depression may actually be very similar to a person with five symptoms of depression. However, in most research the person with five symptoms is categorized as having the disorder and the person with four symptoms is categorized as not having this disorder. If those people are not really that different in terms of severity and other problems associated with depression, then the two groups may not really be different groups. One approach to handling this categorization problem is to measure mental health disorders continuously. By including these continuous measures, researchers and clinicians will have a better idea if a person with abuse versus a person with dependence is at a greater risk of developing a co-occurring disorder.

Importance of the Study to Social Work Practice

The analysis of the SCY data will provide important knowledge that will benefit professionals who work with adolescents. By better understanding the factors related to having mental health problems among adolescents who use substances, clinicians may be able to intervene in more effective ways. Understanding the factors related to mental health problems among adolescents who use substances may also help social workers design interventions. For example, if the results indicate that adolescents who first use substances at a younger age are more likely to develop SUDs and mental health problems, then policy practices should be developed to prevent the onset of substance use. In contrast, if adolescents who have peers who use substance are at a greater risk of

developing a SUD and mental health problems, then at risk adolescents should be identified and programming should be developed to help them resist using when their peers use.

The analysis of these data may also help clinicians better understand which disorders are associated with the development of co-occurring problems. For example, if adolescents who suffer from ADHD or conduct disorder are at a greater risk of experimenting with illicit drugs, then appropriate interventions could be put in place for adolescents with these disorders. More specifically, it may be that adolescents who suffer from MHDs like ADHD or conduct disorder, (which are often associated with having symptoms of impulsivity) would benefit from working on how to cope with those impulsive feelings. It may also be that by identifying certain problems like ADHD earlier in childhood, treatment of the ADHD symptoms may prevent later substance use.

A similar relationship may be supported for internalizing disorders like anxiety and depression. It may be that the risk factors associated with substance use and internalizing disorders differ from the risk factors associated with substance use and externalizing disorders such as ADHD and conduct disorder. By better understanding the characteristics associated with each internalizing and externalizing disorder among adolescents who use substances, more effective interventions may be developed.

Importance of the Study for Policy

The results of this study may also have important implications for policy development or change. For example, if peer behaviors influence substance use and mental health problems, then policies will be needed to fund trainings for teachers and other school staff to identify at risk students. Funding will also be needed for programming in the schools to help adolescents identify risky behaviors of their friends and to broaden their circle of friends.

Similarly, if the behaviors of family members are found to impact substance use and MHPs, then funding for family level interventions will be necessary. For example, if adolescents who come from a family environment where someone they live with is using substances are more likely to themselves use substances and have MHPs, then it will be important for treatment programs that support families and children to be funded. This might include treatment facilities where mothers who use substances can get treatment and housing for their children. It could also include family based treatment programs that involve the children in the treatment program and assist the family in meeting their basic needs for food and housing.

In addition, policies may be needed to fund interventions and prevention with adolescents and children who have ADHD or conduct disorder. Policies to identify adolescents with these problems early either through schools, pediatricians, or neighborhood centers will be necessary.

Many policies that are in place focus only on mental health or substance use prevention and treatment. This study may provide more support to have more overlap in MHD and SUD policies so that adolescents and adults who have co-occurring disorders can be identified and access the needed treatment for both problems.

Brief Summary of Each Chapter

In this chapter, I described why this study on mental health problems among adolescents who use substances is important and described the dataset that I used and my research questions. In addition, I have identified some of the potential implications for the results of this study.

In Chapter 2, I will thoroughly examine what is known about co-occurring disorders among adolescents. First, I will provide definitions. Next, I will describe what is known about the prevalence of co-occurring disorders among adolescents both in the general community and in treatment settings. To provide a framework for understanding

the literature, I will briefly describe three theories commonly used to understand adolescent substance use. I will connect these theories to three models often used to explain the etiology of co-occurring disorders. The remainder of the chapter will be devoted to critically examining the literature on the characteristics associated with having substance use and mental health problems among adolescents. Throughout the examination of the literature, I will identify the associated hypotheses tested in the study. A list of these hypotheses is provided at the end of chapter 2.

In Chapter 3, I will describe the methods for the secondary analysis. First, I will describe the design of the SCY-Project Iowa study with a focus on the original data collection procedures. A description of the longitudinal study is presented in Appendix B. Next, I will describe the secondary analysis of the data collected using the GAIN. Information about each measure is included as well as a brief description of the data analysis procedures.

In Chapter 4, I will describe the results of the data analysis. In the first part of the chapter I will describe the results of the bivariate analyses conducted to answer each of the research questions. I will then discuss the results of the linear and logistic regression analyses.

In Chapter 5, I will make conclusions and discuss implications for practice. Conclusions will be made about each of the factors analyzed in this study. Implications for practice, policy, and research will be discussed.

CHAPTER 2: LITERATURE REVIEW

Definitions

To facilitate a review of the literature on characteristics associated with co-occurring disorders among adolescents, it is necessary to define terms. In this chapter, I will define and describe the terms that will be used throughout this literature review. I will then describe the theories that will be used to understand the research literature. Following a short description of two theories, I will critically review the literature on co-occurring disorders among adolescents. Because few studies have examined the characteristics associated with adolescents having co-occurring SUDs and MHDs, in this chapter, where appropriate, I will also incorporate research from the adult literature and relate it to what is known about adolescents.

Co-occurring Disorders

When a person meets criteria for both a SUD and a MHD the person is typically described as having a *co-occurring* disorder. However, multiple terms have been used to describe people who have both SUDs and MHDs. These terms include *dual diagnosis*, *co-morbid*, *co-occurring*, and *co-existing*. For the purposes of this dissertation, the term most commonly used in the literature at this time, co-occurring, will be used to describe people with both a MHD and a SUD.

Substance Use Disorders

Various terms are used in the literature to refer to SUDs. These terms include *use*, *abuse*, and *dependence*. Substance *use* is a term used to describe a person who uses substances. The term *substance use problem* suggests that a person is reporting problems associated with substance use. These problems may be related to abuse or dependence. *Substance abuse* is the term used to refer to someone who meets DSM-IV-TR criteria for the abuse of alcohol or another drug. *Substance abuse*, according to the DSM, is a

pattern of substance use that leads to clinically significant problems (American Psychiatric Association [APA], 2000). Symptoms of abuse include failing to meet obligations at work, school, or home; using in dangerous situations; experiencing repeated legal problems; or experiencing social or relationship problems. A person meets criteria for substance abuse if he or she has one or more of these symptoms.

Substance *dependence* is the term used to describe someone who has more serious problems with substance use. A person with substance *dependence* may have symptoms such as tolerance; withdrawal; using the substance more or for a longer time than intended; being unable to cut down or control substance use; spending a lot of time getting, using, or feeling the effects of a substance; giving up or reducing social, job, or recreation activities; or continuing to use despite knowing that the substance use is causing or adding to a physical or psychological problem. A person who has three or more of these symptoms would meet the criteria for substance dependence. If a person meets criteria for substance abuse and dependence, they would be diagnosed with dependence because it is the more serious disorder.

In general, the term *SUD* is used to describe meeting criteria for abuse *or* dependence for any substance including alcohol. Throughout this literature review, I will use the term SUD in this way unless otherwise specified.

People may meet criteria for SUDs at different times in life, and specific terms are used to describe these time periods. These terms include lifetime, 12-month, and current SUDs. A person who has a *lifetime* diagnosis of abuse or dependence would meet criteria for abuse or dependence at some point in their lifetime. They may or may not be having symptoms of a SUD currently. A person who meets criteria for a *12-month* or *past year* SUD would meet criteria for abuse or dependence in the past 12 months. That person may or may not also meet criteria for a current or lifetime SUD. A person who meets criteria for a *current* SUD would report symptoms of abuse or dependence at the present time. A person with a current SUD may or may not meet criteria for a lifetime or 12-

month SUD. These terms can be important when determining which participants to include in a study and when examining the implications of results from research studies. For example, a person with a lifetime diagnosis of alcohol dependence could meet criteria for alcohol dependence at sometime in their lifetime. However, it is possible that their symptoms have completely remitted and they would not meet criteria for a 12-month or current SUD. That person would be very different than, for example, an adolescent who meets criteria for a current alcohol dependence disorder.

Different terms are used to describe types of drugs. The term *illicit* drug may be used to describe any illegal substances. Illicit drugs include substances like marijuana, cocaine, heroin, methamphetamine, ecstasy, and misuse of prescriptions drugs. Other drugs, like alcohol, are usually considered licit or legal drugs. That is, the law does not necessarily prohibit the use of this substance. Although the law does not prohibit alcohol use for adults, like all drugs, it can be misused. Oftentimes, instead of referring to licit and illicit substances, researchers will refer to alcohol and other drugs. In this case, other drugs would refer to any drug that is not alcohol.

The difference between alcohol and other drugs can be important for designing a study and examining the research of others. Because adolescents frequently use alcohol and marijuana, these drugs are sometimes grouped together as more commonly used drugs. Fewer adolescents experiment with other illicit drugs like ecstasy and cocaine. Furthermore, the effects of these other illicit or “harder” drugs may be different from the effects of alcohol and marijuana. These effects will be discussed in more detail in a later section. Therefore, when researchers discuss illicit drugs it is important to understand whether they are examining marijuana and other illicit drugs or focusing on the “harder” illicit drugs.

Mental Health Disorders

Like SUDs, there are multiple terms used to refer to MHDs. MHDs can include anxiety disorders; mood disorders like depression, dysthymia, and bipolar disorder; attention-deficit hyperactivity disorder (ADHD); conduct disorder; oppositional defiant disorder; and post-traumatic stress disorder. This literature review and the study will focus on the MHDs most often diagnosed in adolescents: depression, anxiety, ADHD, conduct disorder, and traumatic stress. As mentioned in Chapter 1, the term disorder is typically used to refer to a person who has met DSM-IV criteria for a mental health disorder. Because of the nature of the measures used in the GAIN for mental health disorders, when the study is discussed, the term mental health problem will be used instead of MHD. In contrast, in my descriptions of the literature reviewed, I will use the terms the researchers used.

For adolescents, MHDs are often categorized as externalizing or internalizing. *Externalizing disorders* are those that are associated with symptoms of acting out. The externalizing disorders typically include ADHD, conduct disorder, and oppositional defiant disorder. ADHD is characterized by symptoms of inattention and/or hyperactivity-impulsivity. To meet criteria for ADHD, a person must have six or more symptoms of inattention or six or more symptoms of hyperactivity-impulsivity that last for at least 6 months and cause problems in multiple settings like school, work, or home. Symptoms of inattention include difficulty paying attention at school, difficulty sustaining attention at school or home, difficulty listening, difficulty following through on instructions and finishing schoolwork or other tasks, difficulty staying organized, avoiding activities like schoolwork or homework, losing things needed for activities, being easily distracted, and often being forgetful. Symptoms of hyperactivity include fidgeting or moving around in a seat, leaving the classroom or other situation unexpectedly, running around or climbing on things; having feelings of restlessness, experiencing difficulty playing or engaging in activities quietly, feeling like he or she is

often “on the go” or “driven by a motor”, and talking excessively. Symptoms of impulsivity include blurting out answers before questions have been completed, difficulty waiting for a turn, interrupting or intruding on conversations or games. The DSM-IV specifies that some of the hyperactive-impulsive or inattentive symptoms should have been present before the age of 7.

Conduct disorder is described as a pattern of behavior in which a person violates the basic rights of others or major age-appropriate societal norms. To meet the criteria for conduct disorder, a person must have three or more of the criteria in the past 12 months and meet at least one criterion in the past 6 months. Criteria for conduct disorder are divided into four different types. The first type, aggression to people and animals, includes bullying, initiating physical fights, using a weapon, being physically cruel to people or animals, stealing property, and forcing someone into sexual activity. The second type is destruction of property and includes setting fires and destroying others’ property. The third type is deceitfulness or theft and includes breaking into someone else’s house, building, or car; lying or conning to look good or avoid obligations; and shoplifting or forgery. The fourth type is serious violations of rules and includes staying out at night later than parents wanted to before age 13, running away from home overnight, and often being truant from school.

Oppositional defiant disorder is described as a recurrent pattern of negative, defiant, disobedient, and hostile behavior to figures of authority. This externalizing disorder will not be included because the instrument used did not assess for oppositional defiant disorder. To meet criteria for oppositional defiant disorder, a person must have four or more of the following symptoms: often loses temper, often argues with adults, often defies or refuses to comply with adults’ requests or rules, often deliberately annoys people, often blames others for his or her mistakes or misbehavior, is often easily annoyed by others, is often angry and resentful, is often spiteful or vindictive.

Internalizing disorders typically include anxiety disorders and mood disorders. Because the literature on adolescents most often focuses on depression, PTSD, and anxiety, I will provide specific definitions for each of these disorders. An episode of *major depression* is defined by DSM-IV-TR as five or more symptoms of depression in a two-week period that cause clinically significant impairment or distress. Symptoms of depression may include depressed mood, diminished interest or pleasure in activities, unintentional loss or gain of weight, insomnia or hypersomnia, noticeably agitated or slowed down body movements, fatigue or loss of energy, feelings of worthlessness or guilt, inability to think or concentrate, or recurring thoughts of death or suicide.

In general, *anxiety* refers to feelings of nervousness, tension, apprehension, and fear. Generalized anxiety disorder is described in the DSM-IV-TR as anxiety and worry about a variety of events or activities that is excessive and occurs on most days for at least six months. Furthermore, the worry causes significant distress or impairment, and the person has difficulty controlling the worry. Symptoms of anxiety include restlessness, being easily fatigued, difficulty concentrating, irritability, muscle tension, or experiencing sleep disturbance. Social anxiety disorder may be diagnosed when a person fears social or performance situations. With *social anxiety disorder,* exposure to or thinking about social or performance situations provokes anxiety. In addition, the person recognizes that the fear is excessive and avoids social situations or endures them with anxiety.

PTSD may be diagnosed when a person has been exposed to a traumatic event and then the event is persistently re-experienced through thoughts, dreams, feelings that the event is recurring, psychological distress, or a physiological reaction to cues that resemble an aspect of the traumatic event. Additionally, the person avoids the stimuli that is associated with the trauma and may experience a general sense of numbing. Symptoms of avoidance include avoiding thoughts feelings, activities, or places that remind the person of the trauma; an inability to recall parts of the trauma; diminished

interest or participation in activities; feeling detached; restriction of affect; and a sense of a shortened future. The person may also experience increased arousal, which may include difficulty falling or staying asleep, irritability or anger, trouble concentrating, hypervigilance, or an exaggerated startle response. The GAIN does not include a full measure of PTSD, but instead assesses for traumatic stress.

Models and Theories

For my cross-sectional analysis of data, I will focus on how substance use, family behaviors, and peer behaviors influence mental health problems. Due to the cross-sectional nature of the data, mental health problems will be used as the dependent variable. However, it may be that mental health problems lead to SUDs. While it is not possible to measure whether mental health problems lead to SUDs with this data, it is important to acknowledge that there are theories and research examining the relationship among MHDs and SUDs in this manner. Because I am focusing on mental health problems as the dependent variable, I have chosen to examine theories that contribute some understanding to how substance problem severity, age at first use of substances, type of substance used, peers, and family affect mental health problems.

Theories that contribute to understanding how substance use disorders are related to mental health problems are limited. Instead, in the adult literature, co-occurring disorders are usually examined by using three different models. These models include the self-medication model, the SUD leads to MHD model, and the common or third factor model. As in the adult literature, there are no theories in the adolescent literature that attempt to explain how substance use problems are related to mental health problems. Therefore, I will first describe the models commonly used to describe the relation between substance use and mental health. In addition to describing the three models, I will briefly examine two theories commonly used to explain why adolescents use substances. These theories include social learning theory and problem behavior theory.

Self-medication

The self-medication model, or the model that a MHD leads to a SUD, is the model most commonly used to describe why a person has both a SUD and a MHD. Khantzian first described the self-medication model in 1985 and later revised it in 1997. Khantzian proposed that a person who suffers from a MHD uses substances to relieve the symptoms of the MHD. However, this model seems to assume that the mental health symptoms came first. Because I cannot examine how mental health symptoms affect substance use in this data analysis, this model has limited implications for this study.

SUD leads to MHD

The second model that is discussed in the literature is that a SUD leads to a MHD. This model is often discussed as an alternative to the self-medication theory. There are four different hypotheses or paths used to explain how a SUD may lead to a MHD. The first hypothesis is that the activities associated with using substances may cause problems or disruptions in a person's life, and these problems may lead to mental health problems. For example, an adolescent who uses substances may begin to have problems at school and problems getting along with his or her parents. These problems may then cause the adolescent to feel depressed or hopeless about his or her situation.

The second hypothesis is that substance use may interrupt the normal process of desensitization (Kushner, Abrams, & Borchardt, 2000). This hypothesis is often associated with anxiety disorders and SUDs. Under typical circumstances, a person is exposed to a feared situation over time, like getting on an elevator. When the person is able to get on an elevator without the feared consequences occurring, like having a panic attack, the person slowly becomes desensitized to the situation (i.e., the anxious response to that situation decreases). Some researchers have found that the use of substances can interrupt the normal desensitization process (Cameron, Liepman, Curtis, & Thyeer cited

in Kushner et al., 2000). For example, if a person uses alcohol in feared social situations, that person will not become desensitized to being in social situations.

The third hypothesis is that the chronic cycling of substance use, intoxication, and withdrawal can lead to mental health problems and that these problems may persist after the substance use has stopped. The fourth hypothesis is often referred to as the "trigger" hypothesis. For example, some people may have a genetic predisposition to developing a MHD. When a person with this genetic predisposition uses substances, he or she somehow triggers the MHD to emerge.

The third model of co-occurring disorders is that some third factor, or a common factor, causes or increases the risk of both a MHD and a SUD occurring in a person. This model is different from both the self-medication and the SUD leads to MHD models because it suggests that some other factor causes both problems. For example, a person who experiences a trauma may be at risk of developing a SUD and MHD. A variety of third factors have been examined, including gender (Kessler et al., 1997; Mangrum, Spence, & Steinley-Bumgarner, 2006; Olff, Langeland, Draijer, & Gersons, 2007; Stewart, Grant, Ouimette, & Brown, 2006) and living environment (Barret & Turner, 2006; de Graaf et al., 2004).

Although each of the models of co-occurring disorders contributes to the understanding of why a person may have both problems, there is not a consensus among researchers about one model being the most predictive. In fact, most researchers have concluded that the relationship between SUDs and MHDs is heterogeneous or different for different people. This lack of consensus has led researchers to discuss combinations of the models. The combinations of models have been presented in three different ways. The first combination is that the initiation and maintenance of disorders may be different. The second combination is that the etiological process may be different in different individuals. For example, the process of developing a co-occurring disorder may be different for men and women. The third combination is that the etiological process of

developing a MHD and a SUD may overlap. For example, a person may have a genetic predisposition for depression and may live in an environment where a family member uses substances. If that person experiments with a substance, he or she may trigger the depression.

Summary for Models of Co-occurring Disorders

There is little consensus among researchers who study co-occurring disorders about which model best explains the etiology of co-occurring disorders. Most researchers who have examined these models have concluded that no one model best explains the etiology of co-occurring disorders. Instead, they conclude, the etiology of co-occurring disorders is likely caused by a combination of these models and is heterogeneous, that is, the etiology may be different for different people (Kushner et al., 2000; Morris, Stewart, & Ham, 2005; Schafer & Najavits, 2007; Swendsen & Merikangas, 2000; Zvolensky, Bernstein, Marshal, & Feldner, 2006). Although researchers have attempted to understand the relation between SUDs and MHDs in the adult population, co-occurring disorders have been addressed less frequently among adolescents. Furthermore, as mentioned previously, multiple factors may have an effect on MHDs and SUDs. Because additional factors may help explain how SUDs and mental health problems are related, in the next section I will examine two theories that may contribute to understanding why adolescents use substances and develop SUDs. These theories are social learning theory and problem behavior theory.

Social Learning Theory

One theory commonly used to explain substance use among adolescents is social learning theory (Bandura, 1977). Social learning theory originated from more traditional theories of learning like operant and classical conditioning. Traditional learning theory involves stimulus and response relationships. Bandura broadened traditional learning theory when he included cognitions and the social context in social learning theory

(Miller, 1993). Like traditional learning theory, social learning theory still involves the ideas of stimulus and reinforcement but also includes observational learning or modeling. Observational learning is the idea that people learn new skills or change their behaviors based on their observations of others. Furthermore, observational learning does not require that a person directly receive reinforcement. Instead, just observing that another person receives reinforcement for doing a certain behavior may increase the chances that the observer models the behavior. In addition, Bandura suggested that the relationship between the way a person behaves and the environment is reciprocal (Sommers-Flanagan & Sommers-Flanagan, 2004). That is, the environment has an effect on a person, but a person also has an effect on his or her environment and the way people react to them.

Thus, social learning theory provides various explanations of why adolescents use substances. It may be that the adolescent sees a peer or a parent using and that the adolescent observes that parent or peer relaxing or having fun while using. Social learning theory may also explain why an adolescent chooses to use certain substances. For example, an adolescent who has peers who use alcohol only would be less likely to use other drugs like cocaine and heroin. By contributing to the understanding of why an adolescent uses substances, social learning theory also contributes to understanding how SUDs and MHDs may be related. For example, social learning theory may explain why an adolescent uses cocaine. It may be that the use of that drug contributes to an adolescent developing symptom of tolerance and withdrawal. It may be that the symptoms of tolerance and withdrawal are then related to the adolescent having mental health problems.

Problem Behavior Theory

Problem behavior theory (Jessor, 1991) attempts to explain a variety of problematic behaviors (Jessor, 1991; Petraitis, Flay, & Miller, 1995). However, unlike social learning theory, problem behavior theory is specific to the behaviors of

adolescents. These behaviors include sexual activity, alcohol use, illicit substance use, and criminal behaviors. Furthermore, Jessor (1991) concluded that adolescents who participate in one problem behavior, like alcohol use, are more likely to participate in other behaviors like illicit substance use and sexual activity than adolescents who do not participate in any of these behaviors.

In addition to suggesting that an adolescent with one problems behavior is likely to have other problem behaviors, the problem behavior theory describes the impact of a variety of factors on an adolescent's behavior. Factors that influence these problem behaviors include demographic, biological, cognitive, self-esteem, academic, family influences, peer influences, participation in other problem behaviors, and community influences. Although problem behavior theory incorporates a number of factors that either directly or indirectly affect substance use, it is not clear which factors are most important (Petraitis et al., 1995) and not clear how these factors affect mental health. For example, it is not clear if peer influences may contribute to an adolescent's using substances. It may be that the use of substances then contributes to mental health problems. It could also be that peer influences have a direct effect on mental health. That is, adolescents with more peers who participate in problem behaviors may be more likely to have mental health problems regardless of the severity of the adolescent's use of substances. Alternatively, it may be that adolescents who participate in problem behaviors at a younger age are more likely to try substances at a younger age. Thus, it may be that using substances at a younger age contributes to more severe substance use problems that then lead to mental health problems. It could also be that age at first use has a direct effect on mental health problems.

Summary of Theories

Social learning theory and problem behavior theory each contribute to the explanation of why adolescents use substances and may shed some light on how

substance use among adolescents is related to mental health problems. Furthermore, parts of these theories fit well with the models commonly used to understand co-occurring disorders among adults. However, only social learning theory has really been used in research to explain both SUDs and MHDs. Although problem behavior theory has been used to explain substance use, it has not been used in the literature to explain mental health problems. Thus, there remains a gap in understanding how adolescent substance use and mental health problems are related.

Furthermore, it is not clear which other factors or characteristics may contribute to co-occurring disorders. Although there is evidence in the literature of a relationship between SUDs and MHDs, there is not clear support for which additional factors may contribute to substance use and mental health problems. Therefore, the remainder of this chapter is devoted to the empirical literature on characteristics associated with adolescent SUDs and MHDs. Where appropriate, these theories and the models of co-occurring disorders will be discussed.

Research

As with the theories used to understand adolescent substance use and mental health problems, the empirical literature is somewhat limited in its examination of co-occurring disorders among adolescents. While some studies examine both substance use and mental health problems, other studies focus on one disorder or the other. Therefore, where appropriate in the following literature review, I will try to connect the research on substance use and mental health problems and draw conclusions about what the results might indicate for co-occurring disorders.

In the next sections of the literature review I will review the literature related to the independent variables that will be included in this study. The literature review is divided into five main sections. These sections are 1) the severity of the SUD , 2) age at first use and type of substance used, 3) deviant behaviors by peers and family, 4) other

factors, and 5) control variables. In the summary sections following each section of the literature review, I will discuss how the results of the studies reviewed fit with the models of co-occurring disorders as well as social learning theory and problem behavior theory. Thus, because one theory does not explain co-occurring disorders, I have built upon the models and theories and attempted to make connections with the available literature.

Independent Variables

Severity of SUD

Abuse and Dependence

The severity of substance use problems may put a substance user at a greater risk of having mental health problems. However, there is not a clear consensus in the literature. Some research has indicated that abuse and dependence, but not use, are related to having a co-occurring MHD (Bonn-Miller et al., 2007; Bernstein, Zvolensky, Sach-Ericsson, Schmidt, & Bonn-Miller, 2006; Chan et al., 2008). Other research has shown that dependence but not abuse or use is related to having a co-occurring MHD (Buckner et al., 2008; Diamond et al., 2006; Roberts, Roberts, & Xing, 2007). Still other research has not differentiated between abuse and dependence and instead addressed SUDs as a combined category (Aseltine, Gore, & Colten, 1998; Kandel et al., 1999) or has focused on substance use problems and not used a structured measure to obtain a diagnosis of abuse or dependence (Aseltine et al., 1998; Goldstein, Asarnow, Jaycox, Shoptaw, & Murray, 2007; Lubman, Allen, Rogers, Cementon, & Bonomo, 2007; Hayatbaksh et al., 2008).

Chan and colleagues (2008) examined mental health problems among adolescents and adults in SUD treatment and found that adolescents who met criteria for substance dependence were more likely to have mental health problems than adolescents who only met criteria for substance abuse. Other researchers have found mixed results for how

abuse and dependence are related to mental health problems. Roberts and colleagues (2007) found that adolescents with dependence on alcohol or another substance were more likely to have an anxiety disorder than adolescents who did not have alcohol or substance dependence. The researchers also found that for every type of substance abuse and dependence, the risk of having a mood disorder, conduct disorder, or oppositional defiant disorder was higher. In contrast, having substance abuse or dependence did not increase the risk of having ADHD. The results of this study demonstrate mixed support for the idea that adolescents who have substance dependence are at a greater risk of having a co-occurring MHD than adolescents with substance abuse. These results seem to indicate that adolescents who meet criteria for substance abuse or dependence may be more likely to have mental health problems than adolescents who do not meet criteria for abuse or dependence.

In a longitudinal cohort study, Buckner and colleagues (2008) found that adolescents who developed cannabis dependence and alcohol dependence were more likely to have social anxiety disorder than adolescents who developed cannabis or alcohol abuse. Interestingly, the authors did not find a similar relation between SUDs and depression. Depression at baseline (mean age 16.6) was not associated with having a SUD at follow-up (mean age 30). Unfortunately, the authors excluded adolescents with a SUD at baseline, so it is not clear from this study what effect having a SUD has on having a mental health disorder. Although this study suggests that social anxiety disorder may be associated with having alcohol or cannabis dependence it seems that the relation between depression and SUDs may be different.

Some researchers have focused their investigations on how SUDs are related to internalizing and externalizing disorders instead of focusing on a specific mental health problem or mental health problems as a general category. By examining internalizing and externalizing disorders, researchers can better understand whether SUDs are related to certain types of mental health disorders. In a review of studies that looked at co-

occurring disorders among adolescents and young adults treated for SUDs, Couwenbergh and her colleagues (2006) found that externalizing disorders were more common than internalizing disorders. However, others have found an overlap between externalizing and internalizing disorders. Bagwell, Molina, Kashdan, Pelham, and Hoza (2006) found that adolescents with ADHD and externalizing behaviors (symptoms of conduct disorder and oppositional defiant disorder) or social problems in childhood were more likely to have anxiety and depression in adolescence than adolescents with childhood ADHD only and controls who did not have ADHD.

Winters, Stinchfield, Latimer, and Stone (2008) studied how having an externalizing or internalizing disorder was related to SUD treatment outcomes. When the researchers grouped the adolescents, they found that no adolescents had only an externalizing disorder. Instead, the researchers created a continuous measure that demonstrated whether the adolescent had a pattern of more internalizing or externalizing problems. This resulted in four different groups. An externalizing group (n=76, 48%), an internalizing group (n=65, 41%), a mixed group (n=11, 7%) for whom the scores on externalizing and internalizing were within one standard deviation of each other, and a non-clinical group (n=7, 3%) for whom the scores were below the clinical range. In a study of an adolescent inpatient psychiatric population, Abrantes, Brown, and Tomilson (2003) found certain mental health problems predicted certain SUDs. The researchers found that externalizing disorders predicted drug dependence and ADHD specifically predicted alcohol dependence.

The research on how the severity of substance use problems affects mental health problems among adolescents has had mixed results. While some research indicates that adolescents who meet criteria for substance dependence will be more likely to have mental problems than adolescents who meet criteria for abuse, other research has indicated that adolescents who meet criteria for abuse or dependence will be more likely to have mental health problems than adolescents who do not meet criteria for substance

use problems. Thus, in the current study, it would be reasonable to expect that adolescents who meet criteria for dependence will be more likely to have co-occurring mental health problems than adolescents who meet criteria for abuse or use. The role of externalizing and internalizing disorders is also important to consider when studying adolescents. While fewer studies have looked at mental health problems in this way, it seems reasonable to expect that adolescents who have an internalizing disorder will also have an externalizing disorder. In addition, adolescents who meet criteria for substance dependence will be more likely to have an internalizing disorder than adolescents who meet criteria for use or abuse.

Tolerance and Withdrawal

While the literature has indicated adolescents with substance dependence may be more likely to have mental health problems, few researchers have examined if specific symptoms of dependence are related to having mental health problems (Abrantes et al., 2003; Saha, Chou, & Grant, 2006). As mentioned previously, one path of co-occurring disorders discussed under the model SUDs lead to MHD indicates that the pattern of tolerance and withdrawal from substance use may lead to having mental health problems. This path is supported by the results of a study by Saha and colleagues (2006). Using data from the National Epidemiologic Survey on Alcohol and Related Conditions, Saha and colleagues used item response theory to determine if there is a continuum of severity for abuse and dependence symptoms. Saha and colleagues found that tolerance and withdrawal were at the more severe end of the continuum. While the National Epidemiologic Survey on Alcohol and Related Conditions was based on data collected from adults, it seems reasonable to speculate that adolescents who have symptoms of tolerance and withdrawal may be more likely to have co-occurring mental health problems.

Only one study could be located by this researcher that focused on adolescents and specifically addressed symptoms of withdrawal. Abrantes and colleagues (2003) found that among adolescents in inpatient psychiatric treatment, depression was associated with symptoms of substance withdrawal. In addition, adolescents with more severe withdrawal symptoms had more symptoms of depression and anxiety.

Clearly, more research is needed on the association between symptoms of tolerance and withdrawal and mental health problems. Based on the literature reviewed, it would be reasonable to expect that adolescents who experience symptoms of tolerance and withdrawal may be more likely to have mental health problems than adolescents who do not report these symptoms.

Other Characteristics of Substance Use

Age at First Use

A younger age at first use of substances has been associated with an increased risk of having a co-occurring MHD. Some research has indicated that people who have an earlier age at first use may be at a greater risk of developing a SUD, a MHD, or both problems (Brook et al., 2002; Dawson, Goldstein, Chou, Ruan, & Grant, 2008; Kandel & Chen, 2000). Using data from the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC), Dawson and colleagues (2008) examined the role of age at first drink on the development of an alcohol use disorder. The data were obtained from adults aged 18 and older interviewed during waves 1 and 2 of NESRAC. After adjusting for other risk factors associated with the development of an alcohol use disorder, researchers found that participants who reported drinking before age 15 were at an increased risk of having alcohol dependence (OR= 1.38). Women, but not men, who began drinking between age 15 and 17 were also at an increased risk of having alcohol dependence (OR=1.54). Additionally, participants who reported their age at first drink was before age 15 or between ages 15 and 17 were at an increased risk of meeting criteria

for alcohol abuse (OR=1.52 and OR=1.30). The results of this study indicate that people who begin drinking at an earlier age may be at a greater risk of developing an alcohol use disorder.

Although an earlier age at first drink may be related to having a SUD, the relationship may be more complicated. Some researchers have found that early onset use during adolescence is associated with a range of problems including mental health problems (Brook et al., 2002; Degenhardt, Coffey, Moran, Carlin, & Patton, 2007; Kandel & Chen, 2000; Lubman & Yucel, 2008).

Other research has indicated that an earlier age of first drink may be related to the amount or frequency of substance use, which may be associated with substance dependence and mental health problems. Kandel and Chen (2000) found that adolescents who had early-onset heavy cannabis use were more likely to use cannabis daily by the age of 18 than those with later onset or less heavy use. In addition, the researchers found that adolescents with early onset use were more likely to use more alcohol and other drugs, to have more drug related problems, and more likely to have a psychiatric problem. In a longitudinal study conducted in Australia, researchers found that young adults who had used amphetamines by age 17 were more likely to have a history of cannabis use, symptoms of depression, and symptoms of anxiety (Degenhardt et al., 2007). In addition, adolescents with early onset amphetamine use were more likely than non-amphetamine users to report regular use of cannabis and alcohol.

In a prospective longitudinal study, Brook and colleagues (2002) examined the association between drug use in childhood and adolescence and later mental health problems. The researchers found that early use of alcohol, marijuana, and other illicit drugs predicted major depressive disorder, alcohol dependence, and other substance use disorders when the participants were in their late 20s. Furthermore, the researchers found that the frequency of substance use through childhood and adolescence was related to episodes of major depressive disorder, alcohol dependence, and other SUDs. However,

relatively few adolescents met criteria for major depressive disorder, alcohol dependence, or other SUDs in their late 20s (8.3%, 5.2%, and 6.1% respectively).

The results of these studies suggest that those who begin drinking or using other substances at younger ages are at a greater risk of developing alcohol related problems and may be at a greater risk of having certain mental health problems. However, the relation among these variables needs to be further explored. Although it may be that an earlier age at first use is directly related to developing a SUD, it is likely that this relationship is more complicated. It seems reasonable to expect that a younger age at first drink will be related to the severity of substance use problems and mental health problems. In other words, having an earlier age of first use may be related to developing symptoms of dependence, which may be related to having a MHD.

Type of Substance

Researchers have also examined whether the type of substance an adolescent used has an effect on having a MHD. This has been frequently examined in the adult literature on co-occurring disorders.

Researchers have examined the role of cannabis use in the development of a MHD among adolescents. In a prospective longitudinal New Zealand study, Arseneault and colleagues (2002) divided the participants into three groups for the analysis. The first group (n=494) was participants who had never used cannabis or had only used once or twice. The second group (n=236) had first reported using cannabis three or more times at age 18 and the third group (n=29) had reported using cannabis 3 or more times at age 15. The researchers used multiple linear regression and found that participants in the second and third groups had more symptoms of schizophrenia at age 26 than the control group. Furthermore, the researchers found that use of other illicit drugs did not predict symptoms of schizophrenia beyond the effect of cannabis use. Although the researchers did find a significant relationship between cannabis use in adolescence and symptoms of

schizophrenia in late 20s, they did not find that early cannabis use predicted depression symptoms. However, it should be noted that the sample included a small number of adolescents who had used by age 15 and the results should be interpreted with some caution.

Arseneault, Cannon, Witton, and Murray (2004) later reviewed five prospective studies that examined adolescent cannabis use and adult psychosis. They concluded that cannabis use may increase the risk of schizophrenia, especially among those with a genetic risk of developing this disorder. They also concluded that cannabis use may be one part of the etiology of schizophrenia, but there are many other factors that contribute to schizophrenia that are not yet understood. Arseneault and colleagues focused on the relation between cannabis use and schizophrenia and, therefore, the conclusions that can be made to other mental health problems may be limited. Schizophrenia is typically considered a more serious mental illness than depression, anxiety, and traumatic stress. However, the results of these studies do suggest that there may be a relation between cannabis use in adolescence and the development of serious mental health problems. Thus, the role of cannabis in mental health problems among adolescents who use substances should be further examined.

Bonn-Miller and colleagues (2007) investigated the associations among psychedelic drug use, abuse, dependence, and panic attacks using a general adult population (N=4745). Polysubstance use and alcohol abuse were entered into the model explaining MHDs as covariates. The results indicated that psychedelic abuse and dependence were associated with increased odds of experiencing panic attacks (OR=2.1; 4.6), but psychedelic use was not associated with increased odds of panic attacks. Interestingly, psychedelic abuse, but not dependence, was associated with increased odds of having major depression. These results seem to indicate that the abuse and dependence of a certain type of drug, psychedelics, may be related to having mental health problems. Furthermore, these results seem to indicate that the risk of having panic

attacks increases with the severity of the substance use problems. As with the studies on schizophrenia by Arseneault and colleagues (2004), Bonn-Miller and colleagues focused on a specific type of mental health disorder. Therefore, the implications of this study may be limited to understanding panic disorders. However, the study also suggests that use of certain drugs may be related to having a mental health problems and this should be further examined among adolescents who use substances.

Dehass, Calamari, and Bair (2002) investigated whether type of drug used was related to the type of mental health problems of VA patients. Participants were grouped into two categories; the depressants category included people who preferred alcohol and other depressants like barbiturates (n=34) and the stimulants category included those who preferred amphetamines and other stimulants (n=19). The results suggest that those in the depressants group had more severe depression and anxiety scores than those in the stimulants group. Although this study had a small sample of VA patients, it seems to indicate that there may be a relation between the type of substance used and mental health problems. However, it could also be that the use of depressants caused the participants to experience more anxiety and depression.

Based on the literature reviewed, it seems that there is not a direct relationship between the use of most drugs and having mental health problems. However, this needs to be further investigated. Some research supports the idea that the use of certain drugs, like LSD, other psychedelics, and cannabis may be related to having mental health problems. The research described in this section seems to indicate that adolescents who use other types of illicit drugs may be more likely to have mental health problems. Thus, it seems reasonable to expect that adolescents who use other illicit substances will be more likely to have more severe substance use problems than adolescents who do not use other illicit substances. In addition, adolescents who use other illicit substances will be more likely to have mental health problems than adolescents who only use alcohol.

Furthermore, the relation between the type of substance used and mental health problems may be more complicated. It may be that there is a relationship between the use of illicit drugs and symptoms of dependence. If that is the case, it may be that the dependence symptoms are then related to the adolescent having mental health problems. Therefore, I will examine whether substance use severity moderates the relationship between the type of substance used and having mental health problems.

Summary for Severity, Age at first use, Type of substance

The literature reviewed in this section provides mixed support for a number of factors related to adolescent substance use that may be associated with mental health problems. In general, it seems that people who meet criteria for substance dependence are more likely to have co-occurring mental health problems. However, some research has indicated that a person who meets criteria for substance abuse may also be likely to have a co-occurring disorder. In contrast, the results of most of the research reviewed seem to indicate that substance use, when compared to abuse and dependence, is not related to having mental health problems. These results may fit best with the SUD lead to MHD model and problem behavior theory. People who have more severe problems with substance use are more likely to be involved in a substance using lifestyle, which may contribute to increased mental health problems. It could also be that people with more severe problems with substance use are experiencing more tolerance and withdrawal. Therefore, the cycle of increasing use and withdrawal may lead to mental health problems.

As mentioned previously, most of the research indicated that people who meet criteria for abuse and dependence are more likely to have mental health problems than people who use substances and do not meet criteria for a SUD. However, the results of some of the studies reviewed indicated that the use of certain types of drugs, like cannabis and psychedelics, may be related to having a co-occurring disorder. The results

of these studies fit with the SUD leads to MHD theory. It is possible that the use of substances with certain properties may trigger a MHD in some people. Because there is no clear consensus in the literature, a number of relationships are possible. This of course, could also fit with the theory that suggests that some third factor, like a genetic predisposition, could cause both a SUD and a MHD to emerge in a person. It could also be that people who use certain drugs lead a more harmful drug using lifestyle and may become more dependent on these drugs, or it may be that certain drugs are more addicting. That is, a person may develop more symptoms of dependence sooner for certain types of drugs which, in turn, would lead to mental health problems. Clearly, these scenarios of how certain types of drugs may lead to a MHD could also fit with problem behavior theory or social learning theory. The use of certain drugs may be associated with a more stressful drug using lifestyle which could lead to problems in relationships and lead to mental health problems. It could also be that adolescents who spend time with other adolescents who use certain substances are more likely to try those substances. Therefore, the influence of peers will be examined more in a later section.

The results of the literature reviewed also indicate that the age at first use of alcohol or another substance may be related to having co-occurring mental health problems. This may be explained by several of the theories mentioned and may fit with the SUD leads to MHD model and problem behavior theory. Adolescents who begin using earlier may develop dependence symptoms earlier and try a wider variety of substances. Either of these factors could be related to having a co-occurring mental health disorder. Similarly, an adolescent who begins using substances earlier will have a longer time to develop a substance using lifestyle, which may lead to having a mental health disorder. It seems that the characteristics of substance use examined in this section may have an effect on mental health problems in various ways. Further, it seems that some of these factors may be related to one another. Unfortunately, few studies have examined the potentially more complicated relationships among these variables.

Deviant Behaviors by Peers and Family

As examined in the previous section, characteristics of substance use may be associated with an adolescent having co-occurring mental health problems. Although understanding how the characteristics of substance use relate to mental health disorders is beneficial to understanding co-occurring disorders, it is also important to examine the environment in which an adolescent spends his or her time. In this section, I will examine two environments that are important in an adolescent's life: family and peers. Both of these will be examined in the study. For adolescents, there is typically an overlap among the people with whom they spend time with at school and the people with whom they spend their free time. Thus, the two environments, school and free time will be discussed together under peer influences.

Use, Abuse, and Illegal Activities among Peers

Friends play an important role in adolescents' lives and may have an impact on substance use and mental health. Adolescents whose peers are involved in illegal activities may be more likely to develop a SUD and to have mental health problems. Fergusson, Swain-Campbell, and Horwood (2002) found that adolescent who had friends who participated in deviant activities were more likely to have substance use problems. Deviant activities included using alcohol, tobacco, or cannabis, skipping or being suspended from school, or breaking the law.

Other researchers have found that use and approval of substance use by peers affects adolescent substance use. Barrett and Turner (2006) reported that substance use and approval of substance use by friends was an important predictor of adolescent substance use in their study. Martins, Storr, Alexandre, and Chilcoat (2008) found that marijuana users were more likely to report that they have friends who approve of ecstasy use than non-users. Similarly, adolescents who use ecstasy were more likely to say that their friends approve of ecstasy use than non-users. Other researchers reported that some

adolescents are influenced by their alcohol using peers, but this may depend on the quality of the friendship (Urberg, Luo, Pilgrim, & Degirmenciouglu, 2002).

Agrawal, Lynskey, Bucholz, Madden, and Heath (2007) used baseline and follow-up data from 1065 females to examine the relation among peer, parental, and individual factors and the onset of cannabis use. The researchers found that two important predictors of the onset of cannabis use were peer attitude towards substance use and peer substance use. However, the authors also found that use of cigarettes and alcohol at baseline was also an important predictor of the onset of cannabis use. Thus, this study suggests that peer influences may be an important factor in an adolescent's decision to try different types of substances. However, it remains unclear whether adolescents choose to spend time with peers who are similar on substance use or whether they are influenced by using peers to use substances.

Epstein, Bang, and Botvin (2007) studied the factors that were related to substance use among Hispanic adolescents in New York City in a two-year longitudinal study. They found that, along with the adolescent's mental health problems, use of tobacco and alcohol by peers had a direct effect on the adolescent's substance use.

Research has also indicated that more time spent with deviant peers or having more deviant peers is related to adolescent substance use and substance use problems. In a study of high risk adolescents, Dishion and Skaggs (2000) looked at changes in drinking patterns through the month to understand what factors were related to "bursts" of drinking. The main finding was that monthly increases in exposure to deviant peers were associated with increased substance use during that month. In other words, spending more time with deviant peers was related to an increase in substance use during the month the adolescent spent time with those peers. This result suggests that peer use of substances is a risk factor for substance use among high risk adolescents. However, less is known about non-high risk adolescents. Further, adolescents in this study were

younger, ages 11-14. The impact of peers on substance use problems during later adolescence may differ.

In a longitudinal study of New Zealand children, Fergusson and colleagues (2002) examined the relation between deviant peer affiliations and substance problems. The factor 'deviant peers' was defined as those peers who are involved in substance use, antisocial behaviors, and crime. The researchers found that there was a significant association between having more deviant peer affiliations and having substance use problems.

The studies examined in this section thus far have demonstrated a relationship between peer use and approval of substance use and substance use among adolescents. Some researchers have attempted to disentangle how deviant peers are related to substance use and mental health problems among adolescents. For example, Fergusson, Wanner, Vitaro, Horwood, and Swain-Campbell (2003) examined data from two longitudinal studies from New Zealand and Quebec to understand the relation between deviant peer affiliations and depression. In both analyses, the researchers found support for a mediating model. In the New Zealand study, substance abuse mediated the relation between deviant peer affiliations and depression. Similarly, in the Quebec study, the researchers found that deviant peer affiliations were associated with increased involvement in crime and difficulties with parents, peers, and teachers. These problems were then related to increased depressive feelings. These results demonstrate that the relation among adolescent peer relationships, substance use, and mental health problems may be a mediating (indirect) relationship. That is, it may be that having deviant peers increases the adolescent's participation in substance use and other problem behaviors. Then, the substance use and problem behaviors lead to depression. It may also be that adolescents who participate in problem behaviors like substance use may be more likely to find friends who engage in similar activities.

The results of the studies reviewed in this section suggest a relationship between peer substance use and approval of substance use and adolescent substance use problems. Some researchers have also examined the association between deviant peers to adolescent mental health. The results of the studies fit well with social learning theory. Social learning theory posits that adolescents may model the behaviors of the people they observe. Therefore, adolescents who have peers who they observe having fun or relaxing while using substances may be more likely to try substances. The results of the studies may also fit with problem behavior theory. It may be that adolescents choose to spend time with peers who are more like them. That is, adolescents who use substances may spend more time with peers who also use substances and who are involved in other deviant behaviors. It may be that through participation in substance use and deviant behaviors an adolescent has more problems in their relationships and then develops mental health problems.

Based on the literature reviewed in this section, it would be reasonable to expect that adolescents who have more deviant peers will have more severe substance use problems. Further, it seems reasonable to expect that the severity of substance use problems will mediate the relationship between deviant peers and having mental health problems.

Use, abuse, and illegal activities among family members

Especially for an adolescent, substance use by someone in his or her home may have an important impact on that adolescent's substance use and mental health. In a longitudinal study of boys, researchers examined how exposure to a parent's SUD affected the adolescent's having a SUD (Biederman, Faraone, Monuteaux, & Feighner, 2000). The researchers found that adolescents who had a SUD spent a significantly greater percentage of their life exposed to the parent's SUD. The researchers also examined whether the period of the adolescent's life when the exposure occurred had an

effect on the adolescent having a SUD. The results suggest that exposure to a parent's SUD during adolescence was significantly associated with the participant having a SUD. In contrast, there was no significant relation between exposure during the preschool or elementary years and the development of a SUD in the adolescent.

In a prospective Australian study, researchers examined the effect of maternal smoking and alcohol use when the adolescent was 5 and 14 on cannabis use when the child was 21 (Hayatbakhsh et al., 2007). The researchers found that adolescents whose mothers smoked when they were 14 were more likely to use cannabis than adolescents whose mothers smoked when they were 5 but had stopped by the time they were 14. This result suggests that social learning may explain why young adults who saw their mom smoking when they were 14 would be more likely to use cannabis. The authors also found that adolescents whose mothers had more than one drink per day at age 5 and continued to drink more than one drink per day when the child was14 were more likely to use cannabis than adolescents whose mothers used alcohol daily at only one of those time points. This suggests that chronic alcohol use by mothers may have an effect on the environment in which a child grows and may influence the adolescent's use of substances.

In a longitudinal study that followed children born to low-income mothers, researchers examined the factors related to adult heavy alcohol use (Englund, Egeland, Oliva, & Collins, 2008). The two main findings were that the child's drinking behaviors at age 16 and the mother's drinking behaviors when the child was 16 had a significant effect on how the child's drinking behaviors as an adult. That is, adolescents who consumed more alcohol at age 16 were more likely to be heavy drinkers than moderate or light drinkers. Similarly, adolescents whose mothers consumed more alcohol when the adolescent was 16 were more likely to be heavy drinkers than moderate or light drinkers.

Researchers have also examined the relation between a relative having a SUD and an adolescent having a SUD. Chan and colleagues (2008) found that among adolescents

and adults presenting for SUD treatment, 70% reported that a family member had had problems with alcohol and greater than 50% reported that a family member had had problems with drugs.

Warner, White, and Johnson (2007), in a longitudinal study, examined the factors related to having problems with alcohol among adolescents who reported having tried alcohol. They found that the adolescents clustered into three groups, those with no alcohol related problems, those who had an alcohol related problem in adolescence that remitted in adulthood, and those who had escalating alcohol problems from adolescence through adulthood. The groups differed on a number of factors including the number of family members who had an alcohol problem. Adolescents with no alcohol problems had the fewest relatives with an alcohol problem, those with alcohol problems in adolescence had more relatives with an alcohol problem, and adolescents with escalating problems had the most relatives with an alcohol problem. Those adolescents in the two groups that had alcohol problems were also statistically more likely to have a family member who had an alcohol problem.

Fewer studies have examined the relation between parental substance use problems and adolescent mental health problems. One of these studies examined 542 families participating in a twin family study. Researchers examined the family transmission of externalizing disorders including alcohol and drug dependence, conduct disorder, and antisocial personality disorder (Hicks, Krueger, Iacono, McGue, & Patrick, 2004). The results indicated that the genetic contribution was the most important contributor and that there was a general transmission effect. That is, parents seem to pass on a genetic vulnerability for a range of disorders rather than a specific disorder. This suggests that adolescents in families where a parent has a SUD may be at risk for developing a SUD disorder and conduct disorder.

Other researchers have also examined the role of sibling influences on adolescent substance use. In a review of twin and adoption studies of adolescent substance use,

Hopfer, Crowley, and Hewitt (2003) concluded that sibling drinking behaviors may influence the adolescent's environment and drinking behavior.

The relation between a relative's SUD and an adolescent's SUDs and MHDs fits with social learning theory, the self-medication, third factor, and the SUD leads to MHD model. An adolescent who observes a parent using substances may model that behavior. However, there may be multiple reasons why an adolescent models that behavior. It could be that there is a genetic transmission of SUDs and that the adolescent is at risk of developing a SUD. Thus, when an adolescent models that behavior, it may trigger the SUD. It may also be that the adolescent suffers from a MHD. The adolescent may see a parent or sibling use substances to relax and then may try substances in order to get this desired effect.

The literature reviewed in this section suggests that exposure to substance use and other deviant behaviors in the home may affect adolescent substance use and mental health. While it is not clear how much of the impact is genetic and how much is environmental, exposure to deviant behaviors in the home seems to be an important factor to address. The studies reviewed addressed SUDs in relatives in two different ways. Some researchers focused on relatives who had a diagnosis of a SUD and other researchers looked at exposure to that substance use. Although the results of these studies indicate that there is a relationship between family members' SUDs and adolescents' SUDs and mental health problems, few studies examined how the number of relatives who used alcohol and other substances affected adolescent substance use. In addition, none of the studies reviewed considered related factors like a relative's participation in illegal activities or whether the parent had ever been in alcohol treatment. Finally, only one study examined how parental substance use may affect adolescent mental health problems. Therefore, more research to address these relationships is needed. Thus, it seems reasonable to expect that adolescents who have more family members who participate in deviant activities will have more severe substance use

problems. I will also examine whether adolescents who have more family members who participate in deviant activities will be more likely to have mental health problems. Finally, I will examine whether severity of the substance use disorder will mediate the relation between number of deviant family members and having a mental health problem.

Other Factors in the Literature

Some of the literature reviewed above discussed other variables that may impact substance use and mental health. Two of the most common variables addressed were self-efficacy and stress. This section will briefly address factors that are not included in this study but were identified in some of the literature as potentially impacting adolescent substance use and mental health problems.

Self-efficacy

Self-efficacy may act as a protective factor that reduces the impact of other risk factors on the development of a co-occurring MHD. One type of self-efficacy is how capable an adolescent feels they are to avoid using substances in certain situations. Epstein and colleagues (2007) found that an adolescent's refusal assertiveness affected the impact of peer use on the adolescent's use. That is, adolescents who were less able to be assertive in refusing substances were more likely to be influenced to use substances by their substance using peers.

While self-efficacy to avoid using is likely an important factor in adolescent MHDs and SUDs, the GAIN instrument does include precise measures of self-efficacy. The self-efficacy questions included in the GAIN assess different situations where the adolescent thinks he or she could avoid using and the strength self-efficacy index assesses different areas that the adolescent feels are his or her strength. I decided not to include these measures because they do not seem to address the concept of self-efficacy as it was described in the literature.

Stress or Stressors

Other literature has discussed stress and stressors. Kuperman and colleagues (2005) found that the children of alcoholics had significantly more stressors than children whose parents were not alcoholics. Furthermore, when compared to the comparison group, the children of alcoholics scored higher on both externalizing and internalizing behavior problems and were more likely to have tried marijuana. Barrett and Turner (2006) found that an important factor in the final model predicting substance use problems among adolescents was differences in exposures to stressors.

Dawson, Grant, and Li (2007) used wave 1 of the NESARC data set to examine whether an earlier age at first drink affected the amount of alcohol consumed in response to stress when compared to those with a later age at first drink. Additionally, the researchers examined whether these effects remain after adjusting for confounding effects of gender, family history, co-occurring psychological problems, other substance use, and the interactions between these variables and level of stress. The researchers asked participants about 12 different stressors including death of a family member or close friend, illness of a family member of close friend, change in living situation, problems at work, and disruption of a romantic relationship. The researchers used a count of the number of stressful events to create a continuous measure of stress.

I decided not to include a variable for stress or stressors because the GAIN only asks about an adolescent's exposure to certain stressors and does not assess for their reaction or their experience of stress in response to these events.

Control Variables

A number of control variables will be used in the study. These variables that have been identified in the literature will be briefly discussed in this section. The relationships between and among these variables are complex. The specific contribution of each variable individually is not well understood.

Family Resources

Family resources may affect adolescent substance use and mental health in a variety of ways. Several ways in which family resources may affect adolescent substance use and mental health are examined next.

Low SES

Adolescents who live in poorer households may be more vulnerable to developing substance use problems and a MHD. Researchers have found some associations between a low SES and adolescent substance use and mental health. For example, researchers in Finland found that adolescents with co-occurring ADHD and SUD were less likely to live in a family where the parents were married and more likely to live in a low-income family (Hurtig et al., 2007).

Furthermore, there is also a relationship between the SES and other family factors. Barrett and Turner (2006) found that mother and father families and step-parent families had a significantly higher SES than single parent families. The impact of family structure on adolescent substance use and mental health will be examined in more detail in the next section.

Family Structure

Adolescents who live in a single parent home may be more at risk of experiencing a SUD and MHD than adolescents who live in a two-parent home. Some researchers have looked at family structure and how it relates to substance use problems. Swift, Coffey, Carlin, Degenhardt, and Patton (2008) found that cannabis use was more common among participants with divorced or separated parents than among participants from two parent homes. Goldstein and his colleagues (2008) found that adolescents who had both a SUD and bipolar disorder were less likely to live in a two-parent home than those adolescents with bipolar disorder only. In the three studies just described, the researchers did not hypothesize about why participants from single-parent homes were more likely to use

substances and have substance use problems. Thus, as with SES, it remains unclear whether the association between substance use and family structure is due to more exposure to stress, less supervision, or some other reason.

Others have attempted to examine how single parent and other family types differed on a number of characteristics (Barrett & Turner, 2006; Griffin, Botvin, Scheir, Diaz, & Miller, 2000). Griffin and colleagues (2000) assessed family structure and parenting practices among 228 sixth graders and their parents. The researchers found that adolescents from single parent homes engaged in more problem behaviors including alcohol use. However, the researchers did not find any relation between parenting practices and family structure.

Barrett and Turner (2006) addressed family structure in a sample of 1760 Cuban, Caribbean-born Hispanic, African Americans, and Caucasian young adults. The sample was approximately 25% each race/ethnic group and 50% male. The researchers interviewed the young adults and at least one parent about substance use, SES, and living situation. Barrett and Turner identified four family types, mother and father present, single parent, single parent with an extended family member present, and families with a step-parent. Young adults with mother and father families reported lower substance use by family, and lower parental approval of substance use. Thus, this study demonstrated that family type reflects the distribution of factors that may influence risk for substance use. However, it must be noted that these family types and their relation to risk factors may vary depending on race and ethnicity.

The effect of the differences in family structure identified in the study by Barrett and Turner (2006) may fit with the theories being used for this study. According to social learning theory, adolescents model parental substance use. Therefore, if adolescents who grow up in two parent families are less likely to be exposed to substance use, they will be less likely to model this behavior. Moreover, if parents are modeling alternative ways of handling stress and mental health problems, then adolescents may be less likely to use

substances as a way to relax or deal with problems. Although the studies reviewed in this section suggest that family structure may play an important role in adolescent SUDs and MHDs, it remain unclear exactly how family structure affects adolescent problems.

Gender

Gender may also influence mental health problems and SUDs. Kandel and Chen (2000) found that among cannabis users, males were more likely than females to start using earlier and were more likely to report heavy use of cannabis. Swift and colleagues (2008) found in a group of adolescents followed longitudinally from age 14 to 24, that cannabis use was more common among males than females. Additionally, the researchers found that males were at a greater risk than females of developing problematic cannabis use outcomes, like dependence or daily use, by age 24.

Researchers found that among adolescents with depression, male gender was a significant predictor of problem alcohol use (Goldstein et al., 2007). In another study, researchers found that among adolescents with alcohol abuse or dependence who have a co-occurring MHD, females are at a greater risk of having a mood disorder than males (Roberts et al., 2006). In contrast, males with alcohol abuse, marijuana dependence, any substance abuse, and any substance dependence are more likely to have a co-occurring conduct disorder or oppositional defiant disorder. Researchers found have also found that boys engaged in more problem behaviors than girls (Griffin et al., 2000). Couwenbergh and her colleagues (2006) found that boys were more likely to have externalizing problems and girls were more likely to have internalizing problems.

Age

Chan and colleagues (2008) found that among adults and adolescents presenting for SUD treatment, the rate of internalizing problems increased with age and the rate of externalizing problems decreased with age. The researchers also found that greater than 40% of adolescents and young adults endorsed symptoms for both internalizing and

externalizing problems. Researchers have found that alcohol and substance use and problems with use generally increase with age (Epstein et al., 2007; Goldstein et al., 2007).

Research Questions and Hypotheses

Based on this literature, the following research questions and hypotheses were formulated to guide the conduct of this study.

RQ1. Among adolescents who use substances, how is the severity of the SUD related to having a MHP?

H1. Adolescents who meet criteria for dependence will be more likely to have a co-occurring MHP than adolescents who meet criteria for abuse or use.

H2. Adolescents who report symptoms of tolerance and withdrawal will be more likely to have a co-occurring MHP than adolescents who do not report symptoms of tolerance and withdrawal.

H3. Adolescents' internalizing disorders and externalizing disorders will co-occur.

H4. Adolescents who meet criteria for dependence will be more likely to have an internalizing disorder than adolescents who meet criteria for use or abuse.

RQ2. Among adolescents who use substances, how is age at first use related to having a MHP?

H5. Adolescents with a younger age of first use will be more likely to have mental health problems.

H6. Severity will mediate the relation between age at first use and having a MHP.

RQ3. Among adolescents who use substances, how is the type of substance use related to having a MHP?

H7. Adolescents who use substances other than alcohol will be more likely to have mental health problems.

H8. Severity will mediate the relation between type of substance and having a MHP.

RQ4. Among adolescents who use substances, how are the behaviors of peers related to having a MHP?

H9. Adolescents who have more peers who participate in deviant activities will have more severe substance use problems

H10. Adolescents who have more peers who participate in deviant activities will be more likely to have a MHP.

H11. Adolescents who have more peers who participate in deviant activities will be more likely to have an externalizing disorder than an internalizing disorder.

H12. Severity will mediate the relation between number of deviant peers and having a MHP.

RQ5. Among adolescents who use substances, how are the behaviors of family members related to having a MHP?

H13. Adolescents who have more family members who participate in deviant activities will have more severe substance use problems

H14. Adolescents who have more family members who participate in deviant activities will be more likely to have a MHP.

H15. Severity will mediate the relation between number of deviant family members and having a MH

CHAPTER 3: METHOD

Design

This study was a secondary analysis of cross-sectional data from the longitudinal study, Strengthening Communities for Youth (SCY) Iowa City project site. The purpose of the longitudinal SCY study was to compare two types of substance use disorder treatments for adolescents. James A. Hall[1] was the principal investigator and the study was funded by Center for Substance Abuse Treatment [CSAT] from March 1, 2002 to August 31, 2007 (grant TI13354). Participants for the SCY study were recruited from the Adolescent Health and Resource Center (AHRC), which was a central site that provided assessment, treatment, and limited health services for adolescents in Eastern Iowa. The adolescents seen at the AHRC completed an initial intake assessment with the Global Appraisal of Individual Needs- Intake Version (GAIN-I; Dennis, 1998) and a follow-up appointment that included referrals to treatment as needed. Extended outpatient and intensive outpatient substance use disorder treatment were also offered at AHRC.

The data for this secondary analysis were gathered during the initial assessment. This data set was selected because it contained data on a large number of adolescents with varying levels of substance use problems. The variability in problem levels allowed me to analyze how certain characteristics of substance use are related to mental health problems. Furthermore, the data collection instrument, the GAIN-I, is a semi-structured comprehensive assessment conducted by trained interviewers that provides information on a variety of areas including mental health, substance use, and the environment. In this section, I will first describe the original SCY study then describe the procedures used for the secondary analysis of the data.

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[1] At the time this study was conducted, James A. Hall was a professor in the School of Social Work, Department of Pediatrics, and School of Nursing at the University of Iowa. Presently, Dr. Hall is the dean and professor at the University of Alabama School of Social Work.

Project Iowa SCY

The AHRC was a centralized site that housed a variety of health and social services for adolescents and their families. The primary purpose of the AHRC was to improve the community's response to adolescent substance use through prevention, early intervention, and treatment. The services included assessment, substance use disorder treatment, physical health services, and psychological testing. When the AHRC was being developed, the principal investigator and research assistants contacted local agencies that might encounter adolescents in need of substance use disorder treatment services and other social services. The agencies included juvenile court officers in Johnson, Iowa, and Cedar Counties; principals and counselors at junior highs and high schools in those counties; counselors in private practice and counselors affiliated with the University of Iowa Hospital and Clinics; medical professionals at the University of Iowa Hospitals and Clinics; and youth agencies including United Action for Youth. Information about AHRC was also posted on a web page accessible through the University of Iowa home page. In addition, the Crisis Center of Johnson County, which provides referrals for social services in Johnson County, was notified of the services available at AHRC and provided referrals to callers.

Sampling Procedure for the Secondary Data Analysis

Selection Criteria

As mentioned previously, this study was a secondary analysis of cross-sectional data collected from the longitudinal SCY study at the Iowa City project site. The sample for the secondary analysis will be limited to adolescents and their parents who were referred to the AHRC by one of the referral sources previously mentioned. Thus, adolescents who had used substances but had not had legal trouble or caused concern with their doctor, parents, or another agency would probably not have been referred to the AHRC. Some participants in the SCY study were in detention when the data were

collected. However, towards the end of the SCY study, the University of Iowa Institutional Review Board (IRB) required the researchers to cease collecting data from adolescents who were currently in detention. To be included in the SCY study, parents needed to consent and adolescents assented to complete the GAIN-I, which was the primary data collection instrument. Thus, if an adolescent and parent scheduled an appointment and did not show up for the appointment or refused to sign consent for the GAIN-I, they were not included in the SCY sample or the secondary analysis.

Sample Characteristics

The total number of adolescents who completed a GAIN-I was 881. Fifty-six percent of participants assessed were male. The participants' ages ranged from 12 to 21 with a mean age of 16.07 years. The adolescents could report more than one race or ethnicity. The majority of the adolescents endorsed that they were white or Caucasian (83.8%). The remaining adolescents endorsed that they were African American or black (10.7%), Hispanic, Latino, or Chicano (8.2%), and other races or ethnicities (8.8%).

Selection Criteria for the Secondary Data Analysis

The selection criteria for this secondary analysis included:

1. Adolescents aged 12-19.

   Two participants were over the age of 19 at the time they were assessed with the GAIN-I and excluded from the analysis. They were excluded due to their developmental stage. The problems of adolescents age 20 and older may be different from adolescents aged 12-19.
2. Adolescents who completed a GAIN-I and who reported using substances at least once in the past 12 months.

Forty-one participants did not report substance use in the last 12 months and were removed. Alternative inclusion criteria were considered but not accepted. The alternative inclusion criteria included the following:

- Including all adolescents with GAIN-I responses who met criteria for substance abuse or substance dependence. Using these criteria might have resulted in an overlap in the independent variable. That is, including abuse or dependence criteria as inclusion criteria would have made it impossible to examine those symptoms as factors associated with having a mental health disorder. Thus, the decision was made to define the sample using substance use in the past 12 months.
- Including those who used in the past 90 days would have excluded those adolescents who use substances, but for some reason, have not used in the recent past. Including those who reported using in their lifetime was also rejected.

Using these criteria, and after excluding missing data (described below), the final sample consisted of 801 cases, 95.4% of the total cases. The demographics of the final sample used in the analysis are displayed in Table 1. The mean age was 16.18. The sample included more males (63.2%) than females and a majority of Caucasian adolescents (85.8%). Most adolescents did not report being low social economic status (97.9%). The majority of adolescents reported living in a situation other than their parents living together (63.3%).

Table 1. Demographic Characteristics (N=801)

Variable	Percent	Mean
Age		16.18 (SD=1.18)
Gender		
Male	63.2	
Female	36.8	
Race and/or Ethnicities		
Caucasian	85.8	
African American	9.4	
Hispanic or Latino/a	6.1	
Other	8.4	
Low Social Economic Status		
Yes	2.1	
No	97.9	
Family Structure		
Parents Living Together	36.7	
All Other Living Situations	63.3	

Note: Participants could report more than one race

Generalizability

To determine whether the participants in the original SCY study are similar to other adolescents, I compared use among participants in this sample to data obtained from studies with adolescents in the United States, Iowa, and selected counties in Iowa. See Table 2 for a comparison of these data.

Adolescents assessed at the AHRC generally reported using at higher levels than adolescents who completed national and state questionnaires. The Monitoring the Future Survey (Johnston et al., 2008) is a survey of 50,000 8th, 10th, and 12th graders from 400 school districts in the United States. Although the results of this survey do not include adolescents not enrolled in school or adolescents who did not attend school the day of the

survey, the results do provide a view of what substance use looks like among adolescents nationwide. Compared to adolescents in this national school based study, more males and females reported having used alcohol in each grade level. Reports of illicit substance use were also much higher in the SCY sample than in the national sample.

The Iowa Youth Survey conducts surveys with adolescents in public and private schools in the state of Iowa (Research Institute for Studies in Education, 2006). Data are collected from 6th, 8th, and 10th graders from participating schools. In 2005, the sample for the Iowa Youth Survey consisted of 95,895 public school students and 2,351 private school students. As with the Monitoring the Future study, this study is limited to adolescents enrolled in school and who attended school on the day the survey was administered. Adolescents who are home schooled, have dropped out of school, or who were absent would not have been included in the sample. Unfortunately, the Iowa Youth Survey does not collect data on past year use of substances and instead focuses on use in the past 30 days and lifetime use. Furthermore, the Iowa Youth Survey does not look at substance use by race. Adolescents in the SCY sample also used alcohol and other substances at higher rates than adolescents in the state of Iowa and the counties that the AHRC served.

It is not surprising that adolescents in the SCY sample reported higher levels of use than adolescents in the national and state studies. The national and state studies were administered in the schools, so adolescents who had dropped out or attended alternative schools were not assessed. Furthermore, it would be expected that adolescents who are being referred for an assessment will report more substance use than adolescents in the general population. Thus, the results of this study will not necessarily be generalizable to all adolescents in Iowa or the United States. However, the results will likely be generalizable to adolescents in other areas who have used substances.

The races represented by the SCY sample also differ from the population of Iowa that of Johnson, Cedar, and Iowa counties and the United States. While the majority of

the SCY sample was white, 10.7% of the sample was African American and 8.2% of the sample was Hispanic. Similar differences were found when comparing the SCY sample to the general population (U.S. Census, 2000).

Data Collection Procedures

Data for the SCY study were collected by professionals working at the AHRC. Several BA and MA level research assistants provided the initial assessments and referrals to treatment. The research assistants were also responsible for recruiting eligible adolescents and their parent or parents into the longitudinal study and conducting the follow-up appointments. The research assistants received training and supervision from the MSW level program administrator to become certified in administering the GAIN-I and follow-up GAIN instruments and to ensure inter-rater reliability. The training consisted of presentations on the GAIN instruments and recording mock GAIN interviews that were listened to by the program administrator. The program administrator provided feedback on the taped interview. When the RA became competent in the mock interview, he or she would conduct an interview with a client. These interviews were also recorded (with the client's permission) and assessed by the program administrator. When the RA became competent in administering the GAIN, the program administrator would certify the RA. After becoming certified, the RA would continue to record the interviews for quality assurance purposes. A similar process was followed with training and supervision for providing feedback and referrals to adolescents following the initial interview.

In addition to the RAs, several MA level therapists, also supervised by the program administrator, were employed to provide the substance use disorder treatment. The therapists were contracted through MECCA, a local substance use disorder treatment agency. A pediatrician and a psychologist, employed by the University of Iowa Hospitals

Table 2. Generalizability

	Sample											
Grade Level/Race/ Ethnicity	SCY		Johnson County		Cedar County		Iowa County		State of Iowa		United States	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Ever used alcohol (%)											
6th	0.0	50.0	16.0	8.0	16.0	10.0	11.0	12.0	18.0	11.0		
8th	42.1	66.7	25.0	20.0	25.0	20.0	35.0	37.0	32.0	31.0	30.9	32.7
10th	90.2	92.3									54.4	58.2
11th	97.7	97.8	58.0	65.0	59.0	63.0	68.0	64.0	67.0	67.0		
12th	97.1	100.0									66.2	66.1
	Ever used Illicit Drugs (%)											
6th	0.0	0.0	6.0	3.0	5.0	3.0	5.0	2.0	7.0	5.0		
8th	63.2	40.0	9.0	10.0	8.0	9.0	9.0	12.0	13.0	14.0	13.2	12.9
10th	77.2	69.2									29.5	26.7
11th	80.3	71.1	38.0	31.0	36.0	21.0	37.0	22.0	36.0	32.0		
12th	60.0	66.2									38.4	33.2
White	83.8		77.0		93.0		91.0		84.0		75.1	
Afr. Am.	10.7		7.0		1.0		1.0		3.0		12.3	
Hispanic	8.2		4.0		1.0		2.0		4.0		12.5	

and Clinics, were contracted to work at AHRC one day a week to provide assessment and treatment for adolescents who did not have insurance.

Initial Assessment

When an adolescent received a referral for an assessment from one of the agencies previously described, the adolescent or a guardian called to make an appointment for the initial assessment. The initial appointment consisted of going over a consent form with the parent and adolescent, obtaining consent from the parent and assent from the adolescent, completing the GAIN-I with the adolescent, and collecting a urine analysis from the adolescent. The initial appointment lasted between one and three hours with most appointments lasting an hour and a half to two hours.

The GAIN-I assesses seven areas of life including background, substance use, physical health, risk behaviors, environment, legal, and vocation. The administration of the GAIN-I took from one to three hours to complete with most assessments taking one hour.

During the initial appointment, the research assistant first met with the adolescent and the parent. While both the adolescent and the parent were in the room, the research assistant described the assessment process and obtained consent from both the parent and the adolescent to participate in the study. Following the informed consent process, the parent was taken to a separate room where the research assistant instructed the parent on how to complete the collateral form of the Global Appraisal of Individual Needs (GAIN-CI). This questionnaire consisted of questions almost identical to those that the adolescent would be answering and allowed the parent to provide his or her view on the teen's behaviors.

Once the parent was set up to complete the GAIN-CI, the research assistant returned to the adolescent and began the interview. The GAIN-I was typically completed using a computer but could also be completed using a paper version that was later entered

into the computer. During the intake appointment, a urine sample for a urine analysis (UA) was also obtained. When the adolescent had completed his or her interview and the parent had completed his or her questionnaire, the research assistant answered questions and then scheduled a follow-up appointment for the family. The follow-up appointment was typically scheduled one to two weeks after the initial assessment. This allowed time for the UA results to be returned to the center.

During the initial GAIN-I interview, research assistants entered data directly into a computer program that had been developed specifically for the GAIN instruments. More information on this computer program is available at www.chestnut.org. When the interview was complete, the research assistant uploaded the case into a shared storage space. Data from this shared storage space were sent to Chestnut data management services for cleaning and for transfer into SPSS files. The cleaned SPSS files were then returned to the data manager housed at AHRC. All data for this secondary analysis were taken from the initial GAIN interviews with the adolescents.

Procedures for Protection of Human Subjects

The University of Iowa IRB approved the Iowa City SCY procedures. This secondary analysis was also approved by the University of Iowa IRB. The analysis of the data was not started until IRB approval was received. I have signed a General Data License Agreement and received approval to access these data from the PIs James A. Hall and John Knutson. For this study, I retrieved the GAIN data set from shared database stored at the central research office. The SPSS data set was transferred to a password protected portable disk and a password protected storage space provided by the University of Iowa.

All data were de-identified before being provided to this researcher. Because this is a secondary analysis of de-identified data, the risks to the subjects who completed GAIN-Is are minimal. This researcher does not have access to the master file that

contains the names and other identifying information on the participants. These data will not be accessed by anyone other than this researcher and members of the dissertation committee for purposes of assistance with data analysis. The data were stored using a password-protected computer file on computers or storage devices kept in locked offices on campus. Only this researcher has access to the password.

There will be no direct benefits to the original participants in this study. However, the analysis of this data may help adolescents in the future. By understanding which factors are associated with co-occurring substance use and mental health problems, treatment providers may be able to better plan intervention that are beneficial to adolescents who suffer from both of these problems.

Measures

The measures used to test the hypotheses are described next. All measures used were developed based on the literature. The GAIN-I is a standardized bio-psychological measure with eight sections (Dennis, Chan, & Funk, 2006). These sections include background, substance use, physical health, risk behaviors, mental health, environment, legal, and vocational. All measures for this analysis will be obtained from baseline (initial) GAIN-I data.

In this section, the dependent variable is described first, followed by the independent variables, and then the control variables. Table 3 provides an overview of the dependent, independent, and control variables. A detailed description of the measures is provided in Appendix C.

Table 3. Variables

Type of Variable	Name	Responses	Level of Measurement
Dependent	Mental Health Problems (categorical)	Yes, No	Nominal
	Mental Health Problems (continuous)	Score on scale	Scale
	Type of Mental Health Problem	No disorder, internalizing only, externalizing only, both internalizing and externalizing	Nominal
Independent	Severity of Substance Use Disorder (categorical)	Use, abuse, dependence without withdrawal symptoms, dependence with withdrawal symptoms	Ordinal
	Severity of Substance Use Disorder (continuous)	Score on scale	Scale
	Age at first use	Reported age	Scale
	Type of Substance used	Alcohol only, marijuana with or without alcohol, other illicit drugs	Ordinal
	Deviant Behaviors by Peers	Score on scale	Scale
	Deviant Behaviors by Family	Score on scale	Scale
Control	Age	Current age	Scale
	Gender	Male, female	Nominal
	Low SES	Yes, no	Nominal
	Family structure	Parents living together, other living situation	Nominal

Dependent Variable

Mental Health Problems

The dependent variable, mental health problems (MHP), was modeled in two different ways. The first model included a dichotomous measure of MHPs. In model 1, meeting GAIN-I diagnostic criteria for depression, anxiety, traumatic stress, ADHD, or conduct disorder in the past 12 months was categorized as having a MHP.

The measures on the GAIN-I for MHPs included the somatic symptom index (4 items, Alpha=0.66), depressive symptom index (9 items, Alpha=0.82), the anxiety symptom index (12 items, Alpha=0.83), traumatic stress index (13 items, Alpha=0.92), ADHD index (18 items, Alpha=0.93), inattentive disorder index (9 items, Alpha=0.92), hyperactivity-impulsivity index (9 items, Alpha= 0.86), and conduct disorder index (15 items, Alpha=0.85). Dennis, Chan, and Funk (2006) reported that the internal consistency for these indices was good (alpha over .70) and that the test-retest reliability was good (over 1-3 days, Rho over .79 on problem counts, Kappa over .60 on categorical measures).

A subset of items from each scale can be used to indicate each MHP or disorder. For example, a subset of items from the somatic symptom index and depressive symptom index were used to indicate depression. The questions for depression on the GAIN-I ask the adolescent to indicate whether or not they have had various symptoms in the past 12 months. To meet criteria for depression, an adolescent must report 5 or more of the following symptoms related to depression: feeling trapped, lonely, sad, blue, depressed or hopeless about the future; or feeling easily irritated, or having trouble controlling your temper; or losing interest or pleasure in work, school, friends, sex, or other things you cared about.

In order to test some of the hypotheses proposed, it was necessary to further categorize the MHPs into externalizing disorders, internalizing disorders, and a combined

group. For these hypotheses, adolescents who met criteria for ADHD or conduct disorder and who did not meet criteria for an internalizing disorder were categorized as having an externalizing disorder only. Adolescents who met criteria for traumatic stress, depression, or anxiety and who did not meet criteria for an externalizing disorder, were categorized as having an internalizing disorder only. Adolescents who met criteria for both an internalizing disorder and an externalizing disorder were categorized as a combined group.

The second model of MHPs used a continuous measure. The continuous measure was based on the Internal Mental Distress Scale and the Behavioral Complexity Scale (Dennis et al., 2006) which each includes a number of subscales. The Internal Mental Distress Scale includes a count of the mental health symptoms and includes the traumatic stress symptoms, somatic symptoms, depression, anxiety, and suicidal thoughts (Dennis et al., 2006). The theoretical range of the scale is 0-43 and higher scores indicate higher levels of internal mental distress. The scale has good internal consistency (alpha=0.94 with adolescents). The behavioral complexity scale includes a count for the symptoms of ADHD and conduct disorder (Dennis et al., 2006). The theoretical range of this scale is 0-33 and higher scores indicate more problems controlling behaviors. This scale also has good internal consistency (alpha=0.94). On each of these scales, higher scores indicate higher severity. In this study, the count of symptoms from both scales was combined to create one continuous measure of MHP severity. Thus, the theoretical range for the combined scales was 0-76.

The purpose of modeling the MHPs in two different ways was to understand whether the way the MHP is measured affects the number of adolescents who would be considered as having a MHP. For example, some research has shown that adults who have 4 out of 5 criteria for a MHP may not be different from adults who meet the full criteria for a disorder (Goldstein et al., 2007; Norman, Tate, Anderson, & Brown, 2007). Thus, in some studies, people with 4 out of the needed 5 symptoms are categorized as not

having a disorder while people with 5 or more symptoms are categorized as having the disorder. If the adults are really not that different in terms of severity and related problems, then the way people are grouped may impact the results of the study. That is, if many people in the group without the disorder actually have symptoms of the disorder and problems related to those symptoms, they may not look very different on outcomes when compared to the group categorized as having the disorder. Based on the implications of the adult literature on continuous versus categorical measures, I included a continuous measure in my analysis in order to understand whether the measurement criterion has an effect when studying adolescents.

Independent Variables

The independent variables used to address the research questions were severity of the substance use disorder, age at first use, type of substance, deviant behaviors by peers, and deviant behaviors by family.

Severity of the Substance Use Disorder

The severity of substance use problems may impact whether an adolescent has MHPs. However, it is not clear whether abuse is an important factor or whether only adolescents with dependence are at risk of having co-occurring MHPs. Further, the literature does not indicate whether certain symptoms associated with dependence, like withdrawal or tolerance, affect an adolescent's having MHPs more than other symptoms. Therefore, a measure to indicate the severity of problems an adolescent is experiencing with substances was included. Severity of substance use will be treated as an ordinal variable with categories ranging from 0-3. Participants were grouped as use only (0), abuse (1), dependence without tolerance and withdrawal (2), and dependence with tolerance and withdrawal (3). Adolescents were assigned to a group based on their responses to items on the GAIN.

The GAIN measures substance abuse, dependence, tolerance, and withdrawal with a series of sub-scales. Adolescents are asked to indicate the last time they experienced DSM-IV-TR symptoms of dependence and abuse. Adolescents respond with the most recent time period they had experienced each symptom. These time periods include the past month, 2-12 months ago, over a year ago, and never. I will examine the abuse and dependence symptoms which the adolescent reports experiencing within the past year.

Substance abuse will be measured using four items from the Substance Abuse Index-Past Year. These four items are based on the four DSM-IV-TR symptoms of substance abuse and have good internal consistency (alpha=.70; Dennis, Dwaud-Noursi, Muck, & McDermeit, 2003). To determine how to categorize the substance use severity of each participant, adolescents were asked the last time that alcohol or substance use caused them to not meet obligations, they used in dangerous situations, they experienced repeated legal problems, or they experienced social or relationship problems. Adolescents responded with the last time they had this problem. Responses include past month, 2-12 months, over a year, or never. Adolescents who reported one or more symptoms of abuse in the past month or two to twelve months met criteria for abuse. As long as they did not meet criteria for dependence, the adolescents were categorized as having substance abuse (*abuse*=1). These criteria were based on the DSM-IV-TR.

Substance dependence was determined by responses to seven items from the Substance Dependence Scale-Past Year. These seven items are based on the seven DSM-IV-TR symptoms of substance dependence and have good internal consistency (alpha=.83; Dennis et al., 2003). Adolescents who report three or more symptoms of dependence would be categorized as having substance dependence. These criteria were also based on the DSM-IV-TR.

The dependence symptoms in the GAIN include the following:

1. you used alcohol or drugs in larger amounts, more often or for a longer time than you meant to;
2. you were unable to cut down or stop using alcohol or drugs;
3. you spent a lot of time either getting alcohol or drugs, using alcohol or drugs, or feeling the effects of alcohol or drugs (high, sick);
4. your use of alcohol or drugs caused you to give up, reduce or have problems at important activities at work, school, home or social events;
5. you kept using alcohol or other drugs even after you knew it was causing or adding to medical, psychological or emotional problems you were having;
6. needing more alcohol or drugs to get the same high or found that the same amount did not get you as high as it used to;
7. you had withdrawal problems from alcohol or drugs like shaking hands, throwing up, having trouble sitting or sleeping, or that you used any alcohol or drugs to stop being sick or avoid withdrawal problem.

Because it is not clear from the literature (Abrantes et al., 2003; Saha et al., 2006) whether certain symptoms of dependence are more strongly related to having MHPs, I will deconstruct substance dependence. Therefore, I will analyze some of the symptoms of dependence separately. Adolescents who report one or both of the following symptoms will be categorized as having tolerance/withdrawal.

6. needing more alcohol or drugs to get the same high or found that the same amount did not get you as high as it used to;
7. you had withdrawal problems from alcohol or drugs like shaking hands, throwing up, having trouble sitting or sleeping, or that you used any alcohol or drugs to stop being sick or avoid withdrawal problem.

Thus, adolescents who meet criteria for dependence, but do not report symptoms of tolerance or withdrawal, will be categorized as having dependence without tolerance or withdrawal (*dependence without* =2). Adolescents who meet criteria for dependence

and report either tolerance and/or withdrawal will be categorized as having dependence with tolerance or withdrawal (*dependence with* =3).

In order to include the ordinal measure of severity in a linear regression model, dummy variables were created to represent each category of severity. These dummy variables were coded as D1=use, D2=abuse, D3= dependence without, D4=dependence with. Each case was coded appropriately and the necessary dummy variables were included in the linear model.

As described in the dependent measure (MHP) section, much of the literature on substance use disorders focuses on a categorical measure of substance use problems. Because I am interested in those people who may have two but not all three of the symptoms of dependence, I have included an alternative, continuous way to measure the severity of substance use problems. That measure is described next.

Alternative Measure for Severity of SUD

Although certain symptoms of dependence may be related to having a MHP among adolescents, it may also be that adolescents with more symptoms of abuse and dependence are more likely to have a MHP. That is, adolescents with more symptoms are at a greater risk of having a MHP than adolescents who simply meet criteria for dependence. To assess for the severity of substance use problems the *Substance Problem Index-Past Year and Substance Problem Index-Past Month* were used. The Substance Problem Index- past year has high internal consistency (alpha of 0.90 with adolescents) (Dennis et al., 2006).

These scales consist of a count of the number of problems related to substance use that a client endorses having in the past month, two to twelve months ago, over a year ago, or never. These substance problems found on the Substance Problem Index include DSM-IV symptoms of abuse and dependence. In addition, the scale includes questions about substance issues such as hiding use, people complaining about use, weekly use, and

having health or psychological problems related to substance use. Adolescents who report having a problem either in the past month or past two to twelve months will be counted as having that problem. This will create a continuous measure. The number of problems reported on these 16 items will be used as a severity score. Higher scores will indicate more severe substance use problems.

This alternative measure of severity will be entered into the model after the effects of the ordinal measure of severity are assessed. The measure that explains the most variance in MHPs will be included in the following steps of the analysis. More details on this process will be described in the data analysis section.

Age at First Use

The age at first use of substances may be related to having MHPs (Brook et al., 2002; Dawson et al., 2000). This will be assessed by the question "How old were you when you first got drunk or used any drugs?" This continuous measure allowed me to examine the relationship between an earlier age at first use, severity, and MHPs among adolescents.

Type of Substance

The type of substance an adolescent uses may be related to an adolescent's MHPs (Arseneault et al., 2002; Arseneault et al., 2004; Bonn-Miller et al., 2007). The types of substances an adolescent reports using will be assessed by the question "when was the last time (if ever) you used…" This question then goes through a list of 13 different types of drugs. The adolescent responds by reporting the last time he or she used that drug. Response choices include 1-2 days ago, 3-7 days ago, 1-4 weeks ago, 1-3 months ago, 4-12 months ago, over a year ago, or never. Because the results of some of the studies in the literature indicated that adolescents who use marijuana or other illicit drugs may be more likely to have MHPs (Arseneault et al., 2002; Arseneault et al., 2004; Bonn-Miller et al., 2007), a variable was created to test this. Adolescents who report ever using any

substances other than alcohol will be categorized accordingly as having used marijuana only or other illicit drugs. I considered only categorizing adolescents who had used a substance in the past 12 months. However, it may be that there is something different about adolescents who try illicit substances other than marijuana. For example, using other illicit substances may be related to impulsivity (Grunebaum et al., 2006; Miller, Vogt, Mozley, Kaloupek, & Keane, 2006; Shipherd, Stafford, & Tanner, 2005). Therefore, I decided to categorize adolescents based on their having used certain substances in their lifetime.

Adolescents will be coded as having used alcohol only, marijuana only or marijuana and alcohol, and other illicit drugs. It was decided to include marijuana as a separate category, because several articles (Arseneault et al., 2002; Arseneault et al., 2004; Bonn-Miller et al., 2007) addressed the possible effects of marijuana use. Therefore, this will be an ordinal variable (*alcohol only*=0, *marijuana with or without alcohol*=1, *other illicit drugs*=2). In order to include the ordinal measure of type of substance used in a linear regression model, dummy variables were created to represent each category of substance type. These dummy variables were coded as T1=alcohol only, T2= marijuana with or without alcohol, and T3= other illicit drugs. Each case was coded appropriately for these dummy variables and the appropriate dummy variables were included in the linear model.

Deviant Behaviors by Peers and Family

These measures identify the impact of persons in the adolescent's environment who could make a difference in the adolescent's use of alcohol and other drugs. Adolescents who spend more time with people who use substances may be at a greater risk of using substances and developing substance use problems. The GAIN-I includes the *Environmental Risk Scale* that measures the amount of time that an adolescent spends with people who use substances or who are involved in other deviant activities. The

Environmental Risk Scale is comprised of three sub-scales: the *Living Risk Index,* the *Vocational Risk Index,* and the *Social Risk Index*. The subscales indicate the number of people the adolescent lives, works, goes to school with, or associates with during free time who are involved in school, training, illegal activities, arguing, fighting, using substances, are in treatment, or are in recovery. Each subscale is summative, consists of 7 items, and scores can range from 0-28. Thus, the Environmental Risk Scale collectively consists of 21 items and scores can range from 0-84. A continuous measure is created and higher scores indicate more time spent with people using alcohol, drugs, involved in illegal activity, who argue, and who are not in school or work. Internal consistency for the environmental risk scale at baseline is 0.63 (Dennis, Rourke, Lennox, Campbell, & Caddell, 1995). The entire Environmental Risk Scale was used to measure the impact of deviant behaviors by peers and family in this study.

On the *Living Risk Index* adolescents first report the number of people with whom they normally live. They then use the response choices, *none*, *a few*, *some*, *most*, or *all* to report the number of people with whom they live who are involved in each activity. Four items are considered risk items. These include having people with whom an adolescent lives who were involved in illegal activity, weekly got drunk or had 5 or more drinks in a day, used any drugs during the past 90 days, and shouted, argued, and fought most weeks. These items are coded as follows: *none*=0, *a few*=1, *some*=2, *most*=3, *all*=4.

Three items are considered protective items on the GAIN-I. These are having people with whom an adolescent lives, works, or is in school or training full-time, have ever been in drug or alcohol treatment, and would describe themselves as being in recovery. These items are coded as follows: *none*=4, *a few*=3, *some*=2, *most*=1, *all*=0. Because I want to understand how spending time with people who use substances is related to the adolescent's substance use and MHPs, I chose to code only the variable about the number of people with whom an adolescent lives who are employed or in school or training full-time as a protective item (*none*=4, *a few*=3, *some*=2, *most*=1,

all=0). Thus, the items about people who have been in alcohol or drug treatment and about the number of people who would describe themselves as being in recovery were coded as risk items (*none*=0, *a few*=1, *some*=2, *most*=3, *all*=4). Therefore, for the purposes of this analysis, higher scores on the Living Risk Index indicated more people with whom an adolescent lives who are involved in alcohol or other substance use.

The Vocational Risk Index asks about how many people the participant attends school with or works with who attend school, attend a job, are involved with illegal activities, use substances, have been in treatment, or are in recovery. The Social Risk Index asks about how many people the participant regularly socializes with or hangs out with who attend school, attend a job, are involved with illegal activities, use substances, have been in treatment, or are in recovery. The response choices for the Vocational Risk Index and the Social Risk Index are identical to the Living Risk Index and coded in the same way. For the purpose of this analysis, the Vocational Risk Index and the Social Risk Index were combined to create a composite measure called *Deviant Behaviors by Peers*.

The indices from the Environmental Risk Scale were included because they provide a measure of environmental influences from friends, peers, and family. Further, each index asks about a number of deviant behaviors that may have an effect on adolescent substance use and mental health.

Control Variables

Gender and Age

Gender and age may also have an impact of substance use and mental health. Males are more likely to report symptoms of abuse, although females are more likely to report symptoms of dependence and mental health symptoms (Kandel & Chen, 2000; Goldstein et al., 2007; Roberts et al., 2006; Swift et al., 2008). Similarly, one would expect substance use and substance use problems to increase as age increases (Chan et

al., 2008; Epstein et al., 2007). Thus, these variables will be accounted for in the data analysis.

Low SES

The literature suggests that adolescents who are from low-income families may be at a greater risk of having a co-occurring MHP (Chan et al., 2008; Epstein et al., 2007; Goldstein et al., 2007). This will be measured using the question, "during the past 90 days, about how much did you receive all together from each of the following sources?" Response choices include wages from a job, money from family, alimony or child support, disability pay such as SSDI, unemployment compensation, and welfare or public assistance programs such as TANF, food stamps, or housing assistance. Because a more reliable measure of income is not available in the GAIN-I, this question is being used as a proxy for Low SES. This will be coded categorically (*Low SES*=1, *Not Low SES*=0). It should be noted that adolescents who responded to this question may not have known whether their family receives assistance. I considered using a question that asks the participant to report the number of people in their household and the amount of money made by everyone in the household together in the past 90 days to create an index of poverty. However a large number of participants reported that they did not know how much their family made in the past 90 days.

Family Structure

Family structure may affect MHPs in adolescents. Adolescents who live with a single parent may be more at risk of having a MHP and a SUD disorder (Barrett and Turner, 2006; Goldstein et al., 2008; Griffin et al., 2000; Hurtig et al., 2007; Swift et al., 2008.). Family structure will be measured using a question which asks about the custody arrangement of the adolescent. The choices include parents who live together, parents who are separated but share custody, a single parent, other family members, legally emancipated minor living on own/runaway/County/State, Juvenile or correctional

institution, and some other situation. This measure will be coded as follows, parents living together=0; parents who are separated, a single parent, legally emancipated/runaway/count/state/juvenile or correctional institution, and some other situation=1. While it will not be exactly clear from this question if the adolescent lives in a single parent home, this question provides an acceptable proxy for the living situation.

Data Analysis Procedures

To answer the hypotheses, a series of bivariate and multivariate analyses (using SPSS) were conducted to look at the relationship between each independent variable and the dependent variable. Two types of regression were used to further analyze the data. For the model using a continuous measure of MHPs, linear regression was used. For the model using a dichotomous measure of MHPs, logistic regression was used. Logistic regression was also used to further examine the categories of externalizing and internalizing disorders as part of the dependent variable.

Data Transformations

The data were studied by examining the plot of the data and measures of deviation in order to assure that the assumptions for regression and other statistical tests were not violated. Based on these preliminary analyses of the distributions, the continuous measure of MHPs needed to be transformed due to possible non-normality. The original distribution of the continuous dependent variable is provided in Appendix D-1. The Box-Cox (Box & Cox, 1964) method was used to find the appropriate transformation for the dependent variable. Values of lambda that minimize the RMSE were found. A graph of the RMSE and Lamda is provided in Appendix D-2. The lambda value of 0 was used with the transformation formula below to create a new dependent variable to use in the linear regression model.

The Box-Cox Transformation: $y(\lambda)=\ln(y) \quad \lambda=0$

The distribution of the transformed dependent variable was visually compared to the original dependent variable. A graph of the transformed dependent variable is provided in Appendix D-3. It was determined that this distribution of the transformed dependent variable was normal compared to the original dependent variable. In other words, it was decided that the transformation normalized the distribution of the dependent variable. Therefore, the transformed dependent variable was used in the linear regression models. It should be noted that this transformation of the dependent variable somewhat limits the interpretation of the regression equation. For example, in order to predict a specific person's MHP score, the following formula would need to be used.

Formula for Prediction of y scores: $y=e^{\text{regression equation}}$

Missing Data

Missing data patterns were carefully examined in these data. Based on consultation with committee members, the following approach was used to handle missing data. The dependent variable, continuous MHPs and the transformed variable were missing for 26 cases. The following independent variables were found to have missing values.

1. Deviant Behaviors by Peers was missing data on 52 cases.
2. Deviant Behaviors by Family was missing data on 26 cases.
3. Age of first use was missing data on 51 cases.

When the patterns of missing data were further examined, this researcher found that 39 cases were missing data on two or more variables. Therefore, these 39 cases were coded as missing two or more. This was done by creating a new variable called *Missing Two or More* and this variable was coded dichotomously as missing or not missing two or more variables (0=not missing two or more, 1=missing two or more). These 39 removed cases were then compared to the remaining 801 cases. Using Pearson Chi-square, no significant differences were found on the variables gender, type of substance,

family structure, or low SES. Using independent samples t-tests, no significant differences were found on age, continuous MHPs, the substance use problem scale, age of first use, deviant behaviors by peers, and deviant behaviors by peers. Removing those 39 cases left the remaining missing values.

1. Continuous MHPs was missing 17 cases.
2. Deviant behaviors by peers was missing 16 cases.
3. Deviant behaviors by family was missing 8 cases.
4. Age of first use was missing 44 cases.
5. A total of 85 cases were missing data on one variable.

These 85 cases were compared to the remaining 716 cases without missing data. Pearson Chi-square tests indicated no significant differences between those cases with one missing value and those without missing values on substance use disorder diagnosis, gender, and having a MHP. A significant difference was found on the variable type of substance [$X^2(2, N=801)=16.09, p<0.001$]. Among those with missing data, 44.7% reported using alcohol only, 36.5% reported using marijuana with or without alcohol, and 18.8% reported using other illicit drugs. Among those without missing data, 24.4% reported using alcohol only, 47.8% reported using marijuana with or without alcohol, and 27.8% reported using other illicit drugs. These results may indicate that those in the group with missing data may represent a less severe group of adolescents.

When participants with missing data were compared to participants without missing data on age of first use, the continuous measure of MHPs, deviant behaviors by peers, and the substance problem scale, no significant differences were found. However, the results of a t-test indicated that adolescents without missing data had higher scores on the deviant behaviors by peers (mean=22.90) scale than those without missing data (mean=20.65) [$t(783)=2.87, p=0.004$]. These results may indicate that adolescents with missing data have fewer peers who participated in deviant activities.

Because the group with missing data differed significantly from the group without missing data on two independent variables, it was decided to replace the missing values for these 85 cases. The following paragraphs describe the approach used to replace missing values for each variable.

For the variable age of first use the mean age of use for each age group was used to replace the missing value. For example, for adolescents who report a current age of sixteen, the mean age of first use was 14.1. Thus, the value 14.1 was used to replace the missing values for age of first use for sixteen year olds. Similarly, the mean age of first use for fourteen year olds was 13.09. Therefore, the value 13.09 was used to replace the missing value on age of first use for fourteen year olds. This strategy was used to replace 44 missing values for the variable age of first use.

A similar strategy was used for the variable deviant behaviors by peers. For the variable deviant behaviors by peers, the two scales that make up the variable deviant behaviors by peers were examined. For the 13 cases missing one value on the vocational risk index, the mean for their age category was used to replace the missing score on the vocational risk index. For the 3 cases missing one value on the social risk scale, the mean score for their age category was used to replace the missing score on the social risk index. Using the replaced values for the vocational risk index and the social risk index, a new value for the variable deviant behaviors by peers was calculated for those 16 cases that had missing data on this variable. For the variable deviant behaviors by family, the mean score for each age category was used to replace the missing values for this variable.

Because adolescents who have more substance use problems at a younger age may have more MHPs, the age category strategy for replacing missing values was not used for the continuous mental health variable and the transformed dependent variable. Instead, the mean score for the continuous MHP variable (14.64) was used to replace the 17 missing values.

After removing 39 cases and replacing missing values on 85 cases a final sample size of 801 was achieved.

Bivariate Data Analysis

The bivariate relationships between the dependent variable MHPs and the independent variables (substance use severity, substance problem scale, age of first use, type of substance, deviant behaviors by peers, and deviant behaviors by family) were tested using the Chi-square test for the categorical variables. T-tests and One-way ANOVAs were used to test the relationships for the continuous variables.

Linear and Logistic Regression Models

The linear regression analyses used the transformed continuous dependent variable. The linear regression model identified the effect of the independent variables on the likelihood that the adolescent would have MHPs. The logistic regression analyses used the dichotomous dependent variable. The logistic regression model identified the effect of the independent variables on the likelihood that the adolescent would have MHPs.

The models were built by adding variables in the following order:

1. Dummy variables for the variable severity of the substance use disorder and to determine the amount of variance explained by this categorical variable.
2. The continuous variable substance problems scale. It was determined that the continuous measure of severity of the substance use disorder explained more of the variance in the dependent variable and was retained in the following models. All variables were retained in each step.
3. Age of first use.
4. Type of Substance using the dummy variables.
5. Deviant behaviors by peers.
6. Deviant behaviors by family.

7. The control variables: age, gender, low ses, and family structure

CHAPTER 4: RESULTS

Univariate Results

As demonstrated in Table 4, the results of the data analysis indicate that 49.9% (n=400) of the adolescents in the study met criteria for a MHP. Using the continuous measure of MHPs, participants had a mean score of 14.64 on the scale ranging from 0 to 69. Typically on this scale, a score of 0 to 3 or 4 would indicate low concerns and a score of 5 or more would indicate clinical concerns. Among those who met criteria for a MHP, 4.0% met criteria for an internalizing disorder, 21.1% met criteria for an externalizing disorder, and 24.8% met criteria for both an internalizing and an externalizing disorder.

Most of the participants met criteria for substance use (40.8%). The remaining participants met criteria for abuse (30.2%), dependence without tolerance and withdrawal symptoms (4.2%), and dependence with tolerance and withdrawal symptoms (24.7%). Using the continuous measure of the severity of the substance use disorder, participants had a mean score of 4.41 on the scale ranging from 0 to 16. Typically on this scale, a score of 0 suggests no problems, a score of 1 or more suggests abuse, and a score of 4 or more suggests dependence.

The participants had an average age of first use of 14.23. Most adolescents reported using marijuana with or without alcohol (46.6%). The remaining participants reported using alcohol only (26.6%) and other illicit substances (26.8%).

The participants had a mean score of 9.11 on the deviant behaviors by peers scale. Scores on the deviant behaviors by peers scale ranged from 0 to 56. The participants had a mean score of 2.89 on the deviant behaviors by family scale. Scores on the deviant behaviors by family scale ranged from 0 to 28.

Table 4. Univariate Analyses of Dependent and Independent Variables (N=801)

Variable	Percent	Mean	SD	Minimum	Maximum
Dependent Variable					
Mental Health Problems	50.1				
No Mental Health Problems	49.9				
Continuous Measure of Mental Health Problems		14.64	14.57	0.00	69.00
Type of Mental Health Problem					
No Disorder	50.1				
Internalizing Only	4.0				
Externalizing Only	21.1				
Both Internalizing and Externalizing	24.8				
Severity Variables					
Use	40.8				
Abuse	30.2				
Dependence	4.2				
Dependence with Tolerance and/or Withdrawal	24.7				
Substance Problem Scale		4.41	4.02	0.00	16.00
Age of First Use		14.23	1.9	2.00	18.00
Type of Substance					
Alcohol Only	26.6				
Marijuana with or without Alcohol	46.6				
Other Illicit Substances	26.8				
Deviant Behaviors by Peers		9.11	7.53	0.00	38.00
Deviant Behaviors by Family		2.89	3.24	0.00	20.0

Bivariate Analyses

A series of bivariate analyses were conducted to understand the relationships between the independent variables and the dependent variable. Table 5 displays the results of the bivariate analyses examining the relationship between MHPs (DV) and the independent variables. Overall, adolescents with MHPs reported more severe substance use, were younger when they first began using substances, reported more use of illicit

substances, and reported more problems with deviant behaviors by peers and family. All independent variables were significant at the 0.01 level.

Gender was significantly related to MHPs [X^2 (1, N=801) =8.317, p=.004]. Among females, 56.6% met criteria for a MHP. Among males, 46.0% met criteria for a MHP. These results suggest that being female may be a good predictor of whether a person has MHPs. That is, females may be more likely to have MHPs than males. Similar results were found when males and females were compared on the continuous measure of MHPs. Females had significantly higher mean scores (M=16.58, SD=15.69) on the continuous MHPs composite measure than males (M=13.53, SD=13.78) [t (544) =-2.72, p=.006].

Race and ethnicity were not significantly related to MHPs. Adolescents who identified being Caucasian [X^2 (1) =2.522, p=0.112], African American [X^2 (1) =0.678, p=.410], or Hispanic [X^2 (1) =1.047, p=0.306] were not more likely to have a MHP. Similarly, Low SES was not significantly related to having MHPs [X^2 (1) =3.039, p=0.081]. Family structure was significantly related to the continuous measure of MHPs. Adolescents living in a two parent home had significantly lower scores on the continuous MHPs scale (M=12.30, SD=12.57) than adolescents living in other situations (M=16.01, SD=15.47) [t (714) =-3.70, p<.001).

Current age was significantly related to MHPs (t (771) =4.46, p <.001). Adolescents without MHPs were significantly older (M=16.37, SD=1.05) than adolescents with MHPs (M=15.98, SD=1.27).

Table 5. Bivariate Analyses (N=801)

	Dependent Variable		
Variable	No Mental Health Problems	Mental Health Problems	Continuous Measure MHP (M)
Severity Variables (%)*			
Use	55.6	26.0	9.01(10.96)
Abuse	33.7	26.8	11.66(12.43)
Dependence w/o tolerance/withdrawal	1.2	7.3	23.43(11.63)***
Dependence w/ tolerance /withdrawal	9.5	40.0	26.08(15.60)***
Substance Problem Scale (M)	2.56 (SD=2.61)	6.27(SD=4.31)	
Age of First Use (M)**	14.86(SD=1.55)	13.60(SD=2.02)	
Type of Substance (%)*			
Alcohol Only	39.9	13.3	7.39(10.62)***
Marijuana with or without Alcohol	50.6	42.5	12.01(11.55)***
Other Illicit Substances	9.5	44.3	26.40(15.72)***
Deviant Behaviors by Peers (M)**	5.85(5.72)	12.37(7.71)	
Deviant Behaviors by Family (M)**	1.84(2.52)	3.92(3.53)	
Gender (%)*			
Female	31.9	41.8	18.69 (16.55)**
Male	68.1	58.3	12.29 (12.72)**
Age (M)**	16.37 (1.05)	15.98 (1.27)	

Table 5-continued

SES			
Low SES	98.8	97.0	19.35(14.56)
Not Low SES	1.2	3.0	14.54(14.56)
Family Structure*			
Two Parent Family	38.4	35.0	12.30(12.57)**
Other Living Situation	61.6	65.0	16.01(15.47)**

Note: *Chi-square tests were significant at the 0.01 level.

**t-tests were significant at the 0.01 level.

***One-way ANOVA tests were significant at the 0.01 level.

Post-hoc analyses indicated that dependence with tolerance/withdrawal symptoms and dependence without tolerance and withdrawal symptoms were significantly different from use and abuse.

Analyses for Research Questions

Each of the research questions and attendant hypotheses will be addressed in order. The first research question was, *among adolescents who use substances, how is the severity of the SUD related to having a mental health problem*? The first hypothesis stated that adolescents who meet criteria for dependence will be more likely to have co-occurring MHPs than adolescents who meet criteria for abuse or use. This was tested using logistic regression and answered by interpreting the odds ratios. The independent variable was the categorical measure of the severity of the SUD and the dependent variable was the dichotomous MHP variable. The Cox and Snell R square value was 0.168 and the Nagelkerke R square value was 0.224. The odds ratios of dependence with and without withdrawal and tolerance symptoms were compared to the odds ratios of use and abuse. Results indicated that adolescents with dependence with or without withdrawal symptoms were more likely to have MHPs than adolescents with use or abuse. When compared to adolescents who met criteria for use, adolescents who met criteria for either type of dependence were about six times more likely to have a MHP. These results support the first hypothesis.

Table 6. Severity of the SUD and MHP

Variable	Odds Ratio	95% Confidence Interval
Severity		
Use	0.28	[0.21, 1.21]
Abuse	0.72	[0.53, 0 .97]
Dependence without tolerance /withdrawal	6.19	[2.37, 16.16]
Dependence with tolerance/withdrawal	6.36	[4.31, 9.40]

These results were confirmed through an ANOVA analysis. The ANOVA analysis indicated that there was a significant difference on the scores on the MHP scale among the different diagnoses [F (3, 797) = 84.65, p<.001]. Post-hoc analyses indicated that the mean score on the continuous MHP measure for adolescents who met criteria for dependence with or without withdrawal and tolerance symptoms was significantly higher from the MHP score for those adolescents who met criteria for use or abuse. These results are detailed in Table 7.

Table 7. Severity of the SUD and Continuous MHP

Variable	N	Mean	Standard Deviation
Use	327	9.01	10.96
Abuse	242	11.66	12.42
Dependence without withdrawal symptoms	34	23.43*	11.63
Dependence with withdrawal symptoms	198	26.08*	15.60
Total	801	14.64	14.57

Note: Post-hoc tests indicated that dependence without withdrawal symptoms and Dependence with withdrawal symptoms were significantly different from use and abuse at the p<.001 level.

The second hypothesis stated that adolescents who report symptoms of tolerance and withdrawal will be more likely to have co-occurring MHPs than adolescents who do not report symptoms of tolerance and withdrawal. The same analyses that were used for hypothesis one were used to examine hypothesis two. The odds ratios for both types of dependence were very similar as indicated in Table 6. The post-hoc tests for the ANOVA comparison indicated that adolescents who met criteria for dependence with withdrawal or tolerance did not have a significantly higher score on the MHP scale than those with dependence without withdrawal and tolerance symptoms (p=0.675). As indicated in

Table 7, adolescents with dependence without withdrawal or tolerance symptoms had a mean MHP score of 23.43 while adolescents who met criteria for dependence with tolerance or withdrawal symptoms had a mean score of 26.08. Based on these results, the second hypothesis was not supported. However, it should be noted that there were only thirty-four adolescents who met criteria for dependence without withdrawal symptoms. Thus, among adolescents in the sample who met criteria for dependence, having withdrawal or tolerance symptoms was very common. This small number of adolescents who did not have withdrawal or tolerance symptoms may have affected these results.

The third hypothesis stated that adolescents' internalizing and externalizing disorders will co-occur. This was first tested by examining the Pearson's correlation between internalizing and externalizing disorders. Internalizing disorders were significantly correlated with externalizing disorders [r (801) =.515, p<.001]. This relationship was further examined by looking at the number of adolescents with each disorder. As indicated in Table 8 below, among adolescents with a MHP (n=400), almost 50% had both an internalizing and externalizing disorder. Only 8% had an internalizing disorder only and 42.3% had an externalizing disorder only. These results supported the third hypothesis.

Table 8. Internalizing and Externalizing Disorders

Variable	N (N=400)	Percent
Internalizing disorder only	32	8.0
Externalizing disorder only	169	42.3
Both externalizing and internalizing disorders	199	49.8

The fourth hypothesis was that adolescents who meet criteria for dependence will be more likely to have an internalizing disorder than adolescents who meet criteria for abuse. Chi-square was used to test this hypothesis. The two categories of dependence (without tolerance and withdrawal and with tolerance and withdrawal) were combined for this analysis. Chi-square results were significant, indicating a significant difference among the groups [$X^2(3) = 38.35$, $p<.001$]. Adolescents who met criteria for dependence more frequently met criteria for an internalizing disorder than those who met criteria for abuse or use. Among those with an internalizing disorder (n=238), 43% met criteria for dependence, 31% met criteria for abuse, and 19% met criteria for use. These results supported the fourth hypothesis.

The second research question was, *among adolescents who use substances, how is age of first use related to having mental health problems*? The fifth hypothesis stated that adolescents with a younger age of first use will be more likely to have MHPs than adolescents with an older age of first use. This hypothesis was tested using the continuous measure of MHPs. The results of a Pearson correlation indicated that there was a significant negative correlation between the age of first use and MHPs [r (801) = -0.358, $p<.001$]. These results indicated an inverse relationship and supported the fifth hypothesis. That is, adolescents with a younger age of first had a higher score on the MHPs scale.

The sixth hypothesis stated that the severity of the substance use disorder will mediate the relationship between age at first use and having MHPs. This was tested using the Baron and Kenny (1986) method for testing mediation. First, a relationship between age of first use and MHPs was established in a previous analysis. Using the transformed continuous variable, the regression equation was logMHP=5.73 + -.254(age of first use). Next, a relationship was established between the variable age of first use and the mediator severity. This was done by using a linear regression analysis where age of first use was the indicator and the continuous measure of severity (substance problem

scale) was the dependent variable. This relationship was significant [F (1,799) = 83.98, p<.001, R=.308, R^2=0.095, Severity=13.675 + -.651(age of first use)]. Then it was established that the mediator, severity, is related to the dependent variable, transformed MHPs. This was tested by using linear regression and including both age of first use and severity as the independent variables and the transformed mental health variable as the dependent variable. The results of this analysis were significant [F (1,799) = 183.33, p<.001, R=0.561, R^2=0.315, logMHP= 3.745+ -0.160(age of first use) + .144(severity)]. It was determined that severity partially mediates the effects of age of first use because the mediator was related to the dependent variable, but the coefficient for age of first use did not decrease to zero. Furthermore, age of first use remained a significant variable in the model (p<.001). Severity of the substance use disorder was also significant in the full model (p<.001). Thus, the sixth hypothesis was supported. Furthermore, the results of the meditational analysis were similar when the non-transformed dependent variable was used. The regression equations were as follows.

1. MHP= 53.689 + -2.74(age of first use)
2. Severity= 13.675 + -.651(age of first use)
3. MHP= 28.484 + -1.50(age of first use) + 1.84 (severity).

The third research question was, *among adolescents who use substances, how is the type of substance used related to having mental health problems*? The seventh hypothesis stated that adolescents who use substances other than alcohol will be more likely to have MHPs. First, a Chi-square test was used to understand whether adolescents who used marijuana and other illicit drugs were more likely to have a MHP. Among adolescents who met criteria for a MHP (N=400), 44.3% reported using other illicit drugs, 42.5% reported using marijuana, and 13.3% reported using only alcohol. The Chi-square was significant [X^2(2) =146.55, p<.001], thus supporting the hypothesis.

ANOVA was then used to compare the mean scores on the continuous MHPs variable and the type of substance variable. The continuous measure of MHPs was used

as the dependent variable and the type of substance used was the independent variable. Results indicated that there were significant differences between the groups [*F* (2,798) =137.34, *p*<.001]. Post-hoc tests indicated a significant difference between each of the type of substance groups. As indicated in Table 9, adolescents who used alcohol only had the lowest mean score on continuous MHP, followed by adolescents who used marijuana with or without alcohol. Adolescents who used other illicit drugs had the highest mean score of MHPs. This provides further support of the hypothesis.

Table 9. Type of Substance Used and MHP

Variable	N (N=801)	Mental Health Problems (M)	Standard Deviation
Alcohol only	213	7.39	10.62
Marijuana with or without Alcohol	373	12.01	11.55
Other illicit drugs	215	26.40	15.71
Total	801	14.64	14.57

Note: Post-hoc differences between each group were significant at the *p*<.001 level.

The eighth hypothesis stated that severity will mediate the relationship between type of substance used and having a MHP. This was tested using the Baron and Kenny (1986) method. Using linear regression, a relationship was established between the type of substance used and MHPs. This was done using the dummy variables for type of substance and the transformed continuous measure of MHPs. This relationship was significant [F (2,798) =114.71, p=0.00, R=0.473, R^2=0.223, log of MHP= 1.36 + 0.662(marijuana use) + 1.669(other illicit drug use)]. Next, a relationship was established between severity and type of substance used. This was done using linear regression. The dummy variables for type of substance used were the independent variables and the

continuous measure of severity was the dependent variable. Results of this regression indicated a significant relationship between type of substance used and severity [*F* (2,798) =184.288, p=0.00, R=.562, R^2=.316, Severity= 1.765 + 2.195(marijuana) + 6.063(other illicit drug use)]. Finally, it was established that the mediator, severity of substance use disorder, affects the dependent variable, transformed MHPs. In a linear regression model, the independent variables were the dummy variables for type of substance used and the continuous measure of severity. The dependent variable was the transformed continuous measure of MHPs. Results indicated that there was a significant relationship [*F* (3,797)=122.021, *p*<.001, R=.561, R^2=.315, log of MHP=1.15 + .401(marijuana use) + .949(other illicit drug use) + .119(severity)].

It was determined that severity partially mediates the effects of type of substance used because the mediator is related to the dependent variable, but the coefficient for type of substance used did not decrease to zero. All of the independent variables in this model (substance use severity, marijuana use, and other illicit drug use) were significant at the *p*<.001 level. Thus, the eighth hypothesis was supported. Furthermore, the results of the meditational analysis were similar when the non-transformed dependent variable was used and when the categorical measure of type of substance used was used instead of the dummy variables.

Research question four was, *among adolescents who use substances, how are the behaviors of peers related to having mental health problems*? The ninth hypothesis stated that adolescents who have more peers who participate in deviant activities will have more severe substance use problems. Pearson's correlation was used to test this hypothesis. The results indicated a significant relationship between deviant behaviors by peers and severity of substance use problems [*r (*801) =.525, *p*<0.001]. This relationship was also examined using the ordinal measure of severity (use, abuse, dependence) and the variable deviant behaviors by peers. The results of the ANOVA indicated a significant difference between the groups [*F* (3,797) =414.784, *p*=0.001]. Post-hoc tests

indicated a significant difference between each group. As indicated in Table 10, adolescents who met criteria for use had the lowest score on the deviant behaviors by peers scale, followed by abuse, dependence without withdrawal, and dependence with withdrawal symptoms. Therefore, the ninth hypothesis was supported.

Table 10. Deviant Behaviors by Peers and Severity of SUD

Variable	N (N=801)	Deviant Behaviors by Peers (M)	Standard Deviation
Use	327	1.39*	1.54
Abuse	242	4.13*	2.18
Dependence without withdrawal symptoms	34	7.85*	2.43
Dependence with withdrawal symptoms	198	9.16*	3.85
Total	801	4.41	4.02

Note: Post-hoc tests indicated significant differences between each group at the $p<0.05$ or $p<.001$ level.

The tenth hypothesis stated that adolescents who have more peers who participate in deviant activities will be more likely to have MHPs. First, a correlation using the variables deviant behaviors by peers and the continuous measure of MHPs was used to test this hypothesis. The results of this analysis indicated a significant relationship between deviant behaviors by peers and MHPs (r (801) = .473, $p<.001$). This indicated that adolescents with higher scores on the deviant behaviors by peers scale reported more MHPs. These results were checked using a t-test. In this analysis, the categorical measure of MHPs was used. The results of the t-test indicated that adolescents with a

MHP had significantly higher mean scores (M=12.38, SD=7.71) on the deviant behaviors by peers measure than adolescents without a MHP (M=5.85, SD=5.72) [t (736) = -13.60, p<.001]. These analyses confirm the hypothesis.

The eleventh hypothesis stated that adolescents who have more peers who participate in deviant activities will be more likely to have an externalizing disorder than an internalizing disorder. This hypothesis was tested using ANOVA. The independent variable was type of disorder (no disorder, internalizing only, externalizing only, and both internalizing and externalizing) and the dependent variable was deviant behaviors by peers. Results of the ANOVA indicated that there was a significant difference between groups [F (3,797) =77.30, p<.001]. Post-hoc analyses indicated that adolescents with no MHP had significantly lower scores on deviant behaviors by peers than adolescents with any type of disorder. Adolescents with an internalizing disorder only, had significantly higher scores on deviant behaviors by peers than adolescents with no disorder. There was not a significant difference on deviant behaviors by peers between adolescents with an internalizing disorder and adolescents with an externalizing disorder (p=0.875). Adolescents with both an internalizing and an externalizing disorder had significantly higher scores on deviant behaviors by peers than adolescents with an externalizing disorder only. Because adolescents with an externalizing disorder did not have a significantly higher mean score on deviant behaviors by peers than adolescents with an internalizing disorder, the hypothesis was not supported. The mean scores on deviant behaviors by peers for each type of MHP are shown in Table 11below. It should also be noted that adolescents with an internalizing disorder only actually had a higher score for deviant behaviors by peers than adolescents with an externalizing disorder only. However, this difference was not significant.

Table 11. Type of MHP and Deviant Behaviors by Peers

Variable	N (N=801)	Deviant Behaviors by Peers (M)	Standard Deviation
No disorder	401	5.85	5.72
Internalizing disorder only	32	11.15	5.79
Externalizing disorder only	169	10.19	6.71
Both externalizing and internalizing disorders	199	14.42	8.23
Total	801	9.11	7.53

Note: Post-hoc analyses indicated significant differences between adolescents with no disorder and all the other groups. Adolescents with both externalizing and internalizing disorders were significantly different from all other groups. All differences were at the $p<0.05$ or $p<0.001$ level

The twelfth hypothesis stated that severity will mediate the relationship between deviant peers and having MHPs. This was tested using the Baron and Kenny (1986) method. First a relationship was established between the independent variable deviant behaviors by peers and the dependent variable continuous MHPs. For this analysis, the transformed dependent variable was used in a linear regression analysis. Results demonstrated a significant relationship between the variables [F (1,799)=238.28, $p<.001$, R=.479, R^2=.230, log MHP=1.359 + .083(deviant behaviors by peers)]. Next, a relationship was established between deviant behaviors by peers and severity. These results were significant [F (1,799) =304.084, $p<.001$, R=.525, R^2=.276, Severity= 1.863 + 0.280(deviant behaviors by peers)]. Finally, a relationship was established between severity, deviant behaviors by peers, and the transformed dependent variable. This relationship was significant [F (2,798) =192.802, p=.001, R=.571, R^2=.326, log MHP= 1.138 + 0.05(deviant behaviors by peers) + 0.118(severity)].

It was determined that severity partially mediates the effects of deviant behaviors by peers because the mediator is related to the dependent variable, but the coefficient for deviant behaviors by peers did not decrease to zero. Both independent variables were significant at the $p<0.001$ level in the final model. Thus, the twelfth hypothesis was supported. Furthermore, the results of the meditational analysis were similar when the non-transformed dependent variable was used. The models using the non-transformed MHPs variable were as follows.

1. MHP= 6.299 + 0.916(deviant behaviors by peers)
2. MHP= 3.297 + 0.465(deviant behaviors by peers) + 1.612(severity)

The fifth research question was, *among adolescents who use substances, how are the behaviors of family members related to having mental health problems*? The thirteenth hypothesis stated that adolescents who have more family members who participate in deviant activities will have more severe substance use problems. The results of a Pearson's correlation analysis between severity and deviant behaviors by family members was significant[r (801) =0.248, $p<.001$]. Therefore, the thirteenth hypothesis was supported.

The fourteenth hypothesis stated that adolescents who have more family members who participate in deviant activities will be more likely to have MHPs. This hypothesis was first tested using a correlation. The continuous measure of MHPs was used in this analysis. Results indicated that there was a significant positive correlation between the variable deviant behaviors by family members and MHPs [r (801) =0.413, $p<.001$]. This hypothesis was also tested using a t-test. For the t-test, the categorical measure of MHPs was used. Results indicated that adolescents with a MHP had a significantly higher score on the measure deviant behaviors by family [t (722) = -9.61, $p<.001$]. Adolescents without a MHP had a mean score of 1.85 while adolescents with a MHP had a mean score of 3.93 on the measures deviant behaviors by family. These analyses support the hypothesis.

The fifteenth hypothesis stated that severity will mediate the relationship between the number of deviant family members and having MHPs. This was tested using the Baron and Kenny (1986) method. First, a relationship was established between deviant behaviors by family members and the transformed continuous measure of MHPs. This relationship was significant [F (1,799) =127.90, p<.001, R=.371, R^2=0.138, log MHP=1.68 +0.150(deviant behaviors by family)]. Next a relationship was established between deviant behaviors by peers and severity. This relationship was significant [F (1,799) = 52.55, p<.001, R=.248, R^2=.062, Severity = 3.526 + 0.308(deviant behaviors by family)]. Finally, a relationship was established between severity, deviant behaviors by family, and the dependent variable. This relationship was significant [F (2,798) = 195.48, p<.001, R=.573, R^2= .329, log MHP= 1.167 + 0.105(deviant behaviors by peers) + 0.147(severity)].

It was determined that severity partially mediates the effects of deviant behaviors by family because the mediator affected the dependent variable, but the co-efficient for deviant behaviors by family did not decrease to zero. Both independent variables were significant at the p<.001 level in the final model. Thus, the fifteenth hypothesis was supported. Furthermore, the results of the meditational analysis were similar when the non-transformed dependent variable was used. The models using the non-transformed MHPs variable were as follows.

1. MHP= 9.287 + 1.857(deviant behaviors by peers)
2. MHP= 2.910 + 1.300(deviant behaviors by peers) + 1.808(severity)

The bivariate and multivariate analyses described above test the hypotheses and provide some indications about how each of the independent variables is related to the dependent variable, MHPs. However, it was also important to understand the whole picture of how the independent variables are related to the dependent variable. For that reason, linear regression was used first to determine the effect of the independent variables (severity, age of first use, type of substance, deviant behaviors by peers, and

deviant behaviors by family) on the likelihood that an adolescent would have MHPs (using the transformed dependent variable). Logistic regression was also used to determine the effects of the independent variables on the categorical dependent variable. This will be described in the following section.

Linear Regression

Using Categorical Severity

The independent variables were entered one at a time to examine the effects of each variable on the transformed dependent variable. This model is described in Table 12 below. Severity was entered first and the dummy variables for severity were used in the equation (D2, D3, and D4). Results indicated that severity was a significant predictor of MHPs [F (3,797)=68.33, p<.001, R^2=0.205]. The coefficients for all of the dummy variables for severity were significant. Next, age of first use was included in the model with severity. This model was significant [F (4,796) =67.25, p<.001, R^2=0.253, R^2 change = .048]. Again, all the independent variables were significant in the model. In the next model, the dummy variables for type of substance were included. This model was also significant [F (6,794) =56.87, p<.001, R^2=0.301, R^2 change=.048]. In this model, all coefficients were significant except for the coefficient for the dummy variable abuse (p=0.271). Next, the variable deviant behaviors by peers was included in the model. This model was also significant [F (7,793) =60.48, p<.001, R^2=0.342, R^2 change=.041]. In this model, all coefficients were significant except for the coefficient for the dummy variable abuse (p=0.712). Next, the variable for deviant behaviors by family was included in the model. This model was also significant [F (8,792) =57.15, p<.001, R^2=0.366, R^2 change= .024]. Again, the coefficient for the variable for dummy abuse was not significant (p=0.712). The final model was as follows. logMHP=2.35 + 0.64(dummy abuse) + .582(dummy dep wo wd sx)+ .525(dummy wwdsx) + -0.84(age

first use) + 0.240(T2) + 0.609(T3) + 0.37(deviant behaviors by peers) + 0.61(deviant behaviors by family).

Table 12. Linear Regression Model with Categorical Measure of Severity of SUD

Step 1	Step 2	Step 3	Step 4	Step 5
Severity* (dummy variables)	Severity* (dummy variables)	Severity (dummy variables)	Severity (dummy variables)	Severity (dummy variables)
F=68.33* R^2=0.21	Age of first Use*	Age of first Use*	Age of first Use*	Age of first Use*
	F=67.25* R^2=0.253	Type of Substance* (dummy variables)	Type of Substance* (dummy variables)	Type of Substance* (dummy variables)
		F=56.87* R^2=0.301	Deviant Behaviors by Peers*	Deviant Behaviors by Peers*
			F=60.48* R^2=0.342	Deviant Behaviors by Family*
				F=57.15* R^2=0.366

Note: *All were significant at the $p<0.001$ level.

Continuous Measure of Severity of Substance Use Disorder

It was determined that the continuous measure of severity (substance problem scale) explained more variance in the transformed MHP variable (R^2=0.266) than the categorical measure of severity (R^2=0.205). Therefore the continuous measure of severity was used in the linear regression analysis. The transformed dependent variable was used in each analysis.

The independent variables were entered one at a time to examine the effects of each independent variable on the dependent variable. The results of these analyses are reported in the table below. Each independent variable was a significant predictor of the dependent variable at the 0.001 level. The same analyses were run with the non-transformed dependent variable. The R^2 values were slightly different in the model using the non-transformed dependent variable. Each independent variable was a significant predictor of the dependent variable at the $p<.001$ level.

Table 13. Effects of Independent Variables on the Dependent Variable

	Model 1(with log MHP)		Model 2 (with MHP)	
Variable	B	R^2	B	R^2
Severity	0.168	0.266	2.069	0.325
Age of first use	-0.254	0.137	-2.744	0.128
Type of Substance		0.223		0.256
Marijuana	0.622		4.619	
Other Illicit	1.669		19.009	
Deviant Behaviors by Peers	0.083	0.230	0.916	0.224
Deviant Behaviors by Family	0.150	0.138	1.857	0.170

Next, a model was developed by entering each variable into the model in a step-wise fashion. In the final model, the co-efficient for the dummy variable for marijuana use became non-significant (p=0.59). The steps for building the model are described in Table 14 below.

Finally, a model was run including the control variables, low SES, gender, age, and family structure. Adding the control variables did explain additional

variance in the transformed dependent variable [F (10,768)=58.710, p<0.001, R^2=0.433, R^2 change=0.042]. However, in the full model, the coefficients for the variables age of first use (*p*=0.148), low SES (*p*=0.061), and family structure (*p*=0.485) were not significant.

When the regression model was run with the non-significant variables removed, the results were as follows F(7,793)=83.139, p=0.00, R^2=0.423. The final equation is logMHP=4.376 + 0.091(SPS) + 0.255(marijuana) + 0.572(other illicit) + 0.034(deviant behaviors by peers) + 0.061(deviant behaviors by family) + -0.201(age) + -0.274(gender).

The full model was also run using the non-transformed dependent variable, continuous MHP. More variance was explained by the independent variables (F(6,794)=109.587, p=0.00, R^2=0.453) than in the model with the transformed dependent variable. This may be due to the non-normal distribution of the dependent variable. In the final model, all the coefficients were significant except for the dummy variable for marijuana use. The final model was as follows

Continuous MHP=14.637 + 1.263(SPS) + -0.778(age first use) + -0.955(marijuana use) + 5.136(other illicit use) + 0.20(deviant behaviors by peers) + 0.950(deviant behaviors by family).

When the control variables were included in the model with the non-transformed dependent variables, more variance in the dependent variable was explained [F (10,768) =77.728, p<0.001, R^2=0.503]. The coefficients for the variables marijuana use (*p*=0.715), age of first use (*p*=0.531), low SES (*p*=0.218), and family structure (*p*=0.169) were all non-significant in this model. When these variables were removed the results were as follows F (6,794) =130.974, p=0.00, R^2=0.497. The model was MHP=38.929 + 1.275(other illicit) + .264(deviant behaviors by peers) + 0.886(deviant behaviors by family) + -2.086(age) + -4.285(gender).

Table 14. Linear Regression Model

Steps	Variables in Model	Degrees of Freedom	F Statistic	*p*-value	R^2	R^2 change	Model
1	Substance Problem Scale	1,799	289.08	*p*< .001	0.266		1.376 + 0.168(SPS)= log MHP
2	Substance problem scale, age of first use	2,798	183.329	*p*< .001	0.315	0.049	3.754 + 0.144(SPS) + -0.160(age of first use)= log MHP
3	Substance Problem Scale, age of first use, type of substance used (dummy variables)	4,796	103.875	*p*< .001	0.343	0.028	3.082 + 0.111(SPS) + -0.126(age first use) + 0.296(marijuana use) + 0.744(other illicit) = log MHP
4	Substance Problem Scale, age of first use, type of substance used (dummy variables), deviant behaviors by peers	5,795	93.872	*p*< .001	0.371	0.028	2.712 + 0.087(SPS) + -0.109 (age of first use) + 0.201(marijuana use) + 0.548(other illicit) + 0.03(deviant behaviors by peers) = log MHP
5	Substance Problem Scale, age of first use, type of substance used (dummy variables), deviant behaviors peers, deviant behaviors family	6,794	84.86	*p*< .001	0.391	0.020	2.362 + 0.089(SPS) + -0.091 (age first use) + 0.178(marijuana) + 0.492(other illicit) + 0.028(deviant behaviors by peers) + 0.063(deviant behaviors by family) = log MHP

Logistic Regression

To understand whether the effect of the independent variables was different when the dependent variable was measured categorically, a binary logistic regression was run. The dependent variable was the categorical measure of MHPs where 0=no MHPs and 1=MHPs. The independent variables were severity of SUD (categorical), age of first use, type of substance used, deviant behaviors by peers and deviant behaviors by family.

Table 15 below provides the coefficients, standard errors, significance levels, and relative odds ratios that estimate the likelihood of having a MHP given a one-unit change in each independent variable. Odds ratios greater than one indicate an increase in the likelihood of having MHPs, while odds ratios less than one indicate a decrease in the likelihood of having MHPs.

The results indicate that knowing whether an adolescent has either type of dependence helps predict the likelihood of having a MHP. Adolescents with dependence without withdrawal were 1.347 times more likely to have a MHP than adolescents who only met criteria for use. Similarly, adolescents who met criteria for dependence with withdrawal were 3.259 times more likely to have a MHP than adolescents who met criteria for use only. Knowing whether someone had abuse was not a significant predictor in this model (p=0.148). In addition, age of first use was not a significant predictor of MHPs in this model (p=0.692).

Knowing the type of substance an adolescent used was a significant predictor in this model. Adolescents who use marijuana are 1.553 times more likely to have MHPs than adolescents who only use alcohol. Adolescents who use other illicit drugs are 3.289 times more likely to have a MHP than adolescents who only use alcohol.

The variable deviant behaviors by peers was also a significant predictor in this model. The table shows that the odds ratio for deviant behaviors by peers was 1.086, which indicates that a one unit increase in the deviant behaviors by peers resulted in an

8.6% increase in the odds that an adolescent will have MHPs. The results were similar for the variable deviant behaviors by family. Table 15 indicates that the odds ratio for deviant behaviors by family was 1.149, indicated that for a one unit increase in deviant behaviors by family, the odds of having MHPs increased by 14.9%. Gender was a significant predictor in this model. As shown in the table, the variable gender had a negative coefficient and an odds ratio of 0.660. This indicates that girls (female=2 and male=1) were more likely to have MHPs than boys. The variables age (p=0.163), low SES (p=0.090), and family structure (p=.269) were not significant predictors in this model.

Table 15. Logistic Regression Model

Variable	Coefficient	S.E.	Odds Ratio
Severity (Use)			
Abuse	0.298	0.206	1.347
Dependence w/o wd	1.610**	0.544	5.002
Dependence w/wd	1.181***	0.274	3.259
Age of first use	-0.024	0.060	0.977
Type of substance(Alcohol only)			
Marijuana	0.440*	0.233	1.553
Other illicit substance	1.190***	0.302	3.289
Deviant behaviors by peers	0.082***	0.016	1.086
Deviant behaviors by family	0.139***	0.035	1.149
Age	-0.083	0.059	0.921
Gender	-0.416*	0.186	0.660
Low SES	1.128	0.655	3.089
Family Structure	-0.204	0.185	0.815

Note: *p<.05, **p<.01, ***p<.001

CHAPTER 5: DISCUSSION AND CONCLUSIONS

The overall purpose of this dissertation was to understand if factors commonly related to co-occurring disorders among adults were similar among adolescents. This focus was developed after reviewing the literature on co-occurring disorders among adolescents and finding that the research is limited. Previous research on co-occurring disorders has focused on adults and much of the information in those studies is based on retrospective reports. Furthermore, because much of the research has focused on adults, certain disorders more commonly found among adolescents, like ADHD and conduct disorder, have not been frequently examined. More specifically, the purpose of this dissertation was to examine which factors are related to having MHPs among adolescents who use substances. Thus, this study makes an important contribution by focusing on adolescents.

In addition to understanding which factors are related to MHPs among adolescents who use substances, this study also addressed the categorization of SUDs and MHPs. In much of the adult literature and the available adolescent literature, SUDs and MHPs are categorized as either present or not present (e.g. Goldstein et al., 2007; Norman et al., 2007). That is, a person either meets criteria for a MHP or does not. Based on the review of the literature, this researcher became curious about those people who have some symptoms of a MHP or a SUD but do not meet the full criteria. Therefore, this study makes a contribution by including alternative measures of MHPs and SUDs.

This study also examined the factor severity of the SUD. This was modeled in two different ways to better understand both the contribution of the symptoms tolerance and withdrawal and the impact of the categorization of SUDs. Thus, by including this variable and modeling it in two different ways, this study makes an additional contribution.

The results indicated that several factors examined were related to having mental health problems in this sample. Gender was an important variable; females were more likely to have mental health problems than males. The severity of the SUD was a key variable in this study. Adolescents with more severe SUDs, like dependence, were more likely to have MHPs. Furthermore, severity partially mediated the relationship between several of the other factors and MHPs. Younger adolescents were more likely to have MHPs. In addition, adolescents with a younger age of first use had more MHPs. The type of substance an adolescent reported using was also important. Adolescents who reported using alcohol only had the lowest MHP scores, followed by those who used marijuana. Adolescents who reported using other illicit drugs had the highest MHP scores.

The deviant behaviors by peers and by family were also important factors in understanding MHPs in this sample. Adolescents who had more peers who participated in deviant activities had more severe substance use problems and were more likely to have a MHP. A similar relationship was found for deviant behaviors by family and MHPs. Adolescents who had more family members who participated in deviant behaviors had more severe substance use problems and were more likely to have a mental health problem.

Discussion

The results of the study indicated that the severity of the SUD was related to MHPs among adolescents who use substances. Using the categorical measure of MHPs, those adolescents who met criteria for the more severe SUD, dependence, were more likely to have MHPs than adolescents who met criteria for abuse or who only used substances. The results also indicated that adolescents who met criteria for dependence also had a higher score on the continuous measure of MHPs. This suggests that adolescents with more severe SUDs had more severe or more symptoms of MHPs.

These results are supported by the literature that suggested that the severity of the SUD may be related to MHPs (Bonn-Miller et al., 2007; Bernstein et al., 2006; Buckner et al., 2008; Chan et al., 2008; Diamond et al., 2006; Roberts et al., 2007).

Surprisingly, the results indicated that having symptoms of tolerance and withdrawal did not have an additional impact on mental health problems. However, it should be noted that there was only a small group of adolescents who met criteria for dependence and did not report symptoms of tolerance and withdrawal. This will be further discussed in the limitations section. Some of the literature reviewed suggested that it might be certain symptoms of dependence, like tolerance and withdrawal, which are related to co-occurring mental health problems (Abrantes et al., 2003; Saha et al., 2006). Because of the small number of people who met criteria for dependence without symptoms of tolerance or withdrawal, it remains unclear what the impact of these symptoms are on MHPs.

The results of this study indicated that about one-fourth (24.8%) of adolescents met criteria for both an internalizing and externalizing disorder. The next largest group was those adolescents who met criteria for an externalizing disorder only (21.1%), followed by those who met criteria for an internalizing disorder only (4.0%). These results seem to support the literature that externalizing disorders are common among adolescents who use substances (Couwendbergh et al., 2006). However, these results also support the previous research findings that internalizing and externalizing disorders commonly co-occur (Winters et al., 2008). Furthermore, the results of this study indicated that adolescents who met criteria for dependence more frequently also met criteria for an internalizing disorder than those adolescents who met criteria for substance abuse.

Severity of the substance use disorder was also found to partially mediate the relationship between other factors examined and mental health problems. These relationships will be discussed in the sections that follow.

The results of this study also indicated that age of first use was an important factor in understanding MHPs among adolescents who use substances. Adolescents in this study reported a mean age of first use of 14.23. The results indicated that adolescents with a younger age of first use were more likely to have a MHP than adolescents with an older age of first use. Furthermore, the severity of the SUD partially mediated this relationship. That is, the severity of the SUD explained some of the variance in the relationship between age of first use and MHPs. This may suggest that adolescents who begin using substances at a younger age develop more severe substance use problems. These more severe substance use problems may then be related to having MHPs. However, the interpretation of severity as a mediator is somewhat limited by the cross-sectional nature of the data. That is, it is not clear in this study whether the substance use problems came before the mental health problems. This important limitation will be further discussed in the limitations section. These results fit with the previous literature reviewed that suggested that people who begin using substances at a younger age would be more likely to have MHPs (Brook et al., 2002; Dawson et al., 2008; Kandel & Chen, 2000).

Type of substance used by the adolescent was also an important factor in this study. The results of this study indicated that almost half (46.6%) of the adolescents in the sample reported using marijuana with or without alcohol. Nearly the same percentages of adolescents reported using alcohol only (26.6%) or other illicit substances (26.8%). The results of this study indicated that adolescents who used marijuana and other illicit drugs were more likely to have MHPs than adolescents who used alcohol only. Furthermore, there was a significant difference between each category of substance. That is, alcohol only users were the least likely to have MHPs, followed by marijuana users, followed by other illicit drug users. This suggests that knowing whether an adolescent uses marijuana and/or other illicit drugs may be important in understanding whether that adolescent has a MHP.

These results seem to be supported by previous studies. The literature reviewed suggested that people who use substances other than alcohol may be at a greater risk of having MHPs. However, it was unclear from the literature whether marijuana use was related to having mental health problems (Arseneault et al., 2002; Arseneault et al., 2004). The results of this study seem to indicate that marijuana use may be related to having mental health problems. Some literature indicated that it was the "harder" or "other illicit drugs" like cocaine or ecstasy that were related to having mental health problems (Bonn-Miller et al., 2007; Dehass et al., 2002). This relationship was supported by the results of this dissertation as well.

As with age of first use, the results indicated that the severity of the SUD partially mediated the relationship between the type of substance used and MHPs. This suggests that adolescents who use marijuana and other illicit drugs may have more severe substance use problems which may then be related to having MHPs.

Peers were also an important factor in understanding MHPs among adolescents who use substances in this study. The results indicated that adolescents who had more peers who participated in deviant activities had more severe substance use problems and were more likely to have a MHP. Some of the literature had indicated that adolescents who had more peers who participated in deviant activities would be more likely to have externalizing disorders than internalizing disorders (Couwenbergh et al., 2006). In the results of this study, adolescents with more peers who participated in deviant activities did not seem to be more likely to have an externalizing disorder. In fact, the results indicated that those adolescents with both an internalizing and an externalizing disorder had the highest score on the deviant behaviors by peers scale.

As with the variables type of substance used and age of first use, severity of substance use partially mediated the relationship between deviant behaviors by peers and MHPs. This may suggest that adolescents who have more peers who participate in

deviant activities may develop more severe substance use problems. These more severe substance use problems may then be related to having mental health problems.

Family plays an important role in an adolescent's development and was an important factor in this study. The results indicated that adolescents who had more family members who participated in deviant behaviors had more severe substance use problems. In addition, adolescents who had more family members who participated in deviant behaviors were more likely to have mental health problems. These results are supported by the literature on family and co-occurring disorders. The literature indicated that family can contribute both a genetic predisposition to SUDs or MHPs and can also contribute to the type of environment in which the adolescent develops (Biederman et al., 2000; Chan et al., 2008; Englund et al., 2008; Hayatbakhsh et al., 2007; Hicks et al., 2004).

As with the variables previously described, severity of the substance use disorder also partially mediated the relationship between deviant behaviors by family and MHPs. This may suggest that living in an environment where family members are participating in deviant behaviors may contribute to the severity of the SUD. This relationship may then be related to having MHPs.

While the hypotheses proposed in this study focused on the relationships of each of the independent variables to mental health problems, this study was also designed to understand whether some of these variables were more important than other variables to understanding MHPs among adolescents who use substances. Therefore, two full models were tested.

In both models, the variables severity, type of substance used, deviant behaviors by peers, deviant behaviors by family, and gender were all significant predictors of MHPs. The control variable current age was significant in the linear model, but not the logistic model. The variables age of first use, low SES, and family structure were not significant in either of the final models.

These results may suggest that when we know about other factors like current age, type of substance used, and deviant behaviors by peers and family, factors like age of first use are not as important to understanding MHPs. Thus, it seems likely that an adolescent's current age may be more predictive of MHPs than the age of first use. This may be because older adolescents are more likely to have used substances and may be using substances more frequently.

Another interesting result involved the variable type of substance used. In the full model without the control variables (low ses, gender, age, and family structure), the dummy variable for marijuana use became non-significant. However, the dummy variable for marijuana use was significant in the full model with the control variables. This is an interesting result because in the bivariate analyses, adolescents who reported using marijuana were more likely to have mental health problems than adolescents who used alcohol only. Based on the bivariate and linear regression results, it seems that more research is need on the impact of marijuana use on adolescent MHPs.

Two things were surprising about these results. First, it was surprising that there were not more differences between the models. This may indicate that measuring MHPs as continuous, or a count of symptoms, does not contribute significantly to the understanding of MHPs. In other words, the traditional method of determining whether or not a person meets criteria for a MHP may be an acceptable way of measuring MHPs. These results could also indicate that those adolescents who met criteria for a MHP and who did not meet criteria for a MHP were appropriately categorized. That is, in this sample, the idea of sub-threshold cases may not have applied. Those adolescents with symptoms of MHPs, may have typically met criteria for a MHP.

The second thing that was surprising about the results was that age of first use was not a significant variable in either of the full models. In addition, current age was not a significant variable in the logistic model. This was surprising because the literature seemed to indicate that age of first use would be related to adolescents having more

severe SUDs and be related to adolescents having MHPs. Because age of first use was significant in the bivariate analyses, it seems that more research is needed. However, based on the results of this study, it seems that when other variables are included in the model, age of first use is not an important variable in explaining the variance in MHPs.

While age of first use was not significant in the full model, the inclusion of this variable in this study was important. In previous studies that focused on adults, age of firs use was reported retrospectively, sometimes many years or decades after the first use occurred. This study included what should have been a much more accurate report of the age of first use because the adolescent would only need to recall back one or two years.

Limitations

There were several limitations of this study. One limitation was that all of the adolescents in the sample had been evaluated for substance use. This limits the way in which the findings of this study can be generalized. One main concern with this limitation is that this study does not include adolescents who have used substances but have not gotten in trouble with the legal system or have not raised concerns with their parents, school, or doctor. It may be that these adolescents who have not gotten into trouble actually are using more serious substances, but because they are not using at a party or another place where they might get noticed, they would not have been referred to the Adolescent Health and Resource Center.

A second limitation of this study was that there was limited diversity in the sample. The majority of the sample in this study was white and from a middle-class household. While the sample was typical of a Midwestern town, the lack of diversity in the sample limits the generalizability of this study. The results of this study best generalize to other populations of adolescents who have been evaluated for substance use in a Midwestern town. More research would be needed in order to understand whether the results of this study can be generalized to other populations.

A third limitation of this study was that this was a secondary analysis of data. Because this was a secondary data analysis, some of the variables were limited. For example, some of the literature had indicated that being from a low-income household might be a factor that is related to a person using substances and having a MHP (Barrett & Turner, 2006; Hurtig et al., 2007). Unfortunately, this data set did not have a very good indicator of a household being low-income. Therefore a proxy, whether someone receives government assistance, was used. This variable is further limited by the adolescent's self-report. It may be that adolescents do not know whether their family receives government assistance.

There were similar limitations with the variable Family Structure. Some of the literature indicated that adolescents who live in a two parent home may be at less risk of having substance use problems and MHPs (Barrett & Turner, 2006; Griffin et al., 2000; Goldstein et al., 2008; Swift et al., 2008). Again, there was not a clear measure of this concept in the data set, so a proxy measure was used. Adolescents responded to the question, "Who currently has legal custody of you?" Response choices included parents living together, parents that are separated and share custody, a single parent, other family members, and other types of living situations. Adolescents who responded that their parents living together had legal custody were placed in one category and all other living situations were placed in another category. Again, it is not clear if adolescents would necessarily understand their parents' custody arrangement. Additionally, this question does not appropriately categorize adolescents who live with one birth parent and have a very involved step-parent. It may be that it is having two parental figures in the home that is related to reduced substance use and mental health problems among adolescents. It may not be necessary that both parents be the adolescent's birth parents. Future research should attempt to address this issue.

A fourth limitation involves the categorical substance use severity variable. As described earlier, this variable was coded as use, abuse, dependence without tolerance or

withdrawal, and dependence with tolerance or withdrawal. This categorization was chosen because some of the literature had indicated that it may be the symptoms of withdrawal and tolerance that are related to having mental health problems. Interestingly, only a small percentage of adolescents met criteria for dependence without tolerance or withdrawal. Because of the small number of people who were in this category, the implications of having or not having these symptoms are limited. In most of the analyses, there were not significant differences between adolescents who had symptoms of tolerance and withdrawal and adolescents with dependence who did not have these symptoms. This also may say something about the type of adolescents in this sample. That is, if an adolescent met criteria for dependence, he or she most likely reported symptoms of tolerance or withdrawal. Thus, it may be that adolescents who were evaluated had the more severe substance use problems (dependence) and had these symptoms. In other words, adolescents who were evaluated for substance use problems and met criteria for dependence typically had the more severe symptoms of dependence. While it was not indicated in the literature reviewed, it may also be that in the general population of substance users, symptoms of tolerance and withdrawal are common. Future research should continue to address the occurrence of these symptoms and how they impact mental health problems.

A fifth limitation is the cross-sectional nature of this study. Because this study was cross-sectional, it is not clear that the effects of the substance use were not causing the mental health symptoms. A longitudinal design would be needed to examine whether the mental health symptoms go away after the substance use has ended. Furthermore, due to the cross-sectional nature of this study, it is difficult to say that this study supports a specific model of co-occurring disorders like self-medication. Again, a longitudinal design would likely be needed to monitor the onset of substance use and mental health problems.

Implications

Implications for Knowledge Development

This study contributes to knowledge about the area of co-occurring disorders in two main ways. One important contribution is that this study focused on an adolescent substance using population. Much of the literature on co-occurring disorders focuses on adult populations. Additionally, most of the adult literature used a retrospective report of age of first use. In this study, age of first use was reported within one or two years of the onset of substance use. Furthermore, this study included adolescents with a range of severity of substance use disorders.

The second contribution is that this study examined factors that had been researched and found to be related to co-occurring disorders among adults. The results of this study indicate that mental health problems are common among adolescents who use substances. Furthermore, many of the factors that have been found to be important to understanding adult co-occurring disorders are also important among adolescents. One of the key factors may be the severity of the substance use disorder. In this study, adolescents with more severe substance use problems were more likely to have mental health problems. Furthermore, severity of the substance use disorder mediated the relationship between other factors and mental health problems.

One additional interesting finding is that in this sample, there were very few adolescents who met criteria for substance dependence without symptoms of tolerance and withdrawal. It was thought that examining symptoms of tolerance and withdrawal would be an important contribution of this study. However, it may be that when an adolescent meets criteria for dependence, they commonly have symptoms of tolerance and withdrawal. Or, it may be that the adolescents in this study were presenting with more severe substance use problems. Therefore, more research is needed on the impact of tolerance and withdrawal on mental health problems.

Additionally, this study also included environmental factors like peer and family behaviors. The results indicated that adolescents with more peers and more family members who participate in deviant activities tend to have more severe substance use problems. Furthermore, these adolescents were more likely to have mental health problems in this study.

Finally, this study makes a contribution by modeling the dependent variable in two different ways. In the literature, adult analyses of co-occurring disorders and many analyses with adolescents were limited to categorical measures of MHPs. This study modeled MHPs in an alternative way in addition to the traditional way. To this researcher's knowledge, co-occurring disorders among adolescents had never really been addressed in this way.

Implications for Social Work Practice

The results of this study indicate some important places where social workers may be able to intervene. Half of the participants in this study met criteria for a mental health problem. Therefore, it is important for practitioners who work with adolescents who use substances to screen the adolescents for mental health disorders. Social work students should be trained in how to use screening tools and the practice of screening should be implemented in SUD treatment settings. Furthermore, adolescents in SUD treatment should be monitored for mental health problems. Based on the results of this study, it is not clear if the symptoms of the MHP will go away once the adolescent stops using substances. Therefore, MHPs should be monitored during treatment.

In addition to monitoring for MHPs, practitioners should be prepared to make appropriate referrals for further evaluation for mental health problems. At this point, most practitioners working in a SUD treatment setting will not be able to also diagnose and treat the mental health problems. However, they should be aware of appropriate

referrals and be prepared to work with the mental health professionals to whom they refer.

Integrating mental health treatment into adolescent SUD treatment is also an important implication. In group and individual treatment, counselors and clients should discuss the relationship of the MHPs and substance use. While the results of this study do not necessarily provide support for either the self-medication model or the model that substance use leads to mental health problems, practitioners and clients should discuss the different reasons why people might use substances and suffer from MHPs. Treatment plans should also be designed to help the adolescent deal with both MHP and the SUD.

The results of this study indicated that among those adolescents who have a mental health problem, both internalizing and externalizing disorders were common. Furthermore, these disorders tended to overlap or co-occur. Practitioners should be educated about both internalizing and externalizing disorders. Because externalizing disorders are common among adolescents who use substances, it may be beneficial for clients to learn how to deal with the impulsive feelings that are often associated with ADHD and conduct disorder. Furthermore, it may be beneficial for parents and social workers to identify symptoms of ADHD early in adolescence or childhood. By helping these adolescents deal with the symptoms of ADHD, some of the substance use may be avoided.

Social workers should also be involved in the prevention of adolescent substance use. This may be through social workers role in the schools or by working with families. In the schools, social workers may be able to identify adolescents who are at risk of developing substance use problems and provide some early intervention and education to those adolescents and their families. Social workers could also work with schools to provide more education about the effects of substance use.

Social workers could also help educate families about the risk factors for substance use and co-occurring disorders. Social workers should encourage families to

discuss the effects of substance use with their children. Families should have conversations about substance use beginning when the child is young and continue those conversations throughout the adolescent years. Social workers should also encourage families to pay particular attention to the adolescent's peers. The results of this study indicated that peer use and other deviant behaviors were related to adolescent substance use and mental health problems.

The results of this study may also help social workers identify adolescents who may be at a greater risk of developing MHPs. It seems that among adolescents who use substances, females are at a greater risk of having MHPs than are males. Therefore, females who use substances may need different interventions than males who use substances.

Adolescents with more severe substance use problems, like dependence, may also be at a greater risk of having co-occurring mental health problems. Therefore, it may be beneficial for social workers to intervene with or treat adolescents who are using substances before those adolescents go on to develop more severe SUDs.

Similarly, adolescents who reported using marijuana and other illicit drugs were more likely to have co-occurring MHPs. Thus, it seems that preventing the onset of drug use may reduce the occurrence of these co-occurring disorders. Furthermore, adolescents who use drugs other than alcohol may need different types of interventions.

Implications for Social Work Education and Continuing Education

The results of this study also have important implications for social work education and continuing education. First, social workers need to learn about co-occurring disorders in both the undergraduate and graduate programs. Based on the results of this study, social workers need to know that MHPs are common among adolescents who use substances. Additionally, they should learn that the severity of the

substance use disorder may be related to MHPs. Furthermore, adolescents may not fit into a perfect category of meeting criteria for abuse, dependence, or a mental health problem. Thus, it may be beneficial to also teach social workers about thinking about substance use and mental health problems on a continuum.

The second implication for social work education is that social workers should be educated in prevention and early intervention methods for both substance use and mental health problems. Social workers are likely to encounter people who use substances in any setting in which they work. For that reason, it is important for social workers to be aware of the signs and symptoms of substance use and to have some skills to use for intervention. Therefore, it is also important that social work students be trained to screen for both mental health and substance use problems.

Implications for Policy

The results of this study also have important implications for policy development and change. The results of this study indicated that peer behaviors are related to adolescent substance use and mental health problems. Therefore, policies are needed to fund training for teachers and other school staff to identify those students who may be at risk of using substances. It would also be beneficial to have funding for programming in schools that would help adolescents identify risky behaviors among their friends and encourage them to broaden their circle of friends.

Based on the results of this study, the behaviors of family members also are related to adolescent substance use and mental health problems. Therefore, funding for family level interventions is needed. For example, adolescents who come from homes where substance use is occurring may need different interventions than adolescents who are in more stable living environments. These interventions or treatments should involve the family members and help the family members to reduce or stop their substance use.

This may also include housing programs where families with children can be supported and receive treatment for substance use and mental health problems.

Policies are also needed to fund interventions for adolescents and children who have ADHD and conduct disorder. If these adolescents can be identified early on and receive help in developing skills to resist substance use and other impulsive behaviors, then some of the substance use problems may be reduced. Families who have children who have ADHD, conduct disorder, or any other mental health problem need to support of schools, pediatricians, friends, and family to help their children transition to adolescence successfully.

Another, larger policy change that is needed has to do with mental health parity. The original Mental Health Parity Act of 1996 attempted to make coverage for mental health treatment equal to the coverage an insurance plan provides for medical treatment. Among other problems was the exclusion of substance use disorder treatment from the act. The Mental Health Parity Act of 2008 says that plans must provide coverage for mental health and substance use treatment benefits and that the coverage cannot be more restrictive than medical or surgical benefits. However, if an insurance plan does not cover mental health treatment or substance use disorder treatment, they are not necessarily required to add it to the insurance plan. Therefore, more changes need to be made in the way the mental health and substance use disorder treatment are paid for. Based on the results of this study, some adolescents may need to access treatment for both a MHP and a SUD. Restricting the money available for these treatments limits the type of help an adolescent can get. Furthermore, the results indicated that adolescents with more severe substance use problems were more likely to have mental health problems. Ideally, adolescents would be able to access treatment before their problems get too severe.

A similar policy implication would be the issue of diagnosing adolescents with substance dependence. Currently, in order for an insurance provider to pay for SUD

treatment, the adolescent must be diagnosed with substance abuse or dependence. Unfortunately, these diagnoses may have serious implications for an adolescent later in life. Having a diagnosis like substance dependence may make it difficult for the adolescent to obtain life or health insurance later. It could even have implications for education and jobs if the employer or school had information about the diagnosis. While it is clearly important for adolescents who have problems with substance use to access treatment, there may be times when the consequences of having a diagnosis outweigh the benefits of treatment. Ideally there would be some alternative diagnosis for adolescents who have problems with substance use so that they could access treatment but not have a label that might follow them through their adult life.

Implications for Future Research

There are several implications for future research based on the results of this study. They are divided into the following four groups: variables, sample, design, and populations.

Variables

Due to the small group size, the results of this study did not provide conclusive information about the relationship between symptoms of withdrawal and tolerance and mental health problems. Therefore, future studies should attempt to examine the impact of these symptoms on mental health problems in more depth.

Similarly, the impact of current age and age of first use were not conclusive. Age of first use was important in the bivariate analyses, but not in the linear or logistic regression models. Current age was significant in the linear model but not in the logistic model. Based on the literature reviewed and these results, it seems that current age and age of first use may be related to mental health problems. However, this relationship needs to be further examined.

The method of comparing a continuous MHP variable to a categorical MHP variable should be replicated in future studies. The results of this study indicated that there were not major differences between the two models. It is not clear from this study whether that is because the adolescents with multiple mental health symptoms were appropriately categorized as having a MHP or whether there really is not an important difference when MHPs are modeled continuously or categorically. By replicating the modeling of MHP as the dependent variable in future studies, more knowledge can be gained about the impact of categorizing MHPs.

Sample

Future research should include adolescents who do not report substance use or have not been referred for a substance use evaluation. In this study, all the adolescents had been evaluated for substance use problems. Therefore, the dependent variable in this study had to be MHPs and not co-occurring disorders. The results of a study that is not limited to adolescents who have used substances could model co-occurring disorders using a different dependent variable and would be more generalizable to the adolescent population.

Future research should also include a sample with greater diversity. This could be done by analyzing GAIN data from other research sites or by conducting a study in a location with a more diverse population. By including a better representation of other races and ethnicities in the sample, the results would be more generalizable to adolescents in general.

Design

Future research should incorporate different research designs. Because this study was a secondary analysis of data, some of the variables were limited. Thus, future studies should include more family history and more SES information.

Additionally, because this study was cross-sectional, there are limited implications for understanding how co-occurring disorders develop or change over time. Future studies should incorporate a longitudinal design. A longitudinal study that begins with participants before they reach adolescence may be able to capture the development of SUDs and MHPs among some adolescents in the sample. A longitudinal study that follows adolescents while they are in SUD treatment, would contribute to understanding how treatment affects the two disorders. Both of these research designs would contribute to the understanding of the different models of co-occurring disorders.

Future research should also incorporate reports from other key informants. Having parental reports of the adolescent's behaviors would provide additional understanding of the adolescent's disorder and the impact of co-occurring disorders on families.

In the future, a cross-sectional or longitudinal study could be conducted with a population of adolescents who have presented for mental health problems. It will be important to understand whether adolescents presenting with mental health problems look similar to or different from adolescents presenting with substance use problems.

Populations

Because the knowledge base on co-occurring disorders is still developing, it is important to conduct future research with different populations. For example, conducting research with young adults or college age students would contribute to the understanding of substance use and mental health disorders. The young adult years are a time when a person has easy access to alcohol and sometimes other substances. Furthermore, binge drinking among college age students is a concern for many colleges and universities. Evaluating college students for binge drinking, substance use problems, and mental health problems would help universities develop better interventions and policies for their students.

Similarly, samples of military service members and veterans should be studied. As with the college age population, many military service members are at an age where drinking and binge drinking are common. Currently, military service members and veterans have the added obstacle of serving in or having served in a war. Research designed to understand SUDs and MHPs in this population both before and after wartime service would contribute to understanding co-occurring disorders. It would also contribute to developing appropriate prevention methods and intervention methods for this population.

Conclusions

The purpose of this dissertation was to understand which characteristics are associated with mental health disorders among adolescents who use substances. To develop research questions and hypotheses, the literature on adult co-occurring disorders and adolescent co-occurring disorders was reviewed. Based on the literature reviewed, it was hypothesized that the severity of the substance use disorder, the type of substance used, age at first use, deviant behaviors by peers, and deviant behaviors by family would be related to MHPs among adolescents who used substances.

The results indicated that many of these factors had a relationship to adolescent MHPs. The most important factors in this model seemed to be severity of the substance use disorder, the type of substance used, behaviors of peers, and behaviors of family. As hypothesized, severity of the substance use disorder had a significant relationship to MHPs and also mediated the relationship between the other factors and MHPs.

In addition to examining factors which had been identified as important to understanding co-occurring disorders among adults, this study modeled the dependent variable in two different ways. MHPs were measured both continuously and categorically and the regression analyses using these dependent variables were compared. The results of the comparison indicated that there were not major differences between the

two models. Only one control variable, current age, was significant in one model and not the other. To this researcher's knowledge, this type of data analysis method had not been used before in understanding co-occurring disorders.

This study provided an initial step in understanding co-occurring disorders among adolescents. However, more research is needed to identify other factors that might impact co-occurring disorders. With continued research in this area, it might be possible to better understand the development of co-occurring disorders. It might also be possible to develop better prevention methods to prevent the onset of a SUD or a MHP. Furthermore, it might be possible to develop more effective intervention methods to treat both disorders.

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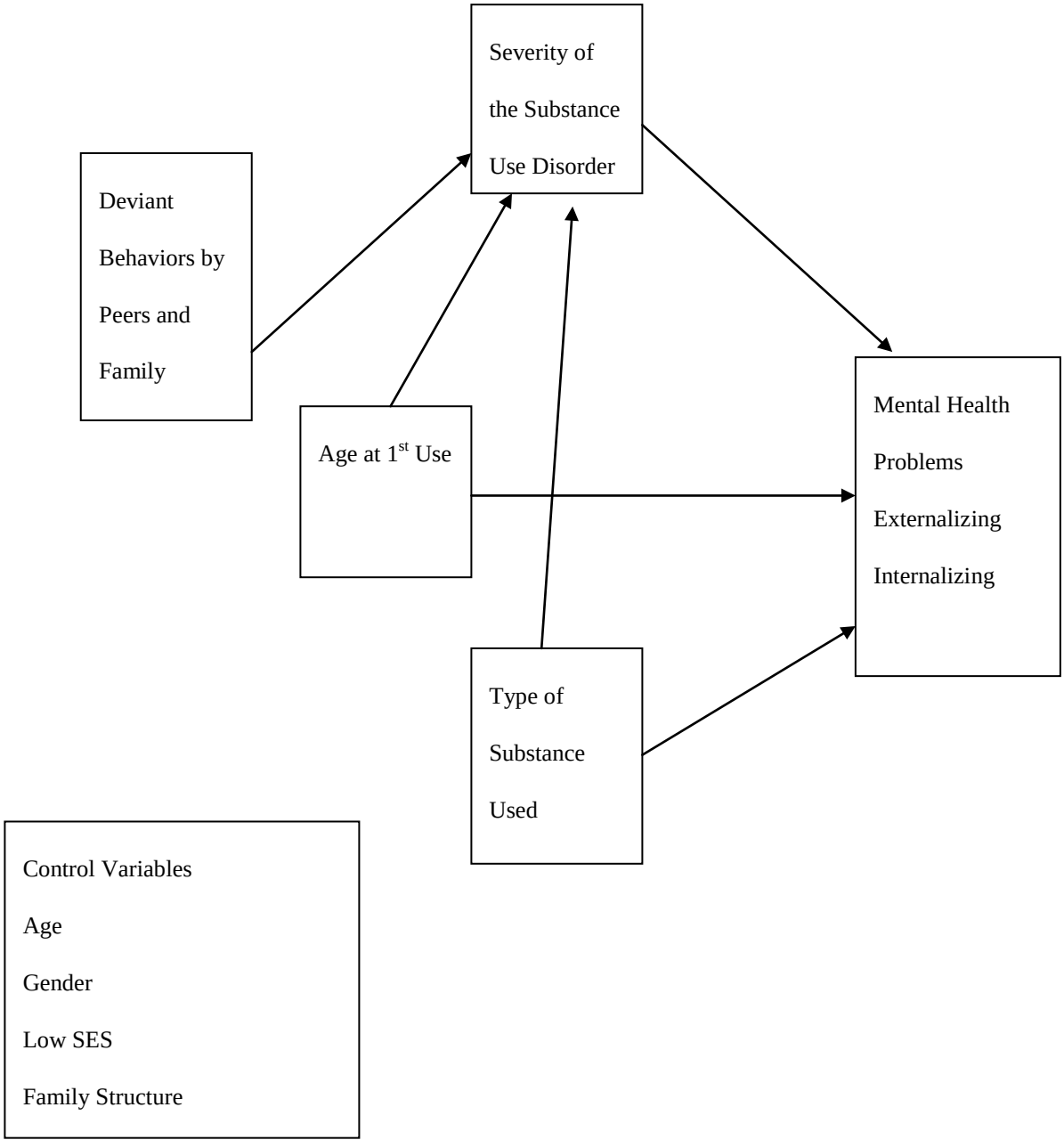
APPENDIX A: CONCEPTUAL DIAGRAM

Figure A-1. Conceptual Diagram



APPENDIX B: DESCRIPTION OF LONGITUDINAL STUDY

Longitudinal Study

Adolescents who were referred to early intervention, regular outpatient, or intensive outpatient were invited to participate in a longitudinal study. The adolescent and the parent were told about the study at the end of the SORT after the recommendation for treatment was made. The purpose of the longitudinal study was to compare a family based treatment to a treatment typically used with teens. Treatment as usual was called Seven Challenges (Schwebel, 1995, 2004)) and is a commonly used treatment for adolescents who have problems with substance use. This type of treatment involves meeting with a counselor and attending group treatment with other teens. The treatment program is based on seven different challenges or topics that help the adolescent recognize their problems with substance use and develop skills to prevent substance use problems in the future. The topics include decision-making exercises, skills training, journaling, and concepts of motivational interviewing.

The study treatment, Strengths Oriented Family Therapy (SOFT) was a family based treatment were family members attended some of the appointments with the counselor and the weekly group treatment consisted of teens and their families (Berg & Miler, 1992). SOFT included components like a motivational family session before treatment, solution-focused family therapy, and skills training groups with multiple families. Teens who agreed to participate in the study were randomly assigned to family treatment or seven challenges treatment from June 2003 through August 2005. In 2005 the principal investigator decided to change to clinical assignment. This change was made because preliminary analyses showed that some adolescents did better in certain types of treatment. For example, adolescents who had experienced trauma had more success in the 7-challenges treatment.

Adolescents who participated in the study completed four follow-ups. Follow-up appointments were completed at 3, 6, 9, and 12 months after the initial GAIN assessment. At each follow-up, adolescents completed a monitoring version of the GAIN called the

Global Appraisal of Individual Needs Monitoring 90 days (GAIN-M90) and additional instruments. Parents attended the 6 and 12-month follow-ups where they completed a collateral version of the M-90 and other instruments. Adolescents and their parents were compensated for attending the follow-up appointments.

APPENDIX C: DETAILED DESCRIPTION OF MEASURES

Table C-1. Detailed Description of Measures.

Measure	Scales	Number of items	Level of Measurement	Diagnostic	Alpha Co-efficient	Reference
Mental Health	Internal Mental Distress Scale (IMDS)	43	Nominal (2 dichotomous)	Higher score indicates more internal mental distress		
Major Depressive Disorder (MDD)-based on subscales of the IMDS	Depressive Symptom Scale (DSS9)	9	Nominal	5+ symptoms indicates MDD	(9 items, Alpha 0.82)	Dennis, Chan, and Funk, 2006
	Somatic Symptom Index (SSI)	1	Nominal		(4 items, Alpha 0.66)	
	Homicidal Suicidal Thought Scale (HSTS)	1	Nominal			
	Anxiety/Fear Symptom Scale (AFSS)	1	Nominal		(12 items, Alpha=0.83)	

Table C-1-continued

Generalized Anxiety Disorder (GAD)-based on subscales of the IMDS	SSI DSS9 AFSS	2 3 3	Nominal Nominal Nominal	3+ symptoms indicates GAD	(4 items, Alpha 0.66) (9 items, Alpha 0.82) (12 items, Alpha=0.83)	Dennis, Chan, and Funk, 2006
Traumatic Stress	Traumatic Stress Scale (TSS)	13	Nominal	Higher scores indicate more problems related to memories of experiences that have happened in the past	(13 items, Alpha=0.92)	Dennis, Chan, and Funk, 2006
ADHD combined type	Inattentive Disorder Scale (IDS) Hyperactivity-Impulsivity Scale (HIS)	9 9	Nominal Nominal	6+ symptoms on each scale indicates combined type	(9 items, Alpha=0.92) (9 items, Alpha=0.86)	Dennis, Chan, and Funk, 2006
ADHD-Inattentive type	Inattentive Disorder Scale (IDS)	9	Nominal	6+ symptoms indicates inattentive type	(9 items, Alpha=0.92)	Dennis, Chan, and Funk, 2006

Table C-1-continued

ADHD-Hyperactive Type	Hyperactivity-Impulsivity Scale (HIS)	9	Nominal	6+ symptoms indicates hyperactive type	(9 items, Alpha=0.86)	Dennis, Chan, and Funk, 2006
Conduct Disorder	Conduct Disorder Scale (CDS)	15	Nominal	3+ symptoms indicates conduct disorder	(15 items, Alpha=0.85)	Dennis, Chan, and Funk, 2006
Substance Abuse	Substance Abuse Index-Past Year (SAIY)	4	Nominal	1+ symptom indicates abuse	(4 items, Alpha=0.7)	Dennis, Dwaud-Noursi, Muck, & McDermeity, 2003
Substance Dependence	Substance Dependence Scale-Past Year (SDSY)	7	Nominal	3+ symptoms indicates dependence	(7 items, Alpha=0.83)	Dennis, Dwaud-Noursi, Muck, & McDermeity, 2003
Alternative SUD severity measure	Substance Problem Index-Past Year Substance Problem Index-Past Month	16 16	Nominal	Higher scores indicate more severe substance use problems	(16 items, Alpha= 0.90)	Dennis, Chan, and Funk, 2006
Age at First Use	1 question "how old were you when you first got drunk or used any drugs?'	1	Continuous			

Table C-1-continued

Type of Substance	1 question "when was the last time (if ever) you used…."	13	Nominal/Ordinal	This will be an ordinal variable (alcohol only=0, marijuana with or without alcohol=1, other illicit drugs=2)		
Deviant behaviors by peers	Vocational Risk Index Social Risk Index	7 7	Summative score/continuous Summative score/continuous			
Deviant behaviors by family	Living Risk Index	7	Summative score/continuous			
Gender	1 question	1	Nominal			
Age	1 question	1	Continuous			
Low SES	1 question	1	Nominal			
Family Structure	1 question	1	Nominal			

APPENDIX D: DATA TRANSFORMATION

Figure D-1. Distribution of Continuous Dependent Variable

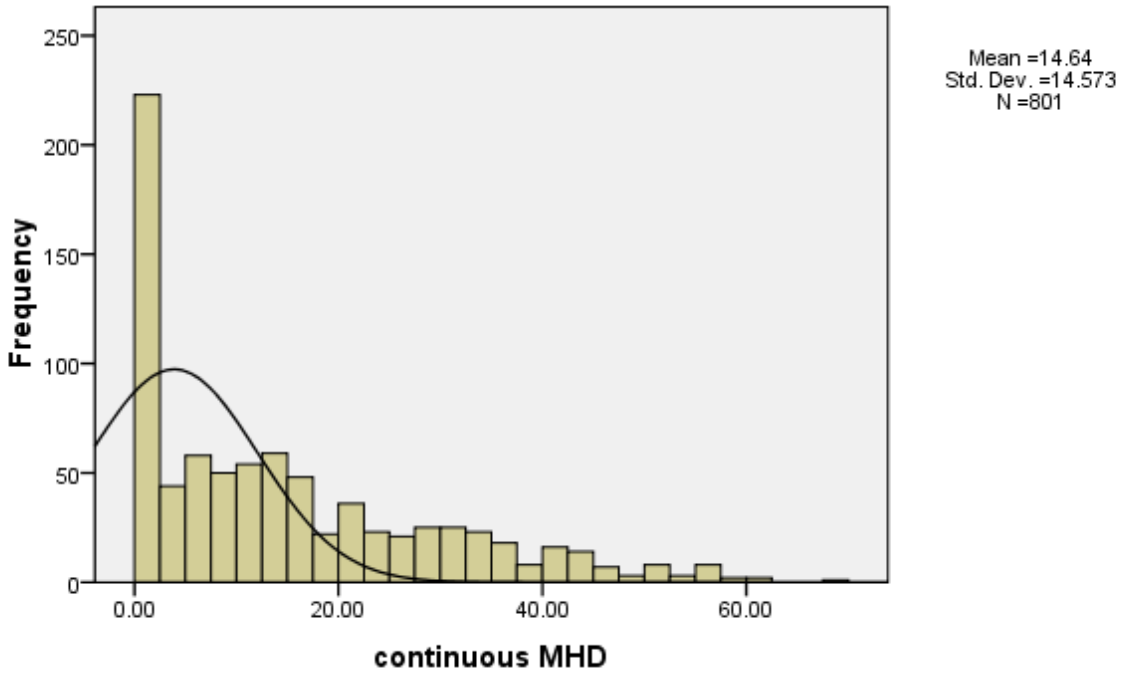


Figure D-2. RMSE and Lambda

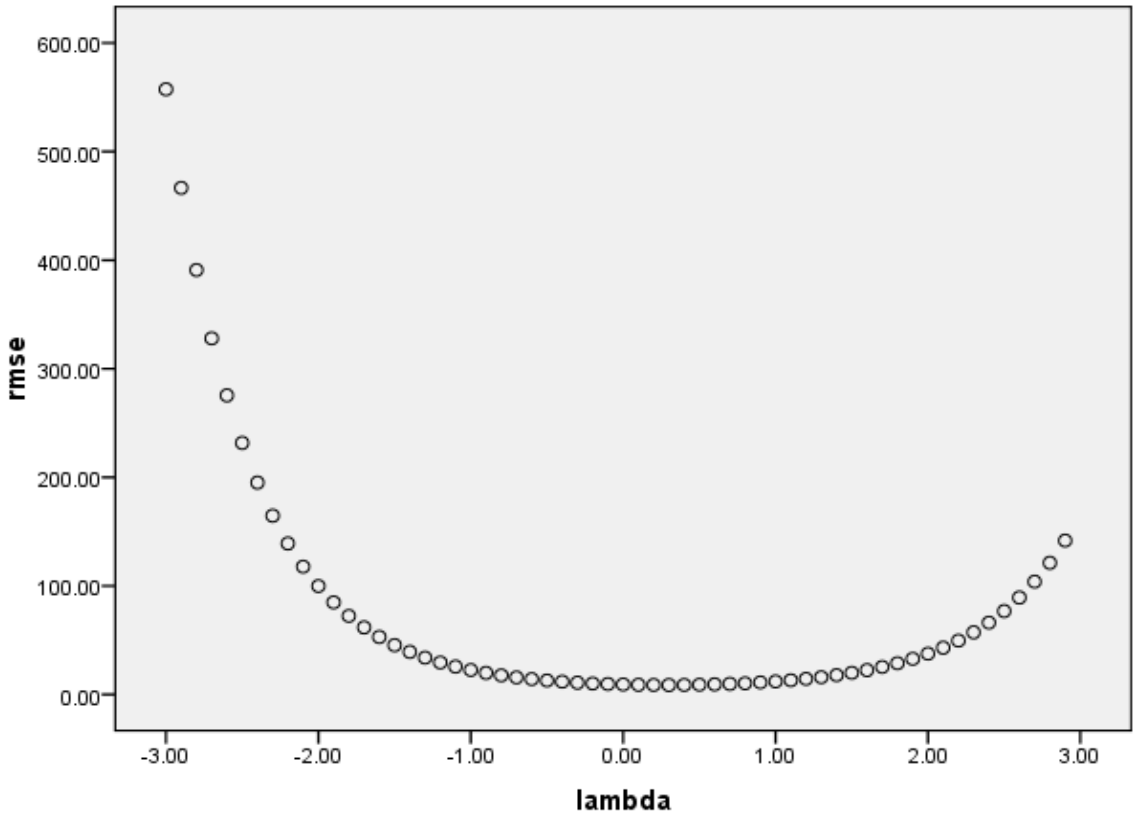


Figure D-3. Distribution of the Transformed Dependent Variable