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Associations between Multi-Level Contextual Factors and Mental Health Service Utilization in Adolescents with Comorbid Depression and Substance-use: Moderating Role of School Connectedness on Racial/Ethnic Disparities in Service Utilization

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"Associations between Multi-Level Contextual Factors and Mental Health Service Utilization in Adolescents with Comorbid Depression and Substance-use: Moderating Role of School Connectedness on Racial/Ethnic Disparities in Service Utilization."

by

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B.S., University of North Georgia

A Thesis Submitted to the Graduate Faculty
of Georgia State University in Partial Fulfillment
of the
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MASTER OF PUBLIC HEALTH

ATLANTA, GEORGIA
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ABSTRACT

"Associations between Multi-Level Contextual Factors and Mental Health Service Utilization in Adolescents with Comorbid Depression and Substance-use: Moderating Role of School Connectedness on Racial/Ethnic Disparities in Service Utilization."

By

Katherine Anne Thornton

08/17/2016

INTRODUCTION:
Comorbid depression and substance-use has been a prevalent issue in adolescent health. Although rates have remained relatively stable their presence is still alarming and efforts to see a decrease have led leaders and organizations to call for research to better understand factors related to both depression and substance-use as well as how these factors may change when focusing on the presence of these disorders together.

AIM:
The primary aim of this study is to better understand the contextual factors related to mental health care utilization in comorbid adolescents. Specifically focus will be directed to better understand how and individual's relationship to their school and teachers may relate to mental health care use and whether or not increased school attachment could reduce disparities present in mental health care use.

METHODS:
Data from the National Survey on Drug Use and Health (NSDUH) was utilized to test the research objectives for this study. The NSDUH is an on-going cross-sectional survey of the civilian and non-institutionalized population of the United States. In order to address the research aims multi-level logistic regression procedures were used to determine the relationship between mental health care utilization and research measures in adolescents with comorbid depression and substance-use.

RESULTS:
Multi-level modeling showed that the model that controlled for individual-level and family-level factors was able to best predict mental health care use (model 4, -2LL=945,303, $p >> 0.001$). In addition, school attachment was shown to be positively associated with mental health care use in all models tested, including the best-fit model selected (OR=2.18 (95% CI 2.13, 2.22). Other contextual factors that were significantly associated with mental health care use were gender (OR=1.92 (95% CI 1.88, 1.94)), parental attachment (OR=1.72 (95% CI 1.70, 1.74)), and poverty (OR=1.59 (95% CI 1.58, 1.62)). In addition, the school attachment and race/ethnicity interaction term was found to be significant with an odds ratio of 3.02 (95% CI 2.96, 3.22).

DISCUSSION:
This research has shown the importance of contextual factors, specifically the school environment, on the service-use of comorbid adolescents. Particularly interesting in the world of mental health prevention is the use of schools as key coordinators in providing specialty mental health services to adolescents who need them especially for those who suffer from service-use disparities.

APPROVAL PAGE

"Associations between Multi-Level Contextual Factors and Mental Health Service Utilization in Adolescents with Comorbid Depression and Substance-use: Moderating Role of School Connectedness on Racial/Ethnic Disparities in Service Utilization."

by

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08/17/2016

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Author's Statement Page

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___Katherine Anne Thornton_____
Signature of Author

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Introduction

1.1 Background

Adolescent mental health has quickly become a prominent health concern in the United States and around the world. It is approximated that 1 in 5 children and adolescents suffer from a mental health disorder yet nearly 80% of these children and adolescents do not receive the treatment they need (Amaral, 2011). Depression, in particular, continues to be one of the most common mental illnesses affecting adolescents. In 2012, a survey conducted by SAMHSA found that 9.1% of the population ages 12 to 17 had a major depressive episode during the past year. Adolescence is a critical time of transition where biological changes meet key developmental tasks such as increasing independence and strengthening crucial bonds with the world outside of one's sole experience through family ties (Park et al, 2006). Thus the presence of mental health disorders can immensely complicate an already difficult transitional period and create significant stress to both the individual and their family and friends. Strong associations exist between poor mental health and other health and developmental concerns of adolescents such as educational achievement, violence, and reproductive/sexual health.

Substance-use and dependence is a major concern among adolescents with depression. A survey by SAMHSA found that in 2013 the rate of illicit drug dependence or abuse among adolescents aged 12 to 17 was 3.5% and that 8.8% of this population were current illicit drug users. (SAMHSA, 2013) Presence of both disorders together in an individual presents immense complications for the health of the individual. Substance-use disorders can lead to poor academic performance, accidents and injuries, overdose, and other adverse outcomes.

Mental health care service utilization within this adolescent population is another prominent public health concern. Several studies have found mental health care utilization rates range from almost 80% to between 25% and 33% of adolescents who need mental health care do not receive that care (Amaral, 2011 and NCCP). Despite the large variation it is still widely known that mental health service utilization is a key issue in this population (Merikangas, 2011). Low rates of utilization have been contributed to a wide-range of factors from sociodemographic to stigma-related factors. However, a

majority of studies have concluded that low utilization rates are most likely due to a combination of factors all working in accordance together to create barriers to treatment.

Mental health and substance-use disorders have been associated with adverse outcomes such as poor school performance, social relationships, involvement in child welfare or juvenile justice, risky sexual behaviors and etc. (Schwarz, 2009). Thus focus on this area of adolescent health is of great importance, especially focused research into specific populations such as comorbid adolescents. The hope is that this narrowed approach will yield a better understanding of a complex system and help highlight where best to allocate resources in order to ensure the treatment of all individuals.

1.2 Purpose of Study

The purpose of this study is to explore contextual factors that may influence the use of mental health service utilization in adolescents with comorbid depression and substance-use. Particular focus will be placed on how factors related to school connectedness and mental health services provided in schools interact with race/ethnicity and economic status. Through this approach the aim is to better understand how schools could help reduce disparities in mental health care use. By exploring how school connectedness interacts with other individual and contextual variables the relationship between school related variables and the individual will be better illuminated. In order to achieve this goal multi-level models will be tested in order to better understand how individual and contextual variables, especially those associated with school interact to influence mental health care service utilization in adolescents with comorbidities. Focus on the adolescent population is intentional due to the major implications of decisions and experiences made during these formative years and their impact on the life-long health of an individual. Previous studies have suggested that in order to better understand mental health service utilization in the adolescent population it is essential to focus research questions on specific disorders and specific subpopulations (Cauce, 2002). In accordance with this suggestion this study will be focused on adolescents with comorbid depression and substance-use. Previous research has also placed major emphasis on the racial/ethnic disparities present in adolescent mental health service utilization (Cummings, 2014, Cummings, 2011, Merikangas, 2011). In order to improve access and use for all

adolescents, it is essential to better understand how to improve the situation for those individuals who experience some of the greatest service disparities. The school has been a primary focus of both research and policy. Schools play a major role in the development of children and adolescents and are uniquely qualified to impart change in the mental health care field. This is mainly due to their unrivaled access to children and adolescents during a critical time in their development. Children and adolescents spend the majority of their time either at school or involved in activities related to school. This allows professionals within this environment to observe youth in their natural context and notice significant impairments that could indicate mental health problems. Also schools are unrivaled in their ability to create a sort of "level playing field" for all children and adolescents in regard to access to services (Stephan, 2007, Power, 2005, Farmer & Farmer, 1999).

1.3 Theoretical framework

In order to design the theoretical framework that will be used to guide appropriate review of the literature as well as inform the creation of the research question, three major theories will be utilized. Special focus will be placed on the social-ecological model first introduced by Bronfenbrenner. This theory establishes the influence of multiple systems on an individual. One individual is characterized to be influenced by both personal/individual factors and broader factors that reside in successive systems; microsystems, mesosystems, and macrosystems. These systems become larger and encompass greater numbers of populations of individuals as progression up the hierarchy continues. The second theory included will be the help-seeking pathway, which will help inform how adolescents seek out service selection and subsequently utilize the services. This is only a part of a larger pathway that begins with problem recognition then the decision to seek help, and finally service selection and utilization (Cauce, 2002). The final theory is Andersen's social behavioral model, which has been used to explain mental health care service utilization in previous studies. This model posits that there is also a hierarchical framework that contributes to the pathway of service utilization. One level of this hierarchy encompasses population characteristics and another individual characteristics. These characteristics include predisposing, enabling, and need-based factors, which sequentially contribute to an individual being more

or less likely to seek out services. For this study focus will be placed on certain subsections of these theories in order to better understand the process that leads to mental health care service utilization in this comorbid adolescent population. This is done based off recommendations in the literature that emphasize that the best way to study this process is to look at subsets of these theories in order to better understand the factors that influence them. For example, focus on service selection and utilization allows for a more complete analysis of contextual factors that influence this part of the help-seeking pathway in the target population. The use of the social-ecological model and Andersen's social-behavioral model will help inform the selection of contextual factors (Figure 1). For example, a common enabling factor may be the socioeconomic status of the family. The hope is that a comprehensive look into these factors will allow for the creation of multi-level models that will ultimately allow for controlling of contextual covariates in order to better understand how school connectedness may moderate the effects of race/ethnicity on mental health care service utilization, a disparity that has been well-established in the literature. (Cummings, 2014, Cummings, 2011, Merikangas, 2011, Garland, 2005).

1.4 Study Hypotheses

The primary objective of this study is to evaluate the relationship between individual, family, and school-level contextual factors and mental health care use in adolescents with comorbid substance-use and depression. First, it will be important to show that these contextual factors are significantly associated with mental health care use in this specific study population of adolescents with co-occurring depression and substance-use. Then focus will be placed on determining the role of school connectedness, a contextual factor, in mental health care use of these adolescents. According to research highlighted in the review of the literature the school is an important arena for identifying and treating afflicted adolescents. Thus it is predicted that higher rates of school connectedness in individuals would increase their likelihood of using mental health services while controlling for other factors that have been shown to also influence service-use. In addition to the inclusion of individual and family factors particular focus will be placed on how models that include race/ethnicity as a predictor of mental health service use are influenced by school connectedness. Race/ethnicity has been shown to be a major factor in mental health

services use and disparities are inherent in many adolescent populations. This study predicts that positive reports of school connectedness may play a protective role in minority mental health service use.

Review of the Literature

2.1 Adolescent Depression, Substance – Use, and Co-occurring Disorders

According to the National Survey on Drug Use and Health (NSDUH), conducted by SAMHSA in 2014, approximately 11.4% of the adolescent population, aged 12 to 17, had a major depression episode (MDE) in the past year and 8.2% had a past year MDE with severe impairment in one or more role domains. MDE was measured using DSM-IV diagnostic criteria and was defined has a period of two weeks or longer in the past 12 months when they experienced a depressed mood or loss of interest or pleasure in daily activities, and they had at least some symptoms in addition such as problems with sleep, eating, concentration, and etc. The percentage of adolescents with MDE in the past year was higher than the percentages seen in 2004 to 2012 but about the same as those seen in 2013 (Center for Behavioral Health Statistics, 2015). Another nationally recognized survey is the YRBS (Youth Risk Behavior Surveillance) conducted by the CDC. The 2015 YRBS was able to measure depression through a proxy measure by estimating the prevalence of adolescents who reported feeling so sad or hopeless almost every day for 2 or more weeks in a row that they stopped doing some of their usual activities. Of the students surveyed, 29.9% of the students nationwide reported these feelings (Kann, 2015). Another study also found that the prevalence of mood disorders, of which depression is one, increased with age. This study reported that there was an observed two-fold increase in mood disorder prevalence from the 13 to 14-year-old age group to the 17 to 18-year-old age group (Merikangas, 2011). Mental disorders, especially depression, make a substantial contribution to the burden of disease in young people. Youth who experience a major depression episode are at an increased risk of mental illness in adulthood (Bond, 2005).

Another prevalent issue in adolescent health are substance-use disorders. Research indicates that up to 75% of adolescents with substance-use disorders also have co-occurring mental health disorders

(Stephan, 2007). In one study it was reported that of all the adolescent's in the sample, 11.4% had substance-use disorders. 8.9% of these adolescents reported drug abuse/dependence and 6.4% reported alcohol abuse/dependence. In addition, approximately 20% of the sample met criteria for a disorder from at least one additional class (Merikangas, 2010). Co-occurring depression and substance-use disorders among adolescents has been a long established problem for the health of this population and its prevalence is consistently present among adolescents. The same NSDUH 2014 study found that the percentage of adolescents aged 12 to 17 who used illicit drugs in the past year was higher among those with a past year MDE (33.0%) than those without (15.2%). In addition, youths with a past year MDE in 2014 were also more likely to be users of marijuana, nonmedical users or psychotherapeutics, users of inhalants, and users of hallucinogens in the past year. 12.4% of the 2.8 million adolescents who had a past year MDE in 2014 also had a past year substance-use disorder (SUD). This is in contrast to the 4.0% of adolescents without a past year MDE who had an SUD (Center for Behavioral Health Statistics and Quality, 2015). Still more research has found that comorbidity estimates of depression and substance-use disorders among youth range from 11.1% to 32.0%, with a median of 18.8% (Scholes-Balog, 2015, Armstrong & Costello, 2002). Adolescent depression as mentioned previously is associated with decreased relationship quality, poor physical health, low educational attainment, and a multitude of other adverse outcomes. In addition, onset of depression in the formative years of adolescence place these individuals at increased risk for adverse developmental experiences. Even more concerning is the increased likelihood of an adolescent with depression to develop substance-use tendencies that can eventually develop into substance abuse and dependence (Scholes-Balog, 2015, Mason, 2012). Several studies have highlighted the link between adolescent depression and use of substances such as tobacco, alcohol, and other drugs (Scholes-Balog, 2015, Cummings, 2012, Armstrong & Costello, 2002). Prevalence of substance-use in adolescents has been shown to predict continued drug use into adulthood as well as produce individuals who are five times more likely to develop abuse and dependence disorders in adulthood (Armstrong & Costello, 2002, Felton 2015). Depressive symptoms in childhood and early adolescence has also been shown to predict mid-adolescent alcohol-related problems and not just issues

later in life (Curry, 2012). Not only has depression been linked to increases in substance-use in adolescents but comorbidity has been shown to impact treatment and recovery which leads to slower recoveries and the likelihood of relapse (Felton, 2015).

The relationship between depression and substance-use is a major public health concern. As stated earlier not only are these disorders common on their own but their comorbidity threatens to be a complex issue that not only complicates current treatment but also increases the likelihood of adverse outcomes and treatment complexity as the adolescent matures into adulthood. A strong association exists between poor mental health and other health and development concerns for young people, including educational achievement, substance use, violence, and reproductive and sexual health. (Amaral, 2011, Crisp, 2006).

2.2 Risk and Protective Factors associated with Mental Health Service Use

Underutilization of mental health services by the adolescent population has been documented in research and is a significant concern for the health of these individuals across their lifetime. According to one study the percentage of adolescents who receive mental health service ranges anywhere from 11% to 40%. An additional study found that approximately 36.2% of adolescents with a mental disorder received treatment for that particular mental disorder over their lifetime. The rates of service use were found to vary according to disorder. Of adolescents with mood disorders, 37.7% received disorder specific treatment and of adolescents with substance-use disorders, 15.4% received disorder specific treatment. In 2012, SAMHSA conducted the annual National Survey on Drug Use and Health (NSDUH). Among the several measures of mental health and lifestyle indicators reported, the NSDUH also estimates mental health service utilization rates among adolescents aged 12 to 17. Among the youths surveyed 3.1 million (12.7%) received treatment or counseling for emotional or behavioral problems in a specialty mental health setting in the past 12 months. In addition, approximately 3.2 million youths (12.9%) received mental health services in an educational setting (SAMHSA, 2012). The trend in service modality setting continued in other studies as well. One study in particular found that 46.5% of adolescents received

treatment in the mental health specialty service sector and 35.4% received treatment in the school setting (Merikangas, 2011).

Essential for conducting research in mental health care service use is the understanding of both the rates of use among certain populations as well as the factors that influence the use of these services. Most research focuses on two broad categories of factors, individual and contextual-level. The Behavioral Model of Health Services Use has often been utilized to identify individual and contextual-level factors in mental health service utilization research. The model states that at both levels there are predisposing, enabling, and need-related factors that influence the usage of mental health services by adolescents. One study found that an influential contextual-factor for mental health service use in this population was the socio-economic status of the community in which the adolescent lived. Another important contextual-level factor identified by several studies were the attitudes and beliefs held by the community regarding mental health conditions and mental health help-seeking. This community could be assessed as more broad such as that of a county or neighborhood or smaller and more specific such as a peer group or groups who share the same culture and beliefs (Cummings, 2014, Power, 2005). Individual-level factors such as parental marital status, parental education level, family structure, disease severity, insurance status, age, gender, and race/ethnic minority status were all correlates of mental health service use in adolescents (Merikangas, 2011, Goldstein, 2006, Power, 2005). Important protective relationships, those that increased the likelihood of service use, were found to be correlated with variables such as parental engagement and support, school attachment (specifically to institutions that foster adolescent development), positive social skills, and positive attachment to peer groups (Dupéré, 2012, Guest 2009, Bond, 2005).

Timely access to mental health service is incredibly important for adolescents with mental health disorders. Early onset of mental health disorders in childhood have been shown to be more symptomatically persistent and delayed or untreated disorders are correlated with long-term difficulties such as persistence of the disorder into adulthood which in turn makes the disorder harder to effectively treat and manage (Gronholm, 2015, Goldstein, 2006).

2.3 School Environment and Mental Health

Mental health, especially depression, has been established as an issue of critical importance in today's healthcare arena. Specifically, early intervention has been established has the norm for which to strive towards. This early intervention requires a focus on children and adolescents since many mental health disorders begin to emerge or show their symptoms at this point in development. Recently there has been a push to bring coordinated mental health services into schools due to the pivotal role they play in the everyday life of an adolescent. Policy statements from the American Academy of Pediatrics and the New Freedom Commission have highlighted the need for effective collaboration between educators, primary health care providers, and mental health professionals and believe that services brought into the school could help improve upon this coordination and access to services for adolescents who need them (Stephan, 2007). The New Freedom Commission, in addition to promoting mental health services in schools in general, also highlighted the need for addressing comorbid mental and substance-use disorders in schools. The Commission states that although rates of youth substance-use have been declining, half of adolescents have tried an illicit drug before they graduated high school (Stephan, 2007).

Mental health service access and coordination in schools offers a solution to many of the service-access issues. For almost half of the adolescents who do not receive mental health services from outpatient professionals the school is their sole provider (Stephan, 2007, Power, 2005, Rones, 2000). Schools offer an unrivaled platform for mental health services due to its prominence in the lives of adolescents. With more than 52 million adolescents attending school, school mental health programs offer increased accessibility to these adolescents by reducing barriers to service use such as stigma associated with receiving care, lack of providers, long waiting lists, cost, lack of transportation, and inconvenient hours. Schools also are also uniquely positioned to provide services within a natural context for students. This meaning that students may feel more comfortable first receiving these services in the school environment in which they feel more control and attachment. In addition, the school environment provides professionals such as counselors and teachers the opportunity to interact with students in a more

natural way which may allow them to notice issues students are having earlier on in their development which can lead to earlier intervention and treatment (Stephan, 2007, Crisp, 2006).

School attachment and positive school environment also has a positive impact on youth development and mental health even outside offering mental health services and coordination. Studies have found that adolescents who experience a weak connection to their school are at an increased risk of engaging in various risk behaviors ranging from earlier debut of sexual intercourse to substance-use and negative psychological outcomes. Connection to positive institutions such as schools is also associated with increased self-efficacy due to the opportunity for adolescents to interact with positive role models such as older teachers and coaches. These interactions also enhance an adolescents' connection to the community which further improves self-efficacy and development. This increased self-efficacy is linked to better adjustment later in life (Dupéré, 2012, Langille, 2012). Also poor mental health has been linked to poor academic achievement. Recent research shows that approximately 46% of failure to complete secondary school is caused by psychiatric disorders and that increased psychological wellness is strongly linked to positive academic achievement. This strong correlation between mental health and academic success highlights even more the need to better coordinate mental health services within schools so that not only can students become the best versions of themselves academically but also become the best versions of themselves in all aspects (Stephan, 2007).

2.4 Racial/Ethnic Disparities

As mentioned earlier, underutilization of mental health services is a prevalent issue among adolescents. In addition, disparities are often present in mental health service use with specific populations of adolescents utilizing mental health services at lower rates than others. The most prominent of these disparities being racial and ethnic, of which has been documented frequently in the literature (Cummings, 2014, Cummings, 2011, Merikangas, 2011, Alexandre, 2009, Garland, 2005). One study found that the adjusted percentages of blacks (32%), Hispanics (31%) and Asians (19%) who received any treatment for major depression were significantly lower than those of non-Hispanic whites (40%; p < .001). Similar disparities were also present for using prescription medication for MDE and receiving

MDE treatment from a mental health specialist (Cummings, 2011). This treatment gap also extends into substance-use disorders despite the fact that comorbidity and disease severity usually increase the likelihood of receiving services (Merikangas, 2011). Also often indicated in the literature is the disparity present in risk factors correlated to lower mental health service use. Recent research has shown that there is a significant racial/ethnic difference present in such factors as caregiver strain, contact with the juvenile justice system, socioeconomic status, and insurance status, all of which have been shown to be associated with reduced mental health care service use in adolescents (Hofstra, 2002).

It is important that future research in mental health care service use identify the prevalence of racial/ethnic disparities and work to understand the barriers and pathways that lead to lack of service use by these adolescents in order to improve service access for all adolescents. Previously mentioned is the important role of school-based mental health services. The school environment has been shown to reduce some of these disparities in mental health service use among adolescents. Although the disparities do not completely disappear the difference in service use becomes less prominent between non-Hispanic whites and Asians and Hispanics when services are provided through the school setting. Even more promising is that recent evidence has shown that blacks do not differ in their likelihood of receiving school-based mental health counseling compared to non-Hispanic whites (Cummings, 2011).

Methods and Procedures

3.1 Data Source

Data from the National Survey on Drug Use and Health (NSDUH) was utilized to test the research objectives for this study. The NSDUH is an on-going cross-sectional survey of the civilian and non-institutionalized population of the United States and has been conducted since 1971. The NSHUH is sponsored by SAMHSA within the U.S. Department of Health and Human Services and its main purpose is to provide information about the use of illicit drugs, alcohol, and tobacco. In addition, the survey provides information on such mental-health related issues as mental health care use and depression as well as substance-use and dependence in the target population. The data in the NSDUH is collected from

all 50 states and the District of Columbia from non-institutionalized individuals 12 years of age and older (CBHSQ, 2015).

In 1999 administration of the survey changed from paper-and-pencil interviewing to a computer-assisted interview model. This new mode of survey administration involves both computer-assisted personal interviewing (CAPI) and audio computer-assisted self-interviewing (ACASI). The switch to a more computer-based administration design allows for respondents to have more privacy and confidentiality when responding to questions. This increases the level of honest reporting of sensitive behaviors such as illicit drug use or drug selling (CBHSQ, 2015).

Since 1999, the NSDUH has utilized a 50-state design with an independent, multistage area probability sample for each of the 50 states and the District of Columbia. This multistage method involves stratification of each state into state sampling regions (SSRs) which partitioned states into geographically roughly equally sized regions in hopes of each state yielding roughly the same number of interviews. This method resulted in a total of 750 SSRs used in the final collection of the survey data. After organizing the states into SSRs the next stage of selection involved organization into census tracts and then further into dwelling units (DU) in which individual observations were eventually taken. In addition, if necessary census tracts were aggregated within SSRs until each tract met the minimum dwelling unit requirement. This requirement was 250 DUs in urban areas and 200 DUs in rural areas in California, Florida, Georgia, Illinois, Michigan, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Texas, and Virginia. In all remaining states and the District of Columbia the minimum DU requirement was 150 in urban areas and 100 in rural areas (CBHSQ, 2015).

3.2 Measures

Several measures were chosen from the NSDUH in order to address the research objectives. In order to assess the reliability of these measures SAMHSA conducted a study as a part of the 2006 NSDUH in order to assess the reliability of responses. This reliability was assessed through comparison of responses from first interview data to responses from a re-interview stage. Reliability was expressed by estimates of Cohen's kappa (κ), which ranges from -1.00 to 1.00 with larger values corresponding to

better agreement. The kappa values for lifetime and past-year substance-use variables showed almost perfect response consistency with kappa values ranging from 0.82 to 0.93. Demographic variables also showed high response agreement with kappa values ranging from 0.95 to 1.00 for various measures (CBHSQ, 2015).

In order to determine mental health care utilization within the subset population of comorbid adolescents, one NSDUH measure was selected that collected information on specialty mental health services received by the adolescent in the past year from any of the six specific inpatient/residential or outpatient services (see Figure 1). In addition, dummy variables were created from relevant NSDUH measures in order to assess school attachment, adolescent perspectives on peer-substance-use, parental attachment, and family structure (see Figure 1). In addition to these dummy variables, adolescent comorbidity was determined according to responses on past-year major depressive episodes and illicit drug-use or binge drinking. Adolescents were considered to have comorbid depression and substance-use if they had both a past-year major depressive episode and either illicit drug-use which was defined as any illicit drug-use in the past year (illicit drugs include hallucinogens, heroin, marijuana, cocaine, inhalants, sedatives, tranquilizers, stimulants, and analgesics) or binge drinking, which was defined as drinking five or more drinks on the same occasion at least 1 day in the past 30 days. In order to fully understand and test the relationship between mental health care utilization and the various individual and family-level factors, measures such as family income, health insurance coverage, and other demographics such as age, gender, and race/ethnicity were all utilized (see Figure 2).

3.3 Statistical Analysis

Due to the nested nature of the data (adolescents nested within dwelling units and etc.) in the NSDUH sample design, we estimated multi-level models using the SAS PROC GLIMMIX procedure in SAS version 9.4. The SAS PROC GLIMMIX procedure allows the researcher to explore the relationships between an outcome and predictors of multiple levels. It also allows for the researcher to account for nested data when it is present due to survey design and can be used when dependent variables are categorical and non-normally distributed. This study focused on mental health care use, a dichotomous

dependent variable. The multi-level models utilized binomial distribution and the logit link in order to estimate the odds of mental health care use and how it is impacted by factors at the varying levels of the model (Ene et al, 2013). In order to determine model-fit maximum likelihood ratios will be used to test significance using a X^2 distribution with an alpha of $p < 0.05$. In order to ensure representativeness of the sample the data was weighted using sample weights. Odds ratios were also determined with 95% confidence intervals.

3.4 Statistical Models

Multi-level models, also called hierarchical generalized linear models (HGLMs), allow for researchers to sequentially fit models in order to select the model that includes predictor variables significantly associated with the response variable when individuals are nested. Our general model is shown below:

$$logit\pi_{ij} = \gamma_{00} + \gamma_{10}x_{ij} + \gamma_{01}w_{ij} + \gamma_{11}(w_{ij} \times x_{ij}) + \varepsilon_{0j}$$

Where $logit n_{ij}$ is the log odds of mental health care utilization in an adolescent i within a dwelling unit j, γ_{00} is the intercept, $\gamma_{10}x_{ij}$ represents individual-level characteristics, $\gamma_{01}w_{ij}$ represents family-level characteristics (could also add another term to represent school-level characteristics, for simplicity only individual and family-level are shown), $\gamma_{11}(w_{ij} \times x_{ij})$ represents the interaction between individual and family-level characteristics, and μ_{0j} represents the dwelling-unit status error term. Due to data restrictions the variable population density of segment was used to account for the nested nature of adolescents within the NSDUH sample instead of the sample design variable for dwelling unit, which could limit the scope of the analysis.

In order to determine how various individual and family-level factors influence mental health care utilization in adolescents with comorbid adolescent depression and substance-use model fitting will be used. The multi-level model fitting starts with an empty model that consists of only the dependent variable, mental health care utilization. This allows for better understanding of how much of the variance in mental health care utilization is contributed to the nested nature of the data and how much can be contributed to unknown factors that can be further tested in the subsequent models. Multi-level modeling

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begins by first evaluating the relationship between the dependent variable, mental health care utilization, and the two main predictor variables of interest, an adolescent's attachment to school and their race/ethnicity (model 1) without any controls. Model building continues by adding in first individual-level factors[1] found to be associated with mental health care use such as gender and peer substance-use (model 2) and family-level factors such as the adolescent's attachment to their parents, insurance coverage (evaluated at a family level), family structure, and poverty (model 3). In order to better understand the relationship between school attachment and race/ethnicity on mental health care use in this population the final model (model 4) includes an interaction term as well as controls for the individual and family-level factors.

Results

4.1 Descriptive Statistics

The total sample size for this study for which sample weights were provided was 520. This small sample size is due to the restriction of observations to adolescents, ages 12 to 17, with comorbid depression and substance-use within the larger NSDUH sample population of 67,901 which includes all individuals ages 12 years and older. Demographic characteristics of study participants can be found in Table 1. Within the study population there were considerably more females than males (23.27% vs. 76.73%). Also non-Hispanic Whites made up most of the study population (59.04%) with non-Hispanic African American (9.62%), Native American (1.92%), Native Hawaiian/Other Pacific Islander (0.19%), Asian (1.73%), more than one race (6.73%), and Hispanic (20.77%) making up the remaining portion of the sample. Within the comorbid population 21.92% of the adolescents lived in poverty with the remaining 78.08% living above the federal poverty threshold. Table 1 also shows associations between demographic characteristics and mental health care use. Simple regression analysis found a significant difference between mental health care use and race/ethnicity (p=.0166) but not among any of the other demographic characteristics.

Table 2 shows the distribution of individual and family-level characteristics within the study sample. Also shown are results from a simple regression analysis between mental health care use and these individual

and family-level characteristics. Significant differences in mental health care use were found in the following characteristics; school attachment (p=0.0011) and family structure (p=0.0166). An interesting finding was that there were no significant differences found between those individuals with health insurance coverage and those without in regards to mental health care utilization, parental attachment, and peer substance-use. Further analysis using multi-level models will hopefully shed more light on the interaction between these factors and mental health care utilization in this population.

4.2 Multi-Level Logistic Regression

Multi-level logistic regression yielded a variety of results depending on the model being tested. First off using the empty model the ICC was determined to be 0.004. This means that approximately 0.4% of the variance in mental health care use is accounted for by the nested-nature of the data. Model 1 showed that adolescents who reported high school attachment were more likely to use mental health care (OR=2.44 (95% CI 2.40, 2.48)) and that race/ethnicity was less likely than school attachment to predict mental health care use (OR=0.88 (95% CI 0.88, 0.89)). In model 2 and model 3, gender, using females as the reference group, (OR=1.92 (95% CI 1.88, 1.94)), parental attachment (OR=1.72 (95% CI 1.70, 1.74)), and poverty (OR=1.59 (95% CI 1.58, 1.62)) were significantly associated with mental health care use. In these models school attachment remained significant however there was a slight decrease observed in the odds ratio values (model 2 OR=2.29 (95% CI 2.24, 2.34), model 3 OR=2.27 (95% CI 2.26, 2.31)). Race/ethnicity odds ratio remained low however there was a slight increase observed in the odds ratio value models 3 (OR=0.90 (95% CI 0.91, 0.98)) and 4 (OR=0.95 (95% CI 0.94, 0.96)). Another significant results can be seen when the interaction term was added in model 4. This interaction term between race/ethnicity and school connectedness had an odds ratio of 0.90 (95% CI 0.89, 0.90). The best-fitting model was found to be model 4. This model had the smallest -2 log likelihood with a significant log-likelihood ratio (p << 005).

Discussion

5.1 Discussion

The results of this study show that school connectedness is a strong positive predictor of mental health care utilization in adolescents with co-occurring substance-use and depression. The odds of using mental health was almost 2.5 times greater in individuals who were positively connected to their school than in individuals who were not in the first model tested (model 1). This model also found that race/ethnicity was significantly associated with mental health care use. The model found that non-Hispanic whites were almost 2 times more likely to receive mental health care compared to all other races (95% CI 1.89, 1.97). Also interesting to note is that as more factors were added into the model and thus controlled for there is a slight decrease in the odds ratio value of school attachment and race/ethnicity (OR=2.50 in model 1 vs. OR=2.20 in model 4 for school attachment and OR=1.93 in model 1 vs. OR=1.84 in model 4 for race/ethnicity). This could indicate that as more contextual factors are controlled for in these models, such as poverty, family structure, etc., that the ability for school attachment to predict mental health care use becomes weaker thus indicating the importance of other contextual factors influence on mental health care use. This phenome is shown through the contextual factors parental attachment and poverty for example. As these factors are added to the model we see that they have significant positive predictive value, odds ratios of 1.72 and 1.59 respectively. Model 4 added an interaction term between school attachment and race/ethnicity. Adolescents of a minority race who were connected to their school were three times more likely to seek out health care compared to those individuals who were not connected to their school (95% CI 2.96, 3.22).

Despite the fact that school attachment may not play as protective of a role in promoting mental health care use on its own this research does suggest that it has strong predictive value, especially in a model that includes other strongly associated contextual factors (model 4) as well it is shown that it plays an important role determining mental health care use in minorities. This best-fit model indicates that mental health care use is best predicted in an individual when a combination of contextual factors, demographic factors, and school attachment are all evaluated together in a model.

5.2 Study Strengths and Limitations

As far as we know this is the first study to explore the relationship between theory and research-based selected individual and family-level characteristics and mental health care utilization in adolescents with comorbid adolescent depression and substance-use using a nationally-representative sample. This study is unique through its exploration of the moderating effect of school attachment on mental health care utilization in comorbid adolescents, specifically the ability of school involvement to reduce the racial disparities present in mental health care utilization. In addition, another strength of this study is the theory informed model selection that takes into account the multi-faceted nature of healthcare use behavior. Despite these study strengths there are several study limitations that should be noted. First, the use of self-reported data in the NSDUH yields the results to a certain level of reporter based bias. Second, the NSDUH utilizes a cross-sectional design thus this limits the scope of our results because of the lack of the ability to take into account the effect of time on certain outcomes. Third, due to the specificity of our study sample selection in which focus was placed on conducting analysis within comorbid adolescents a small study population (n=520) limits the power of the statistical analysis and its representativeness to the general population. Finally, due to data restrictions multi-level logistic regression analysis was done using a proxy sample design variable that is publicly available. This limits the scope of the multi-level model to estimate the nested nature of the data which would be better assessed using a sample-design variable that is currently under restricted use and cannot be accessed.

Conclusion

6.1 Study Implications

The mental health of all adolescents is an incredibly important topic in public health. The appropriate identification of individuals with specific mental health needs is pivotal to providing effective interventions. This research shows that school attachment in adolescents can positively influence their use of mental health care services as well as significantly reduce the racial disparities in mental health care use. Thus it could be suggested that focus on school programs and using the school as a platform for

intervention could increase the likelihood of individuals who need mental health care actually receiving that care. However, this research also shows that there are still important contextual factors, such as parental attachment, gender, and poverty to name a few, that play a significant role in adolescent mental health care. Understanding that these factors will influence the effectiveness of school attachment is incredibly important when designing interventions as well as looking forward to the possibility of increasing the school's role of guiding adolescents into appropriate specialized mental health streams of service.

6.2 Recommendations for Future Research and Prevention

The mental health of adolescents is an important concern for the health of the general population. Early identification and intervention in adolescents is essential for preventing many of the adverse health outcomes experienced by these individuals later in life. Through this current research we have been able to better understand some of the multi-level influences on mental health care utilization in comorbid adolescents. However, future research is needed in order to explore these relationships even further as well as identify new areas of focus that will hopefully lead to improved service access and eventually increased mental health care use for adolescents in need of these specialized services. In particular, it will be important for future research to focus on the different arenas of mental health care use (i.e. by service sector such as inpatient specialty, outpatient specialty, primary care, and etc.) in order to better understand which adolescents are utilizing which sectors and whether or not this has an effect on service use rates and treatment efficacy. Also important will be focused research on rates of mental health care use and identifying contextual factors that influence an adolescent's likelihood of first using mental health care and then returning for further care. In addition, research should continue to focus on disparities present among this population in regards to mental health care use. Research on the influence of social and cultural norms and their influence on service use could be greatly informative in designing new interventions targeting these adolescents. Finally, this analysis will be re-evaluated when the sample design variable of need is made available later this year.

As far as recommendations for prevention this research has shown the importance of contextual factors, specifically the school environment, on the service-use of comorbid adolescents. Thus it will be instrumental for prevention practices to focus on providing culturally competent, integrated mental health service in schools. Particularly interesting in the world of mental health prevention is the use of schools as key coordinators in providing specialty mental health services to adolescents who need them. This meaning that schools and school leaders are in a special position to identify adolescents with mental health care needs and provide the appropriate referrals for those adolescents, if schools are provided with the right support through prevention programs.

Alexandre, Pierre K,PhD., M.P.H., Martins, Silvia S,M.D., PhD., & Richard, Patrick,PhD., M.A. (2009). Disparities in adequate mental health care for past-year major depressive episodes among Caucasian and Hispanic youths. *Psychiatric Services, 60*(10), 1365-71.

Amaral, G., M.H.S., Geierstanger, S., M.P.H., Soleimanpour, S., M.P.H., & Brindis, C., DrP.H. (2011). Mental health characteristics and health-seeking behaviors of adolescent school-based health center users and nonusers. *The Journal of School Health, 81*(3), 138.

Armstrong, T. D., & Costello, E. J. (2002). Community studies on adolescent substance use, abuse, or dependence and psychiatric comorbidity. *Journal of Consulting & Clinical Psychology, 70,* 1224–1239.

Bond, L., Toumbourou, J. W., Thomas, L., Catalano, R. F., & Patton, G. (2005). Individual, family, school, and community risk and protective factors for depressive symptoms in adolescents: A comparison of risk profiles for substance use and depressive symptoms. *Prevention Science, 6*(2), 73-88.

Cauce, A. M., Domenech-Rodríguez, M., Paradise, M., Cochran, B. N., Shea, J. M., Srebnik, D., & Baydar, N. (2002). Cultural and contextual influences in mental health help seeking: a focus on ethnic minority youth. *Journal Of Consulting And Clinical Psychology*, *70*(1), 44-55.

Center for Behavioral Health Statistics and Quality. (2015). *Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health* (HHS Publication No. SMA 15-4927, NSDUH Series H-50).

Center for Behavioral Health Statistics and Quality (CBHSQ). (2015). *2014 National Survey on Drug Use and Health: Codebook*. Retrieved from http://www.samhsa.gov/data/

Crisp, H. L., Gudmundsen, G. R., & Shirk, S. R. (2006). Transporting evidence-based therapy for adolescent depression to the school setting. *Education & Treatment of Children, 29*(2), 287-309.

Cummings, J. R. (2014). Contextual socioeconomic status and mental health counseling use among US adolescents with depression. *Journal of Youth and Adolescence, 43*(7), 1151-62.

Cummings, J. R., & Druss, B. G. (2011). Racial/ethnic differences in mental health service use among adolescents with major depression. *Journal Of The American Academy Of Child And Adolescent Psychiatry*, *50*(2), 160-170.

Curry, J., Silva, S., Rohde, P., Ginsburg, G., Kennard, B., Kratochvil, C., . . . March, J. (2012). Onset of alcohol or substance use disorders following treatment for adolescent depression. *Journal of Consulting and Clinical Psychology, 80*(2), 299.

Dupéré, V., Leventhal, T., & Vitaro, F. (2012). Neighborhood processes, self-efficacy, and adolescent mental health. *Journal of Health and Social Behavior, 53*(2), 183-98.

Ene, M., Leighton, E.A., Blue, G.L., Bell, B.A. (2013). Multilevel Models for Categorical Data Using SAS® PROC GLIMMIX: The Basics. *SAS Global Forum 2013 Proceedings.*

Farmer, E. M. Z., & Farmer, T. W. (1999). The role of schools in outcomes for youth: Implications for children's mental health services research. *Journal of Child and Family Studies, 8*(4), 377-396.

Felton, J. W., Kofler, M. J., Lopez, C. M., Saunders, B. E., & Kilpatrick, D. G. (2015). The emergence of co-occurring adolescent polysubstance use and depressive symptoms: A latent growth modeling approachr. *Development and Psychopathology, 27*(4), 1367-1383.

Garland, A. F., Lau, A. S., Yeh, M., McCabe, K. M., & al, e. (2005). Racial and ethnic differences in utilization of mental health services among high-risk youths. *The American Journal of Psychiatry, 162*(7), 1336-43.

Goldstein, R. B., Olfson, M., Wickramaratne, P. J., & Wolk, S. I. (2006). Use of outpatient mental health services by depressed and anxious children as they grow up. *Psychiatric Services, 57*(7), 966-75.

Gronholm, P. C., Ford, T., Roberts, R. E., Thornicroft, G., Laurens, K. R., & Evans-Lacko, S. (2015). Mental health service use by young people: The role of caregiver characteristics. *PLoS One, 10*(3)

Guest, A. M., & McRee, N. (2009). A school-level analysis of adolescent extracurricular activity, delinquency, and depression: The importance of situational context. *Journal of Youth and Adolescence, 38*(1), 51-62.

Hofstra MB, van der Ende J, Verhulst FC: Child and adolescent problems predict DSM-IV disorders in adulthood: a 14-year follow-up of a Dutch epidemiological sample. J Am Acad Child Adolesc Psychiatry 2002; 41:182-189

Kann et al., if more than six.] Youth Risk Behavior Surveillance — United States, 2015. MMWR Surveill Summ 2016;65(No. SS-#):[inclusive page numbers]

Langille, D., M.D., Rasic, D., M.D., Kisely, Steve,M.D., PhD., Flowerdew, G., PhD., & Cobbett, S., EdD. (2012). Protective associations of school connectedness with risk of depression in nova scotia adolescents. *Canadian Journal of Psychiatry, 57*(12), 759-64.

Mason, W. A., Haggerty, K. P., Fleming, A. P., & Casey-goldstein, M. (2012). Family intervention to prevent depression and substance use among adolescents of depressed parents. *Journal of Child and Family Studies, 21*(6), 891-905.

Merikangas, K. R., He, J., Burstein, M., Swendsen, J., Avenevoli, S., Case, B., … Olfson, M. (2011). Services utilization for lifetime mental disorders in U.S. adolescents: Results from the national comorbidity survey replication-adolescent supplement (NCS-A). Journal of the American Academy of Child & Adolescent Psychiatry, 50(1), 32–45.

Park, M. J., Paul Mulye, T., Adams, S. H., Brindis, C. D., & Irwin, C. E. (2006). The health status of young adults in the united states. *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine, 39*(3), 305-317.

Patel, V.; Flisher, A. J.; Hetrick, S.; McGorry, P. 2007. Mental Health of Young People: A Global Public-health Challenge. *Lancet* 369(9569): 1302-13.

Power, T. J., Eiraldi, R. B., Clarke, A. T., Mazzuca, L. B., & Krain, A. L. (2005). Improving mental health service utilization for children and adolescents. *School Psychology Quarterly, 20*(2), 187-205

Rones, M., & Hoagwood, K. (2000). School-based mental health services: A research review. Clinical Child and Family Psy- chology Review, 3(4), 223–241.

Scholes-Balog, K., Hemphill, S. A., Patton, G. C., & Toumbourou, J. W. (2015). Relationships between substance use and depressive symptoms: A longitudinal study of australian adolescents. *The Journal of Early Adolescence, 35*(4), 538.

Schwarz, Susan Wile. (2009). *Adolescent Mental Health in the United States.* New York: National Center for Children in Poverty, Mailman School of Public Health, Columbia University

Snijders, T.A.B. & Bosker, R.J. (1999). *Multilevel analysis: An Introduction to basic and advanced multilevel modeling.* Thousand Oaks, CA: Sage.

Spirito, A., Hernandez, L., Cancilliere, M. K., Graves, H., & Barnett, N. (2015). Improving parenting and parent-adolescent communication to delay or prevent the onset of alcohol and drug use in young adolescents with Emotional/Behavioral disorders: A pilot trial. *Journal of Child & Adolescent Substance Abuse, 24*(5), 308.

Stephan, S. H., PhD., Weist, M., PhD., Kataoka, Sheryl,M.D., M.S.H.S., Adelsheim, S., M.D., & Mills, C., B.S. (2007). Transformation of children's mental health services: The role of school mental health. *Psychiatric Services, 58*(10), 1330-8.

Substance Abuse and Mental Health Services Administration, *Results from the 2012 National Survey on Drug Use and Health: Mental Health Findings*, NSDUH Series H-47, HHS Publication No. (SMA) 13-4805. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2013.

Tegethoff, M., Stalujanis, E., Belardi, A., & Meinlschmidt, G. (2014). School mental health services: Signpost for out-of-school service utilization in adolescents with mental disorders? A nationally representative united states cohort. *PLoS One, 9*(6)

Watkins MW, Crosby EG, Pearsson JL (2001) Role of the School Psychologist. School Psychology International 22: 64–73. Cunningham PJ, Freiman MP (1996) Determinants of ambulatory mental health services use for school-age children and adolescents. Health services research 31: 409–427.

Tables and Figures

Table 1: Demographic Characteristics within Comorbid Adolescent Population

Participant Characteristics	Unweighted Frequencies (N=520)	Weighted Percent (Survey Population)	Mental Health Care Use Weighted %	No Mental Health Care Use Weighted %	P-value
Sex Male Female Missing	121 399	23.27 76.73	9.08 38.85	14.23 37.69	0.158
Race White African American Native American Native HI/Other Pacific Asian More than one race Hispanic	307 50 10 1 9 35 108	59.04 9.62 1.92 0.19 1.73 6.73 20.77	31.15 3.65 0.96 0 0.58 2.12 9.42	27.88 5.96 0.96 0.19 1.15 4.62 11.15	*0.012
Income *(Poverty Indicator)* Living in poverty Income up to 2X Fed Poverty Threshold Income >2X Fed Poverty Threshold	114 126 280	21.92 24.23 53.85	9.42 11.92 26.54	12.50 12.12 27.31	0.3026

*significant difference (p < 0.05)

Table 2: Individual and Family-Level Characteristics within Comorbid Adolescent Population

Participant Characteristics	Unweighted Frequencies (N=520)	Weighted Percent (Survey Population)	Mental Health Care Use Weighted %	No Mental Health Care Use Weighted %	P-value
School Attachment					*0.0011
Yes	482	92.69	45.19	47.50	
No	38	7.31	2.69	4.42	
Peer-Substance Use					0.1906
Strongly/Somewhat Disapprove	167	32.12	14.04	18.08	
Neither Approve or Disapprove	353	67.88	33.85	33.85	
Parental Attachment					0.4945
Yes	377	72.50	35.38	37.12	
No	143	27.50	12.50	14.81	
Family Structure					*0.0166
Both parents present in household	298	57.31	24.81	32.31	
At least one parent not present in household	222	42.69	23.08	19.62	
Insurance Coverage					0.3893
Yes	491	94.42	45.77	48.86	
No	25	4.81	1.54	3.27	
Don't Know	4	0.77	0.58	0.19	

*significant difference (p < 0.05)

Table 3: Multi-level Logistic Regression

Fixed-Effects	Model 1	Model 2	Model 3	Model 4
Individual-level				
Gender(female reference group)		**1.73 (1.71, 1.75)	**1.92 (1.88, 1.93)	**1.92 (1.89, 1.94)
Race/ethnicity	**1.93 (1.89, 1.97)	**1.89 (1.88,1.91)	**1.83 (1.81, 1.84)	**1.84 (1.83, 1.86)
Peer substance-use		*0.76 (0.75, 0.76)	*0.82 (0.81, 0.82)	*0.81 (0.81, 0.82)
Family-level				
Parental attachment			**1.72 (1.70, 1.78)	**1.73 (1.71, 1.75)
Insurance coverage			*0.34 (0.34, 0.35)	*0.34 (0.34, 0.35)
Poverty indicator			**1.59 (1.58, 1.62)	**1.59 (1.58, 1.62)
Family structure			*0.77 (0.76, 0.77)	*0.76 (0.76, 0.77)
School-level				
School attachment	***2.44 (2.41, 2.48)	***2.29 (2.54, 2.84)	***2.27 (2.26, 2.31)	***2.18 (2.13, 2.22)
Interaction Term				
School attachment X race/ethnicity				***3.08 (2.96, 3.22)
Random effects				
Level-2 intercept (PDEN10)	-0.14 (0.06)	0.17 (0.09)		
Model Fit				
-2LL	953,903	951,041	945,434	945,303[a]

*p < 0.001, **p < 0.001 & OR>1.0, ***p < 0.001 & OR>2.0, ICC = 0.004, values based on SAS PROC GLIMMIX.
Insurance coverage only dummy variable to have "no" as reference group. Entries show odds ratio with 95%
confidence intervals in parentheses
[a]Best-fitting model (p << 0.05)

Figure 1: Variables for Statistical Analysis

Study Measure	Corresponding NSDUH Measures
ANYSMH2 (original NSDUH measure)	Any specialty mental health services use in the past year – *meet at least 1 of 6 specific criteria* - Stayed overnight in a hospital - Stayed in a residential treatment facility - Spent time in a day treatment facility - Received treatment at a mental health clinic - Treatment by a private therapist - Treatment by an in-home therapist
POVERTY2 (original NSDUH measure)	**Poverty indicator** Poverty level (% of US census poverty threshold) Poverty threshold determined by: - Age - Family size - Number of children in household - Total family income
ANYHLTI2 (original NSDUH measure)	**Insurance coverage** Covered by any health insurance?
IRSEX (original NSDUH measure)	**Gender** - Male - Female
NEWRACE2 (original NSDUH measure)	**Race/ethnicity** - non-Hispanic White - non-Hispanic Black/African American - non-Hispanic Native American/Alaskan Native - non-Hispanic Native Hawaiian/Pacific Islander - non-Hispanic Asian - non-Hispanic more than one race - Hispanic
*COMORBID	**Adolescent depression** YMDEYR – past year major depressive episode AND (at least on substance-use measure, below) **Illicit drug-use** SUMYR – past year illicit drug-use, illicit drugs include hallucinogens, heroin, marijuana, cocaine, inhalants, sedatives, tranquilizers, stimulants, and analgesics OR **Binge drinking** BINGEDRK – 5 or more drinks on same occasion on at least 1 day in the past 30 days
*SCHATTACH	**School attachment** SCHFELT – how youth felt about going to school TCHGJOB – teacher let youth know they were doing a good job YTHACT2 – youth participated in activities
*PEERSUB	**Peer substance-use** YFLADLY2 – how youth feels about peer drinking YFLMJO – how youth feels about peer marijuana use
*PRATTACH	**Parental attachment** PRGDJOB2 – parents tell youth they did a good job PRPROUD2 – parents tell youth they are proud
*FMSTRUCT	**Family structure**

	IMOTHER – mother in household IFATHER – father in household
PDEN10 (original NSDUH measure)	**Sample design** *CBSA (Core Based Statistical Area)* 1 = segment in a CBSA with 1 million or more persons 2 = segment in a CBSA with fewer than 1 million persons 3 = segment not in a CBSA

*dummy variables