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Socioeconomic Challenges in the Household and the Prevalence of Comorbidity Among Children with Attention-Deficit Hyperactivity Disorder

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Abstract

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MA, University of Michigan, 1990

BS, Indiana State University, 1985

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

Attention-deficit hyperactivity disorder (ADHD), the most commonly diagnosed childhood neurobehavioral disorder, is increasing annually at about 5% per year. ADHD has been diagnosed in approximately 6.4 billion children in the U.S., and it is estimated that 66% of those afflicted have 1 or more comorbid conditions. Children with ADHD are often from socioeconomically challenged households. What is unclear from the literature is the relationship between socioeconomic status (SES), defined as education, employment, and income and the reporting of comorbidities with ADHD. The problem is that children with ADHD from low SES households may be reporting a higher prevalence of comorbid conditions, which can lead to misdiagnosis, improper treatment, and greater financial burden for families and the public health system. The purpose of this quantitative, descriptive, nonexperimental study was to examine the relationship between household SES and the reporting of a comorbidity (anxiety, depression, behavioral issues) in children with ADHD by analyzing secondary data from the National Survey of Children's Health (N = 99,677). Ecological systems theory guided this study which is based on the premise that individuals encounter many environments in their lives and these environments can impact health and well-being. Multiple logistic regression analysis revealed that parental education level, employment, and household income were significantly associated with the reporting of comorbidities for children with ADHD. This research may lead to positive social change by allowing resources to be allocated to low SES households of children with ADHD to decrease the number of children developing comorbid conditions.

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Dedication

I would like to dedicate this dissertation to my family, without whose support I would not be writing these words. To my parents, I would like to say thank you for believing in me when I gave you many reasons not to. That is truly unconditional love. To my three boys, I want to say thank you for allowing me to continue to grow with you, and for understanding why Dad was sequestered in his home office at all hours of the day and night. And to my wife, my beautiful wife, where do I begin. It was you who planted the seed for this journey and you who nurtured it along with patience, understanding, and encouragement. It was you who covered for me when I had a paper due, you who attended extra school events and family functions, and you who went to bed or woke up alone because I was in the basement writing. There are not enough ways to express what this means to me, and not enough words to describe my gratitude, so I will simply say thank you. Thank you for taking this journey with me, thank you for your unwavering support, and most of all, thank you for your love.

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I wish to acknowledge Dr. Katie Callahan-Myrick, my committee chair. When I emailed her my premise and asked her to consider guiding me through this process, she responded within 24 hours with enthusiasm and acceptance. That rapid response and enthusiasm have continued throughout this journey. Thank you. My committee member Dr. Michael Furukawa and I met by chance at my third residency. He gave me valuable guidance on my data analysis plan, and even though he was not in the School of Public Health, he agreed to be my methods expert. Thank you. The two of you have made this journey educational and rewarding.

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Chapter 1: Introduction to the Study

Introduction

Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental condition that can lead to hyperactivity, impulsivity, and inattentiveness (Vingilis et al., 2015). It is one of the most commonly diagnosed childhood neurobehavioral disorders (Lingineni et al., 2012; Visser et al., 2010). ADHD was originally considered to be a childhood disease, but new research indicates that the disorder persists into adulthood for approximately 55% of the cases (Vingilis et al., 2015). In children, inattentive behaviors, hyperactivity, and impulsivity can lead to reading and learning challenges and difficulty with social interactions (Feldman & Reiff, 2014). The symptoms of ADHD are clinically significant for children because they result in increased physical injury rates, more visits to hospitals and emergency rooms, and stunted academic and social skills (Visser et al., 2014). While the exact cause of ADHD is not fully understood, increasing evidence supports both genetic and environmental components (Kvist et al., 2013; van Dyk, et al., 2015). Because the symptoms of ADHD are typically seen to some degree in all children, the diagnosis of the disorder can be difficult or missed. The diagnosis of ADHD is often made when the symptoms become excessive or out of the norm for age-appropriate behavior and in the absence of an alternative explanation (Feldman & Reiff, 2014).

It is well established that children with ADHD are at increased risk of developing comorbid conditions, such as behavioral issues, depression, and anxiety (Hinojosa et al., 2015b). It has been reported that approximately 66% of children with ADHD have a comorbid condition and as many as 20% have three or more comorbidities (French,

2015). Schei et al. (2015) described an increased risk of substance usage, criminal behavior, psychiatric concerns, poorer quality of life, and premature death for children with ADHD and one or more comorbid conditions. It has also been shown that when children with ADHD report one or more comorbid conditions, it can lead to an increase in caregiver stress (Hinojosa et al., 2012b). The increased caregiver stress varied by race and ethnic background; non-Latino White parents reported a greater prevalence of comorbid conditions (Hinojosa et al., 2012b). ADHD and associated comorbidities in childhood have been found to increase the adulthood risk of nicotine, cocaine, and alcohol use (Vingilis et al., 2015). In 2011, an estimated 1 million children with ADHD were reported to be taking medication for their condition (Visser et al., 2014). Children with ADHD and a comorbid condition had an increased use of nonstimulant medications compared to their non-ADHD counterparts (Radigan et al., 2005).

It has been shown that there is an association between socioeconomic status (SES) and ADHD (Lingineni et al., 2012; Russel et al., 2014). SES is often indexed based on parental education level, employment status, and income (Tillman & Granvald, 2015). These three indices have been shown individually and collectively to impact children with ADHD. According to Tillman and Granvald (2015), parental education was shown to be associated with hyperactivity and impulsivity. Maternal employment status had an association with the diagnosis of ADHD specifically as it relates to rearing practices (Malek et al., 2012) and parents with lower occupational status were less likely to seek out resources for treatment (Knapp et al., 2015). Family income can explain some of the

variability in ADHD symptoms and dysfunction (Martel, 2013). An increased prevalence of the disorder has been shown in families with an income of less than 200% of the FPL.

Another challenge with ADHD is the financial burden the condition places on the families and the health care system. The childhood costs of ADHD in the United States are estimated to be between $21 and $44 billion annually (Doshi et al., 2012). There is an additional $33 to $43 billion spillover costs to the families of children with ADHD (Doshi, et al., 2012). A longitudinal public health concern with ADHD is that the disorder can continue into adulthood and lead to added costs and social issues (D'Amico et al., 2014). Additional concerns include academic underachievement, criminal behavior, psychiatric disorders, substance abuse, and employment disadvantages. Combining the direct and indirect costs of ADHD with the presence of one or more comorbidities and the financial challenges of the condition for the household, for societies, and for the health care system become considerable.

In the United States, ADHD has been diagnosed in about 6.4 million children (Centers for Disease Control and Prevention [CDC], 2016). The rate of diagnosis for ADHD increased by approximately 5% per year from 2003 to 2011 (CDC, 2016). If, as Vingilis et al. (2015) pointed out, the number of children carrying ADHD into adulthood is between 50% and 60%, the disorder constitutes a chronic public health concern, especially when approximately two-thirds of children with ADHD report having one or more comorbid conditions. Because of this public health concern, more research is needed to understand the risk factors involved with ADHD and the association between parental SES and the reporting of comorbidities in children with ADHD.

The current study examined the possibility that children with ADHD from homes with low SES report a higher prevalence of comorbid conditions. This research could lead to positive social change because it could stimulate future research to better understand how low SES increases the incidence of comorbidities in children with ADHD. At that point, public health intervention programs may be used to help reduce or eliminate the defined risk factors. Also, this research could stimulate positive social change by encouraging policy makers to improve services that are directed to families of low SES. This could decrease the risk of children with ADHD developing comorbidities and reduce the financial burden on families and the health care system, while improving the quality of life for all those involved.

The following topics are described in Chapter 1: an overview of the literature on ADHD in children, the role of socioeconomics and comorbidities of ADHD, the problem statement, the purpose of the study, the intent of the project and how this ties in with the problem statement, the research questions and hypotheses, the theoretical framework, the nature of the study, the assumptions and limitations, the scope and delimitations, and the study's significance and implications for positive social change.Begin text here.

Background

ADHD has been recognized in the literature, although under different names and descriptions, for over 200 years (Efron, 2015). The condition is prevalent in 4–12% of school-aged children in the United States (Hinojosa et al., 2015a) and can persist into adulthood. ADHD is believed by many to have both biological (genetic) and environmental components; most experts in the field agree that more research is needed

to better understand the contributions of both components to the condition (van Dyk et al., 2015; Tillman et al., 2015). It is also agreed that additional studies are needed to identify risk factors and predictors that may be modifiable (Efron, 2015).

Socioeconomics are common variables used in research on ADHD to help understand the condition and the related behaviors. But socioeconomic factors may lead to under identification of the disorder because disadvantaged households may have limited or no access to health care or public health resources (French, 2015). In the ADHD literature, SES is commonly indexed by education, employment, and income. In general, children in socioeconomically challenged environments are at greater risk of negative life outcomes compared to their more advantaged peers (Russel et al., 2015). It has been shown that parental education levels, parental employment status, and household income all may play a role in the diagnosis and treatment of ADHD; they can also affect caregiver health (Law et al., 2014; Lingineni et al., 2012; Russel et al., 2015; Tillman et al., 2015).

Clinical researchers have demonstrated that, for children with ADHD, there are higher rates of comorbid conditions, such as substance use, depression, conduct or behavioral disorders, and anxiety (Hinojosa et al., 2012a; Schei et al., 2015; Vingilis et al., 2015). With approximately two-thirds of children with ADHD having a comorbid condition (French, 2015), more public health resources, and health care dollars are needed for their care. For children with ADHD who have a chronic comorbid condition, complementary and alternative medical therapies are commonly used (Kemper et al., 2013). Also, it is known that a comorbid condition is a strong predictor of nonstimulant

(fluoxetine, fluvoxamine, and clonidine) use for children with this disorder (Radigan et al., 2005).

Children from households with low parental SES have a greater risk of developing ADHD (Law et al., 2014). Moreover, children with ADHD are at greater risk of developing comorbid conditions (Hinojosa et al., 2012b). What is not clear, and what appears to be a gap in the scientific knowledge about ADHD, is the association between SES and the reporting of comorbid conditions for children with ADHD. The goal of the current study was to address this gap in order to understand the association between SES and comorbidities. Children with ADHD who have comorbid conditions are at risk of poorer quality of life, lower educational attainment, antisocial behaviors, and other negative outcomes (Schei et al., 2015; Vingilis et al., 2015). It is also important because children with ADHD may carry this disorder into adulthood where the economic impact is estimated to be three times greater than in children and adolescents (D'Amico et al., 2014).

Problem Statement

In the United States between 2003 and 2011, the diagnosis rate for ADHD increased annually by 5%, resulting in approximately 6.4 million children diagnosed with the condition (Centers for Disease Control and Prevention [CDC], 2016). Children with ADHD have behavior, attention, and impulsivity challenges that are neurodevelopmental in nature (Gipson et al., 2015). It has been determined that children with ADHD are often from socioeconomically challenged families (Russel et al., 2014), and these children are more susceptible to comorbid conditions (Kemper et al., 2013). When children with

ADHD had one or more comorbid conditions, an increase in caregiver stress—varying by race and ethnicity—was seen (Hinojosa et al., 2012b). If the health care costs of this condition are $21–$44 billion annually, with an additional $33–$43 billion spillover costs to families (Doshi et al., 2012), the financial burden of ADHD on the household and the health care system become substantial. Add to this the cost of one or more comorbid conditions and the financial burden of ADHD to the household and the health care system becomes substantial.

Adolescents with ADHD may differ from their non-ADHD counterparts regarding sex, social class, and ethnicity (Pliszka, 2015). They may also be exposed to psychosocial factors such as urban decay, poverty, and crime. There is an association between low family income and a diagnosis of ADHD (Larsson et al., 2014). Children with ADHD are more susceptible to comorbid conditions, such as behavioral issues, anxiety, and depression (Kemper et al., 2013). Those with comorbidities are at risk for misdiagnosis and improper treatment because the comorbid condition may mask other signs and symptoms (Barkley, 2009). Parenting children with ADHD and comorbidities can lead to increased stress and health issues for the immediate caregivers (Rockhill et al., 2013).

Understanding the potential impact of low SES on the reported prevalence of comorbidities for children with ADHD is an important gap in the literature. Gipson et al. (2015) concluded that future research is needed to identify the risks and outcomes in children with ADHD from disadvantaged environments. Thus, the problem is that children with ADHD and families with low SES may be reporting a higher prevalence of

comorbid conditions. This can lead to misdiagnosis and improper treatment for the child, increased caregiver stress, and a greater financial burden on families, the health care system, and the public health system.

Purpose of the Study

The purpose of this quantitative study was to examine the relationship between household SES (% FPL, education, unemployment) and the reporting of comorbidities in children with ADHD. By understanding the association between household socioeconomic challenges and comorbid conditions of children with ADHD, it may be possible to develop programs and interventions to address any disparities that exist. Also, understanding the impact of household socioeconomics on comorbidities for these children may allow for the focusing of new health care resources or refocusing of existing resources to help alleviate the problems. While this research project does not address specific risk factors associated with ADHD and comorbidities, it may help advance understanding of this growing public health problem. Further, it could help clarify additional factors that are associated with the lives of children with ADHD and the individuals who care for them.

Research Questions

RQ1: Is there a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_O: There is no relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

RQ2: Is there a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

RQ3: Is there a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues)

among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

Theoretical Framework

In 1958, Anastasi proposed that psychological scientists pursue research to discover how hereditary and environmental factors interact to influence behavioral development (Bronfenbrenner & Ceci, 1994). Nearly 35 years later, Bronfenbrenner and Ceci (1994) sought to explain how genotypes are transformed into phenotypes. Thus, they developed a set of testable hypotheses as part of a bioecological model that the authors and others refined and which become known as the ecological systems theory (EST). EST, which consists of microsystems, mesosystems, exosystems, macrosystems, and chronosystems, indicates that individuals encounter many environments during their life, and that these environments may impact their behavior in different ways (Eamon, 2001). The *microsystem* includes the direct environment in which the individual lives and consists of family, friends, classmates, and teachers (Eamon, 2001). Interactions at this

level influence developmental outcomes for children. Take, for example, the relationship between socioeconomic disadvantage and socioemotional development (Eamon, 2001). The SES and a child's health condition may have multiplicative effects (Eamon, 2001). The *mesosystem* examines an interrelation between two or more structures of the microsystem (Paquette & Ryan, 2001). If the parents of the ADHD child are divorced, the mesosystem is the connection that results from the family structure. *Exosystems* look at the connections between two or more structures where only one of the structures includes the child (Eamon, 2001). In the current project, events at the parent's workplace may impact the home environment. Job loss or pay reductions may result in household stress. The outermost level of the EST is the *macrosystem*. This level includes laws, customs, and cultural values (Paquette & Ryan, 2001). For children with ADHD, cultural beliefs, education, and customs may impact the amount of care they receive and how they are perceived in their social network. The *chronosystem* consists of life transitions over time (Eamon, 2001). Family structure can change over time—through death, birth, or divorce—all of which can influence children with ADHD. All levels of the EST can impact a child's development; this is important to understand in the context of the demographics of the children with ADHD in the study and their socioeconomic environment.

Nature of the Study

A quantitative research project was undertaken using a cross-sectional study design. Descriptive and inferential statistics were used with the secondary data to describe the information and to make generalizations about the population observed in

the sample. Quantitative research was appropriate for this project because large data sets are available for which the survey results are aggregated and in numeric form. A cross-sectional study design is commonly used for survey research (Crosby, 2013) and to examine relationships between dispositions and properties (Frankfort-Nachmias and Nachmias, 2008). For the ADHD project, the cross-sectional design allowed for the description of any potential relationship between the exposure and outcome variables. Multiple logistic regression analysis was undertaken to look for associations between the dependent variable and multiple independent variables. Multiple logistic regression analysis can be used to predict the impact of multiple independent variables on a dichotomous dependent outcome (Sullivan, 2012). Logistic regression modeling can also be used to account for confounding, which can occur when the effect of the independent variable on the dichotomous outcome is distorted by another variable or characteristic (Sullivan, 2012). Gender and medication use are two potential confounding variables that have been shown to have a relationship with ADHD. Boys are twice as likely to be diagnosed with ADHD as girls (Pastor et al., 2015), and medication use for ADHD is seen in approximately two-thirds of children with the diagnosis (Visser et al., 2014).

The National Survey of Children's Health (NSCH), a secondary dataset, was the focus for the ADHD study (CAHMI, 2011-2012). The NSCH survey was conducted between 2011 and 2012 and includes interviews with 95,677 individuals. Interviews were completed using a cross-sectional telephone survey methodology. Households that were included had to have, at a minimum, one child between 0-17 years of age. All data and background for the NSCH is publically available for analysis.

According to Trochim (2006), the data analysis should follow three steps: These include cleaning and organizing the data, descriptive analysis, and ending with an inferential statistical analysis, The NSCH dataset being employed for this project has been cleaned, organized, and made available for download into SPSS. With the aid of the statistical software program, descriptive and inferential statistical modeling was employed to address the research questions and study hypothesis. Two other data sources that were employed for this project are the 2011 HHS Poverty Guidelines (U.S. Department of Health and Human Resources, 2011) and the CDC's statistics for ADHD (CDC, 2016). The 2011 HHS Poverty Guidelines were used to calculate the different poverty levels for the NSCH income data. The CDC's ADHD statistics were used to help establish current demographics for the study population.

Definitions

Socioeconomic Status (SES): The social position of an individual or family based on the number and type of resources possessed from a political, social, and economic viewpoint (Russell et al., 2015). While there are multiple indices of SES those commonly used and the ones used for this project are parental education level, parental employment status, and household income.

Education Level: The level of education obtained by the parent or caregiver of the child with ADHD based on three categories (less than high school, high school, more than high school) (CAHMI, 2015).

Employment Status: The employment status was based on any household member being employed for 50 of the previous 52 weeks (CAHMI, 2015).

Income Level: Total level of household income before taxes. Based on respondents answer, the income level was then categorized based on % FPL (CAHMI, 2015).

FPL (Guidelines): Guidelines developed by the U.S. Department of Health and Human Services based on the number of persons in the household and the average dollar value of all food used in one week (U.S. Department of Health and Human Services, 2015). For this project, the National Survey of Children's Health Survey used a % FPL based on the 2011-2012 Federal Poverty Guidelines (Blumberg et al., 2009).

Comorbid Condition (Comorbidity): One or more additional disease or disorder coexisting with the primary disorder (Schei et al., 2015). For the purpose of this study, comorbid conditions for the primary condition of ADHD will include depression, anxiety, and behavioral (conduct) problems.

Behavioral Issues: For the purpose of this study behavioral issues are self-reported by the respondent based on being told by a doctor or health care provider that the condition was or had ever been present and includes oppositional defiant disorder or conduct disorders (CAHMI, 2015).

Depression: For the purpose of this study depression is self-reported by the respondent based on being told by a doctor or health care provider that the condition was currently present or had ever been present (CAHMI, 2015).

Anxiety: For the purpose of this study, anxiety is self-reported by the respondent based on being told by a doctor or health care provider that the condition was currently present or had ever been present (CAHMI, 2015).

Assumptions

This project was subject to two assumptions. (a) The comorbid conditions of the study participants were diagnosed accurately. A variety of measuring techniques, reporting discrepancies, samples—and the fact that the data were self-reported by the household respondent and not based on medical records— could make an accurate diagnosis difficult (Merikangas et al., 2009). Inaccuracy would affect the validity of this project. (b) The comorbidity is a chronic condition. This is important because the comorbid conditions of anxiety (mild, moderate, severe), depression, and behavioral issues (mild antisocial behaviors to severe defiance) have broad clinical definitions with the diagnosis falling somewhere on a spectrum or continuum for the condition (Bloemsma et al., 2013; Kallitsoglou, 2014). For example, depression can range from mild to severe with mild being temporary sadness to severe which is categorized as clinical depression and can be chronically debilitating (Mayo Clinic, 2016). For the purpose of this study, the assumption was that the condition is current and ongoing.

Scope and Delimitations

In this study, the goal was to better understand the potential effect of socioeconomics on the reporting of comorbid conditions of children with ADHD by parents and caregivers participating in the NSCH. I selected this research project because the diagnosis of ADHD increased by 5% annually from 2003-2011 (CDC, 2016) and has persisted into adulthood for two-thirds of those with the condition (Vingilis et al., 2015). Also, for children aged 4–17, the prevalence rate for ADHD is 10.4% in households with incomes less than 200% of the FPL compared to 8.8% where the household income is

equal to or greater than 200% of the FPL (Pastor et al., 2015). This makes it a chronic public health concern with potential health care disparity issues. In this study I looked for associations between household SES (parental education, employment, and %FPL) and the reporting of comorbid conditions of children with ADHD.

The NSCH included all 50 states and the District of Columbia. Telephone numbers were randomly selected and called to identify households that had one of more children under the age of 18. Inclusion criteria were based on the household having a telephone, either a landline or cell phone, and having a child in residence from 0-17 years of age. If more than one child in the household met this criterion, then one child was randomly selected to be the subject of the interview. Households were excluded from participation if they did not have telephone service or if there were no children under the age of 18. A total of 95,677 interviews were completed between 2011 and 2012, and this included approximately 1,850 per state (range 1,811 to 2,200) (Data Resource Center for Child & Adolescent Health, 2016). External validity may be called into question because the NSCH used telephone random digital dialing for their data collection. This may limit the sample by excluding the very low socioeconomic households. This threat to external validity and the fact that the study is a cross-sectional design may limit the generalizability of the research findings. It is also important to note that any associations found between the variables may not be an indication of causality. It is for this reason that the epidemiological triad framework (ETF) was not considered as the guiding theory, but was closely related to this area of research. The ETF traditionally examines cause and effect relationships between a host, a vector, and an environment (CDC, 2012). The ETF

has been adapted to look at relationships between variables other than a host, vector, or environment (Pheula et al., 2012). The adapted form of the ETF was considered for this project. In this scenario, the children with ADHD would serve as the host, comorbid conditions would be the vector, and socioeconomic factors would be the environment. However, due to the cross-sectional study design, causality will not be determined thus limiting the usefulness of the ETF.

Limitations

This study was subject to four limitations. (a) Because of its cross-sectional design, the study could not determine causation of the outcome variable. Also, the cross-sectional design may create some bias because it could not be determined if the comorbid conditions were current or if they had occurred at a different time in the child's life. (b) The fact that associations do not imply causation (Carballo et al., 2013) calls into question the internal validity of the project. Any association(s) between socioeconomics and comorbid conditions for children with ADHD will require further investigation to determine causality. (c) The use of a survey with self-reported health and socioeconomic data limits the external validity of the study (Crosby, 2013). Using the NSCH data was limited by the number and types of questions related to socioeconomics and comorbid conditions. (d) There may also be an element of response bias by the parent or caregiver answering the questions. Response bias may result from personal or threatening questions and lead to denying or underreporting by the responder (Frankfort-Nachmias & Nachmias, 2008).

Significance

This study addressed the gap in the literature on SES and its impact on the prevalence of comorbid conditions for children with ADHD. The project may add to the body of knowledge on the topic by exposing associations between SES and the reporting of comorbidities, and this is important because, as Pliszka (2015) pointed out, children with ADHD who report having one or more comorbid conditions may be at increased risk of exposure to psychosocial issues, crime, and poverty. He suggested that comorbidities in children with ADHD should be an area for future research. Comorbidities could lead to increased disease severity, decreased responsiveness to treatments (Gipson et al., 2015), and the prevalence of the disease in low-income families (Russell, 2014). These facts highlight the lack of information on SES and comorbidities in children with ADHD and the need for more research.

ADHD is continuing to grow in the United States at a rate of about 5% per year (CDC, 2016). Rockhill et al. (2013) pointed out that in families of children with ADHD and comorbid conditions the quality of life may be decreased and individuals in the household could be more susceptible to caregiver stress. Existing interventions have been targeted at reducing disease burden and stress for children with ADHD and their families, but they have not proven useful in low socioeconomic families, particularly those of racial and ethnic minorities (Hinojosa et al., 2012b).

Summary

This chapter began by introducing the topic of ADHD in children and how it relates to comorbidities and parental SES. Based on the current literature, there appears to

be a gap in the scientific knowledge regarding the potential association between SES and the reporting of comorbid conditions for children with ADHD. It is estimated that 66% of children with ADHD have one or more comorbidities. These comorbid conditions add a financial burden to the child's household and to the public health system. The EST will act as the guiding framework for this quantitative, descriptive, nonexperimental research examining data from the NSCH. Assumptions and limitations were also discussed as was the scope and delimitations of the project. It was pointed out that the significance of this research will add to the existing body of knowledge of the growing public health concern. It is hoped that the research may lead to positive social change by increasing awareness and knowledge of the role of socioeconomic disparities which can lead to the development of new programs and the redirecting of current resources.

In Chapter 2 I review the current and historical literature on ADHD, comorbid conditions, and SES. This includes an explanation of the search strategies and the search engines. The theoretical foundation guiding the project, ecological systems theory is reviewed. And, a discussion of how the literature relates to the key study variables, including the confounding variables is explained. In Chapter 3 I discuss the research methodology, giving both the design and rational for the methods. This also includes a data analysis plan and a covers the potential threats to the validity of the project. Chapter 4 reviews the results of the multiple logistic regression using both descriptive and inferential statistics. In Chapter 5 I explain my interpretation of the findings, discuss the limitations and recommendations, and review potential implications of the research.

Chapter 2: Literature Review

Introduction

According to a 2016 report of CDC statistics, ADHD affects approximately 6.4 million children; the diagnosis rate has been increasing annually from 2003-2011 by about 5% (CDC, 2016). According to the literature, children with ADHD are more susceptible to developing comorbidities: nearly 66% of all children with this disorder report one or more comorbid conditions (French, 2015; Hinojosa et al. 2012b). It is also known that SES can impact ADHD (Lingineni et al., 2012; Russel et al., 2014) and that the SES challenges can be carried into adulthood (Schei et al., 2015; Vingilis et al., 2015). This is a significant public health concern because in approximately 55% of children, ADHD is maintained in adolescence and persists into young adulthood (Vingilis, et al., 2015). ADHD is a public health challenge due to the financial burden that it places on families and the health care system. It is estimated that between $21 and $44 billion are spent annually for ADHD and that an additional $33 to $43 billion spillover cost to the families (Doshi et al., 2012). Because it has been determined that children with ADHD are often from lower SES households (Russel et al., 2014), the economic challenges for these families is a serious concern. If the child with ADHD has one or more comorbid conditions, this financial hardship can be exacerbated for families and the health care system.

Researchers have concluded that more studies are needed to determine protective and risk factors associated with adverse health outcomes for children with ADHD who may be from disadvantaged environments (Gipson et al., 2015). Pliszka (2015) pointed

out that children with ADHD may be at greater risk for poverty, crime, and psychosocial issues because they may differ from other non-ADHD children in social class. Based on the literature review, children with ADHD, because of their lower SES, may be at increased risk of future social and financial challenges and also at risk of developing comorbid conditions (Kemper et al., 2013; Vingilis et al., 2015). There appears to be a gap in the research about the impact of household socioeconomics on the reporting of comorbid conditions. Thus, the problem is that children with ADHD, who come from low SES families, may be reporting a higher prevalence of comorbid conditions. This could lead to misdiagnosis and improper treatment for the child, increased caregiver stress, and a greater financial burden for the families, the health care system, and the public health system.

The current study sought to determine the impact of parental SES on the reporting of comorbid conditions for children with ADHD. The purpose of this quantitative, descriptive, nonexperimental study was to ascertain any associations between household SES (education, employment, %FPL) and the reporting of comorbidities (anxiety, depression, behavioral issues) in children with ADHD. By better understanding any relationship between SES and the reporting of comorbid conditions, resources could be directed or redirected as needed. This study is expected to add to the existing body of knowledge on ADHD and further the goal of understanding this public health concern.

Described here in Chapter 2 was the literature review search strategy that was employed to determine the background, magnitude, and future needs as they relate to children with ADHD. A theoretical foundation, EST, was described and details were

given on how it has been applied in the past and how it will guide this current project. Chapter 2 will also include a thorough review of the literature as it pertains to ADHD, SES, and comorbidities. SES will include parental education, employment, and household income. Comorbid conditions will include anxiety, depression, and behavioral concerns.

Literature Search Strategy

This literature review will incorporate current and seminal knowledge as it relates to ADHD, SES, and comorbid conditions for children. An extensive search was completed to determine substantive findings, theoretical foundations, and methodological examinations of ADHD, SES, and comorbidities in children and the interactions of these variables. The literature was also examined as it relates to the carryover of these issues and conditions into adulthood. The following is a discussion of the databases and search engines that were employed as well as the scope, search terms, and the search strategies that were conducted.

A significant review of the literature was completed with the following databases: CINAHL & MEDLINE Simultaneous Search and Psychology Databases Simultaneous Search. The first database looked for articles in the fields of medicine, nursing, allied health, veterinary medicine, dentistry, pre-clinical sciences, and the health care system. Psychology Databases Simultaneous Search examined multiple psychology databases, including PsychARTICLES, PsychBooks, PsychCritiques, PsychINFO, and PsychEXTRA. I also used SocINDEX, Education Source, Google, and Google Scholar.

Because of the diverse nature of the project, multiple search terms were used in multiple combinations: *attention deficit hyperactivity disorder, ADHD, socioeconomics, socioeconomic status, comorbidity, comorbid condition, parental income, parental education, parental employment, and ecological systems theory*. To use current peer-reviewed literature, some of the searches were limited to the most recent 5–6 years (2011 to 2016/2017). However, to establish a foundation and historical perspective, the seminal literature was employed. To understand and incorporate a theoretical basis for the project, early literature was sought on the topic of EST and ADHDs.

On the topics of children with ADHD and the impact of parental income or employment status, there was very little current research. To overcome this challenge, the reference section of the most recent articles was reviewed for relevant older literature. Thus, some of these articles may be outside the most recent 5-year window. Also, while the majority of the literature is of a systematic review nature, integrative reviews were also considered. The following is the result of a systematic review of the literature as it relates to children with ADHD and the impact and interactions of socioeconomics and comorbid conditions.

Theoretical Foundation

Theories consist of propositions, concepts, and definitions that are intertwined and can give a systematic picture of circumstances by examining the relationship between variables that lead to a greater understanding of events or situations (Glanz, Rimer, & Viswanath, 2015). Ideally, a theory or theories help the researcher summarize the current state of knowledge and determine key constructs or relationships which help guide the

project during the planning, implementation, and evaluations phases (Michie & Johnston, 2012). The use of the appropriate theory for a given project can inform the researcher on the processes, including the sequence of events and the targeted variables (Prestwich et al., 2014). The goal of the current study is to use EST to guide the examination and possible explanation of the relationship between parental SES and the reporting of comorbid conditions for children with ADHD.

Ecological Systems Theory

Anastasi, in 1958, suggested that scientists explore the possibility that human development is influenced by hereditary and environmental factors (Bronfenbrenner & Ceci, 1994). Years later, Bronfenbrenner (1976) took up this charge and proposed that our environment consists of a set of systems that are nested within one another and are interactive. In 1977, Bronfenbrenner explained that "A broader approach to research in human development is proposed that focuses on the progressive accommodation, throughout the life span, between the growing human organism and the changing environments in which it actually lives and grows" (1977, p. 513). He believed that the interdependent interactions of the different systems played an important role in shaping human development and impacted the way individuals viewed or experienced social reality (Algood et al., 2011). These systems and their interdependent interactions have become known as EST. Bronfenbrenner and Ceci (1994) used EST to develop a set of testable hypotheses in a biological model to help explain how genotypes are transformed into phenotypes. This further advanced Anastasi's original consideration of the interaction between heredity and environment on human development, Demographic,

cultural, political, and economic factors can impact an individual's environment and need to be considered when evaluating a child's development (Algood et al., 2011).

EST has evolved from Bronfenbrenner's original premise, and now the proposition is that the theory includes microsystems, mesosystems, exosystems, macrosystems, and chronosystems (Eamon, 2001). EST assumes that these are systems an individual encounters throughout life and they may impact behavior and development in different ways. As it relates to human development, a child can be pictured in a center circle with a set of concentric circles expanding outward representing the microsystems, mesosystems, exosystems, and macrosystems (Darling, 2007). Chronosystems, as explained, is based on the element of time.

The microsystem consists of the complex interactions between the child and the direct environment in which the individual is surrounded (Algood, 2011; Bronfenbrenner, 1977; Eamon, 2001). This often includes the child's home, school, and peer group and can impede or enhance the individual's development (Eamon, 2001). Mesosystems are comprised of the interactions between two or more microsystems which make it a system of microsystems (Bronfenbrenner, 1977; Eamon, 2001). Examples of this would be the interaction between the child and a parent, or the interaction between the peer group and the child (Paquette & Ryan, 2001). The exosystem, which Bronfenbrenner (1977) described as an extension of the mesosystem, includes the interactions between two or more microsystems but one of the microsystems has to include the developing child (Algood, 2011; Eamon, 2001). A parent being impacted by a work event or something occurring in their social network can influence the interaction with the child in the home

environment (Algood, 2011; Eamon, 2001). These are examples of exosystem environmental factors. The outermost circle of influence is the macrosystem. This system is comprised of micro-, meso-, and exosystems that exist in the child's environment (Algood, 2011; Bronfenbrenner, 1977). Bronfenbrenner (1994) described the macrosystem as the blueprint that partially explains what occurs in the inner circles. Cultures and subcultures that include education, legal, political, economic, and social systems are a part of the macrosystem which then influences activities in the other systems (Bronfenbrenner, 1977). An example of a macrosystem impact is the role that culture plays in parental practices in child rearing (Eamon, 2001). Bronfenbrenner (1994) explained that life transitions that can occur over time in the child's environment could impact development as well. This is the basis for the chronosystem which takes into account the time element as it relates to consistencies or changes throughout the child's developmental life course (Eamon, 2001).

There are some assumptions that need to be considered with the EST model. In EST it is assumed that no one systems level is more important than another (Bronfenbrenner, 1977). Thus, all levels, micro-, meso-, exo-, macro-, and chronosystems can play an equal role in child development at any given time. It is also assumed that there is not a logical or sequential order by which the individual levels affect development (Bronfenbrenner, 1977). Another consideration is whether or not the interaction between the child and the environment at the different levels is reciprocal (Bronfenbrenner, 1994). It is assumed that the interaction is a two-way process. However, there may be circumstances where the environment is restrictive and does not allow for

the child to be responsive to the situations or circumstances (Bronfenbrenner, 1994). The elements of the EST can assist in examining the interactions of children with ADHD and their environments to determine if there is a higher probability of reporting of comorbid conditions.

Attention-Deficit Hyperactivity Disorder and Ecological Systems Theory

Previous researchers have used EST to guide their work in examining ADHD, developmental issues, and the mental and physical well-being of children (Algood et al., 2011; Eamon, 2001; Mautone et al., 2011; Pilgrim et al., 2012). Mautone et al. (2011) discussed how researchers used EST and found an impact of teacher-student and teacher-parent relationships for children with ADHD. The authors also discussed how intervention strategies that focused just on family or just on the school were not sufficient. EST was used to demonstrate how a microsystem and mesosystem approach could be more beneficial. Bronfenbrenner's EST has also been used to guide research looking at the effects of poverty on the socioemotional development of children (Eamon, 2001). Using EST to guide them, researchers were able to show that social policies that had an impact on economic resources, school programs, and access to health care, and better housing may have an enhanced effect on the micro- and mesosystem and improve sociodevelopment outcomes of children (Eamon, 2001). EST has been used to examine the maltreatment of children with disabilities related to development (Algood et al., 2011). Specifically, the researchers used the EST framework to look at how microsystem, exosystem, and macrosystem factors played a role in the abuse of children with developmental issues (Algood et al., 2011). This research allowed the authors to discuss

the practice and policy implications for children with these disabilities. Risk and protective factors associated with the physical and mental health of children were examined using EST (Pilgrim & Blum, 2012). These researchers demonstrated using EST that negative environmental factors influenced adolescent's mental and physical health, and allowed the authors to present potential prevention and intervention strategies.

Based on the use of EST from previous researchers, and the goal of the current study to examine the impact of socioeconomics on the reporting of comorbidities for children with ADHD, Bronfenbrenner's EST is the theory chosen to guide this project. All of the individual systems levels of the EST can be applied to this research project. Interactions at the microsystem level have been shown to impact developmental outcomes in adolescents, specifically the relationship between socioemotional development and SES (Eamon, 2001). For this project, the impact of SES was used to look at the reporting of comorbidities for children with ADHD. The mesosystem looks at the interrelation between two or more components of the microsystem, and these interactions can impact this project as well. This is the influence of parental issues on the child. If the parent has lost a job or has to take a pay reduction, this could impact the exosystem of the child with ADHD. At the outermost level, the macrosystem, cultural values, customs, and laws can have an influence on the child. Here, a parents beliefs, education level, or their local laws may directly impact how children with ADHD are perceived and the level of care they may receive. The chronosystem that consists of longitudinal life transitions (Eamon, 2001), may also have an effect on the children with ADHD. A change in the family structure such as birth, death, or divorce may change the

SES of the household. This will impact the resources available for the child with ADHD and how their needs are perceived in the context of the family as a whole.

For this study, the research questions seek to examine the possible relationship between parental SES and the reporting of comorbid conditions (anxiety, depression, behavioral issues). As previously mentioned, EST has been used to guide research into the impact of socioeconomics and child related issues such as development, physical and mental well-being, and disability concerns (Algood et al., 2011; Eamon, 2001; Mautone et al., 2011; Pilgrim et al., 2012). It has also been established that socioeconomics can play a role in children with ADHD (Lingineni et al., 2012; Russel et al., 2014). EST was used for this project to further the understanding of SES on children with ADHD to examine if SES impacts the reporting of comorbid conditions. All levels of EST can impact the development of the child with ADHD, so it is important to use this theory to guide the study in the context of understanding the interactions of the child and their socioeconomic environment.

Literature Review: ADHD, Socioeconomic Status, and Comorbid Conditions

The following is an extensive review of the literature, both current and historical, as it relates to children with ADHD, SES, and comorbid conditions. The discussion of children with ADHD and SES, defined as the social position of an individual or family based on the number and type of resources possessed from a political, social, and economic viewpoint (Russell et al., 2015), will focus on three main indices. Specifically, this section will examine the literature as it relates to parental education, parental employment, and parental or household income. The discussion regarding children with

ADHD and comorbid conditions will also be comprised of three separate sections. These will include the comorbidities of anxiety, depression, and behavioral issues. Behavioral issues will take into account conditions such as an oppositional defiant disorder or conduct disorder.

ADHD and Socioeconomic Status

Studies have, over time, consistently demonstrated an association between socioeconomic disadvantage and the diagnosis and symptoms of ADHD (Choi et al., 2016; Foley, 2011; Jahangard et al., 2013; Sciberras et al., 2011). In a recent study by Russell et al. (2015), researchers sought to determine if there were individual-level associations between parental education, occupation, and %FPL (SES) and ADHD in children using data from the Avon Longitudinal Study of Parents and Children (N = 8,132). The authors found that the strongest predictor of a child being diagnosed with ADHD was financial difficulties (OR 2.23, 95% CI 1.57-3.16). Specifically, families of children with ADHD reported more financial disadvantage than families with non-ADHD children (27.78% vs. 14.44% respectively). Leirbakk et al. (2015) examined the impact low socio-economic position (SEP) on the occurrence of ADHD alone, ADHD with anxiety or depression, and anxiety/depression alone from a cross-sectional survey of 12,900 Norwegian children. SEP was a dichotomized income and a dichotomized education level for the households surveyed. The logistic regression analysis demonstrated a significant association between all three groups and SEP ($p < .001$ for all groups) with the comorbid group of ADHD and depression/anxiety having the strongest relationship (OR 2.737).

An elevated SES has been shown to have positive effects on ADHD stability longitudinally according to Cheung et al. (2015). The authors followed 116 individuals with ADHD for 6.6 years from adolescence into young adulthood to determine childhood factors that would predict future outcomes. The researchers demonstrated that SES and IQ were statistically significant predictors of symptoms and impairment in young adulthood ($p = 0.02$ and $p < 0.01$ respectively). Specifically, their data demonstrated that a higher SES in childhood was associated with fewer symptoms in young adulthood ($N = -0.20$, $p = 0.04$). Law et al. (2014) examined family characteristics that could potentially predict diagnostic stability for children with ADHD from early to middle childhood. The longitudinal follow-up of 88 children who met the inclusion criteria demonstrated that SES was a family-level predictor of ADHD diagnostic stability in the study sample ($p <$ .001, OR 0.56). The authors concluded that SES should be examined closely when evaluating children with ADHD before the age of seven and consideration to this issue should impact interventions, treatments, and future diagnosis. Research conducted by Clearfield and Jedd (2013) demonstrated that the impact of SES begins in infancy with an effect on attention. The authors examined 32 infants at 6, 9, and 12 months to investigated early attention and inattention in high and low SES households. A 3-way repeated measures ANOVA showed a main effect for SES in all conditions examined with one-toy conditions ($F(1, 29) = 6.23$, p , 0.05, $n^2 = 0.215$) and six-toy conditions ($F(1, 29) = 5.22$, $p < 0.05$, $n^2 = 0.180$) demonstrating greater inattention for lower SES infants than high SES infants. The conclusion by the authors was that by as early as 6

months infants from higher socioeconomic environments demonstrated less inattentive behavior than the infants from more socioeconomically challenged environments.

The literature clearly demonstrated that SES has a significant effect on children with ADHD beginning in infancy and continuing into young adulthood (Cheung et al., 2015; Clearfield et al., 2013; Law et al., 2014). As previously mentioned, SES has taken on many different definitions, but for this project, SES will focus on parental education, parental employment, and parental income. Based on this definition, it is important to understand the effects of these three variables independently in children with ADHD. The next three sections examine the literature as it relates to the impact of these three indices in this population.

Parental education. Parental education has been demonstrated to be a strong predictor of literacy and academic success in all children (Kallitsoglou, 2014; Pasutra et al., 2009). According to Rydell (2010), maternal education level is of utmost importance because of the role it plays as an indicator of human capital. She explains that maternal education is a reflection of the parent's cognitive ability and drive and this can have beneficial effects for the child including language development and social and academic skills. Havas et al. (2009) found a relationship between parental education levels and the education level of their offspring and that this relationship had an effect on the mental health of the child. Also, lower levels of education are associated with decreased health literacy leading to less effective parental caregiving (Gipson et al., 2015; Hinojosa et al., 2012b). Many researchers have studied and found an association between parental education levels and the diagnosis of ADHD in children (Caraballo et al., 2013; Cuffe,

2009; Garland et al., 2013; Leirbakk et al., 2015; Russell et al., 2015; Sciberras et al., 2011).

Low parental education can be seen to impact children with ADHD as noted in a project by Carballo et al. (2013). The researchers examined data collected on 7,834 children and adolescents eighteen years of age or younger at public mental health centers in Spain to determine factors associated with ADHD. Using a multiple logistic regression model the authors found that the paternal education level ($x^2 = 9.652$, $df = 4$, $p = 0.022$) and maternal education level ($x^2 = 10.625$, $df = 4$, $p = 0.014$) were predictive for children receiving a diagnosis of ADHD. In a retrospective review of 494 children with ADHD visiting a Child and Adolescent Mental Health Clinic, Duric and Elgen (2013) examined the population for general health and socioeconomic characteristics. In this group, the authors discovered that both mothers (OR 2.19, CI 1.9 – 2.6, $p = 0.005$) and fathers (OR 2.30, CI 1.9 – 2.7, $p = 0.001$) were less educated compared to families without children with ADHD. The authors concluded that in this study cohort the parents of the children with ADHD were less educated and in greater need of support from Child Welfare.

In a cross-sectional study of 68,634 children aged 5-17 from the NSCH (NSCH 2007-2008), Lingineni et al. (2012) searched for associations between ADHD and various factors including family-specific characteristics. In this study population, the authors found that 66.35% of the households reported having a parent, guardian, or caregiver with greater than a high school level education. According to their findings, Lingineni et al. (2012) found that a child living in a family where a parent, caregiver, or guardian had an education level higher than a high school diploma, the child was less

likely to be diagnosed with ADHD (OR 0.78, CI 0.68 – 0.89, $p = 0.05$). The authors concluded that their findings were consistent with previous research looking at the relationship between ADHD and parental education levels but cautioned that the results of this survey were subject to self-reporting and the recall bias of the responding parent, guardian, or caregiver.

It should also be noted that medication and complementary or alternative medical therapies for children with ADHD were impacted by parental education levels (Garland et al., 2013; Kemper et al., 2013; Rabbani and Alexander, 2009; Tillman and Granvald, 2015; van Dyk et al., 2015). Kemper et al. (2013) found that in the 2007 National Health Interview Survey children with ADHD who had parents with a bachelor's degree or higher compared to a high school diploma were more likely to receive some form of complementary or alternative medical treatment (OR 3.04, CI 1.76 – 5.26, $p = < 0.05$). Research completed by Tillman and Granvald (2015) demonstrated that the correlation between inhibition and inattention for children with ADHD was stronger when parents had a higher rather than lower education level ($z = 2.57$, $p < 0.05$). The authors concluded that, because of the impact of parental education on ADHD, it should be looked at as an independent variable, or unpacked, from the SES triad of education, employment, and income.

Parental employment. Historically parental employment has been debated as having both a positive and negative impact on child development (Harvey, 1998). Almost 30 years ago, in 1989, Greenberger and Goldberg argued that having working parents, both mother, and father, increased resources for the household, improved self-efficacy

and worth, and provided a positive role model, all of which benefitted the children (Harvey, 1998). Also in 1989 Johnston and Mash pointed out that for parents of children with ADHD, working outside the home gave them time to rejuvenate themselves, in turn, improving their well-being and parenting efforts (Harvey, 1998). Harvey (1998) also pointed out that in 1977, Mark's research concluded that being employed limited the time parents spent with children and could have a negative effect on child development. Fast forward to the research conducted in the last five years, and the debate continues. Malek et al. (2012) found that maternal employment negatively impacted child training and rearing factors and increased ADHD. Coley et al. (2013) demonstrated that children had enhanced behavioral and emotional functioning in households where the mother was employed outside the home. This historical and current debate is important to understand because typically parental employment is a part of the definition of SES, which is a part of the current study examining this variable on ADHD and the reporting of comorbid conditions.

To understand which factors were associated with ADHD in children without comorbidities, Malek et al. (2012) completed a case-control study comparing the characteristics of 164 children with ADHD to 166 non-ADHD children. The authors found that for mothers who were employed, ADHD symptoms and the likelihood of ADHD were greater for their children than for the children of unemployed mothers (p = 0.001). The Malek et al. (2012) findings are in contrast to the findings of Shelleby and Kolko (2015) who found that unemployed parents were significantly more likely to have

children with greater externalizing symptoms than children in homes with employed parents ($p = 0.014$).

In a study by Duric and Elgen (2011), the authors found that there was not a significant difference between the employment rates of parents of children with ADHD and the parents of non-ADHD children (mother: OR 1.8, CI 0.9 – 3.1; father: OR 2.1, CI 1.2 – 3.9). This work is supported by the work of Russell et al. (2015). Here the authors examined the employment status of parents of 8,132 children aged birth to 3 years in the Avon Longitudinal Study of Parents and Children. The researchers found that the ADHD was more prevalent in households with parents of lower occupational status but this did not show a statistically significant association with ADHD for the mother (OR 1.26, CI 0.56 – 2.84, $p = 0.847$) or the father (OR 1.34, CI 0.74 – 2.43, $p = 0.610$).

To further confound the impact of parental employment on children is the results of the work by Knapp et al. (2015). Although not specifically looking at the parents of children with ADHD, this paper demonstrated that even for parents who were employed, the specific occupational status could have an impact on child development and access to resources. Knapp et al. (2015) looked at the occupational class as seven separate categories consisting of professional, managerial/technical, non-manual/skilled, manual/skilled, semiskilled, unskilled, and never worked. The authors found that lower occupational class was significantly associated with the lower use of needed resources for the child. This is relevant to the current project because the data from the NSCH only address the question of employed or unemployed. It does not take into consideration the

different occupational classes of the parents which could also potentially impact children with ADHD. This is a possible limitation of the current project.

Parental income. Parental income cannot be totally separated from parental employment as discussed in the previous section. Coley and Lombardi (2013) stated there is a balancing act in low-income homes regarding maternal employment and child parenting/rearing. The impact of household income, concerning mental deficiencies, begins in infancy and can grow stronger through early childhood and into adolescence (Anselmi et al., 2012). According to Anselmi et al. (2012), household financial status can indirectly affect child and adolescent psychopathology through a variety of risk mechanisms. These include inadequate parenting, lack of supervision, parental depression, stressful household circumstances, association with undesirable acquaintances, and parental depression. These risk mechanisms are associated with childhood ADHD (Choi et al., 2016). Also, Choi et al. (2016) pointed out that the effect of low income or poverty on childhood development may depend on the timing of the financial disadvantage and how long the poverty lasts.

For children with ADHD low household income or poverty status has been shown to be associated with increased risk of ADHD (Larsson et al., 2014; Leirbakk et al., 2015; Lingineni et al., 2012; Pastor et al., 2015) and increasing ADHD symptoms (Martel, 2013). In a study using data from the NSCH, Pastor et al. (2015) found that of the 29,968 households surveyed with children between 4-17 years of age, 10.4 % of children from families with incomes less than 200% of the federal poverty threshold had been diagnosed with ADHD whereas only 8.8% of the children in households with incomes

greater than 200% of the federal poverty threshold had the same diagnosis ($p = 0.05$). Similarly, Lingineni et al. (2012) found that children living $\leq$ 200% the poverty level had higher odds of being classified as having ADHD (OR 1.33, CI 1.17 – 1.51). Lower family income has also been associated with increased ADHD symptoms according to Martel (2013). The author found that both inattention and hyperactivity increased significantly ($p < 0.05$) for children with ADHD from socioeconomically challenged households (r = -2, and - .27 respectively).

A possible confounder in parental income and ADHD diagnosis is the change of income or poverty status over time. Anselmi et al. (2012) demonstrated that increasing family income was associated with reducing symptoms of childhood psychopathologies, specifically conduct disorders and oppositional defiant disorders. Choi et al. (2016) more recently demonstrated that children were found to be at risk of being diagnosed with ADHD if they were living in households with decreasing (HR 0.909, CI 1.197 – 2.382), consistently low (HR 1.476, CI 1.048 – 2.079), and consistently mid-low incomes (HR 1.363, CI 1.077 – 1.726) compared to children who lived in households with mid to high incomes.

Other considerations for children with ADHD in low-income households is the access to resources, medications, and treatment. Duric and Elgen (2011) found four times greater risk of families of children with ADHD needing child welfare support compared to non-ADHD families (20% versus 5% respectively, OR 3.9, CI 0.1 – 5.1). In a project by Rabbini and Alexander (2009) the authors discussed the fact that children from higher incomes had higher stimulant use which they believed was due to better access to

resources but they also suggested the increased stimulant use may be the result of a "substitution effect" whereby the stimulants replace parental presence due to the demands of the workplace. And finally, Shelleby and Kolko (2015) determined low income was a predictor of treatment response and thus had statistically higher externalizing symptoms compared to their higher income family counterparts ($p \leq 0.01$). All these factors stress the need for more research on the impact of low household income for children with ADHD.

ADHD and Comorbid Conditions

It is well documented that ADHD is one of the most common afflictions for children around the world (Chen et al., 2013; Freitag et al., 2012; Hinojosa et al., 2012; Masi & Gignac, 2015). What is becoming more prevalent in the literature is the presence of comorbidities in association with ADHD, and some researchers are now claiming that ADHD with at least one comorbid conditions is the norm instead of the exception (Becker et al., 2012; Silva et al., 2015). In 2006, Crawford et al. (2006) pointed out that over half of the children with ADHD in studies had an additional diagnosis of anxiety/mood disorders or oppositional defiant disorder. Similar statistics have been reported by Becker et al. (2012) showing 45-84 % of children with ADHD also meet the diagnosis criteria for conduct disorder, and 50% have depression or anxiety. French (2015) stated that about two-thirds of children with ADHD had one comorbid condition and as many as one-fifth had three or more comorbidities with their ADHD.

What constitutes a comorbid condition can vary by definition from researcher to researcher, but two encompassing terms that are frequently used in the literature are

internalizing and externalizing comorbidities (Law et al., 2014). Internalizing disorders are those that are expressed inwards and typically include mood disorders (depression and dysthymia) and anxiety disorders (Cosgrove et al., 2011). Externalizing disorders are those that are expressed outward and often include substance use disorders, antisocial behavior, conduct disorders, and oppositional defiant disorder (Cosgrove et al., 2011). This is significant because researchers have shown that the presence of one or more comorbid conditions in a child with ADHD can have a significant impact on behavior, cognition, and life circumstances (Becker et al., 2012; Crawford et al., 2006; Pliszka, 2015). Rajendran et al. (2013) found that cognition issues had an impact on ADHD severity over time. Specifically, the authors found that an improvement in neuropsychological function as measured by the NEPSY (a developmental neuropsychological assessment tool) correlated to a longitudinal decrease in the severity of ADHD ($p < 0.001$). This reinforces the potential ties for comorbidities that affect cognition to ADHD severity.

Another consideration regarding the impact of comorbid conditions on ADHD is outcomes that are carried into early adulthood. ADHD and other mental challenges with a childhood onset may decrease with age but some are often carried into adolescence and early adulthood (Cheung et al., 2015; Havas, et al., 2009). Cheung et al. (2015) looked at factors associated with early-life ADHD in an attempt to find which predict future outcomes. The authors found that for the 110 boys with data in their study, both social and emotional problems as co-occurring conditions significantly increased the likelihood of ADHD symptoms persisting into young adults ($p = 0.01$ and $p = 0.04$ respectively).

The researchers also concluded that SES had an impact on carrying ADHD into adulthood ($p = 0.02$). Also, it should be noted that, according to Masi et al. (2015), the more common comorbid conditions change over time with conduct disorders occurring in early childhood, anxiety in the middle-school years, and depression in the adolescence or high-school years.

To better understand the effect of comorbid conditions on ADHD it is necessary to clearly define which comorbidities are being considered. For this project, three of the major comorbid conditions were explored. These include anxiety, depression, and behavioral issues which are frequently reported as conduct disorders or oppositional defiant disorder. The remainder of this literature review will focus on these major comorbid conditions and their role and prevalence in ADHD.

ADHD and anxiety. Co-occurring conditions can impact the neuropsychological function of children with ADHD, and anxiety, in particular, has been shown to increase inattentive symptoms while mitigating some of their impulsivity (Crawford et al., 2006; Michelini, et al., 2015). Anxiety disorder (AD) has many definitions and symptoms vary, but in general, for children with ADHD, AD can worsen inattention and concentration concerns (Masi, et al., 2015). The anxiety statistics for children with ADHD appear to be more significant than chance would account for and can put these children at greater risk for other mental health problems (Becker et al., 2012). Merikangas et al. (2009), claimed that anxiety was the most common comorbidity for children in the general population followed by conduct disorders, and depression respectively. While exact statistics vary by researcher and publication, it is evident that anxiety for ADHD kids is significant as well.

The reported prevalence of co-occurring anxiety and ADHD is between 25%-50% in the published literature (Bloemsma et al., 2013; Becker et al., 2012; Crawford et al., 2006; Masi et al., 2015; Michelini et al., 2015).

In a study by Liu et al. (2014), the authors found that children with the more severe symptoms of ADHD exhibited more significant anxiety than those without severe symptoms using the Multidimensional Anxiety Scale for Children (β .104, t 4.581, $p <$ 0.001). The authors concluded this suggested an association between significant symptomology of ADHD and severity of anxiety in these children. Multiple anxiety comorbidities have also been associated with poor quality of life for children with ADHD according to Sciberras et al. (2014). The authors reported that children with ADHD and two or more comorbid anxiety disorders had a poorer quality of life compared to children with ADHD and no anxiety (effect size: -0.8, CI -1.0 to 0.6, $p < 0.01$). Kemper et al. (2013) found that complementary and alternative medical (CAM) therapies were commonly used by children with ADHD and anxiety. The author's data showed that children with ADHD alone had less CAM therapy usage (17.3%) than children with a comorbid mood disorder such as anxiety or depression (36.2%). An additional consideration with the comorbid condition of ADHD and anxiety in youth is the long-term quality of life. Research conducted by Yang et al. (2013) showed that childhood ADHD with persistent ADHD symptoms or anxiety decreased the quality of life into adulthood (β -4.12, *SE* 0.80, $p < 0.001$). The authors concluded that mental health professionals should screen children with ADHD for symptoms of anxiety because of the negative impact it can have on the quality of life longitudinally.

Taken collectively, the literature demonstrated the negative impact of anxiety as a comorbid condition for children with ADHD. Anxiety frequently occurs in youth ADHD and can increase medication use placing an additional financial burden on the families and the health care and public health systems. Also, the literature, as demonstrated, showed that anxiety associated with ADHD could decrease the quality of life in children. This negative impact on quality of life for the youth can also lead to persistently decreased quality of life in adults.

ADHD and depression. ADHD and comorbid conditions create diagnostic, clinical, and treatment challenges for health care practitioners (Masi et al., 2015). Depression is a comorbidity of ADHD that is often found in children and can persist into adulthood. In the ADHD literature depression is often listed as a mood disorder or major depression. Masi et al. (2015) pointed out that the for children with ADHD depression tends to be more frequent in adolescents of early high school years, as compared to anxiety, which is more frequent in middle school for children with ADHD. In the general population (non-ADHD), major depression is reported in about 2% of children and increases to 6-8% for adolescents (Jerrell et al., 2015). For the ADHD population with the comorbidity of depression, the literature also varies on the prevalence. A little over a decade ago it is was estimated that depression co-occurred in approximately 29-39% of children with ADHD (LeBlanc & Morin, 2004). More recent literature has broader ranges including 15-75% (Gunther et al., 2011) and 14% for 6-7-year-old children with ADHD compared to 1% in the general population (Di Trani, et al., 2014). Jerrell et al. (2015) and Gunther et al. (2011) reported that the literature, in general, states that the risk of

developing depression is approximately 5-5.5 times higher for children with ADHD than those without the disorder.

Depression has been linked to attention-deficit disorder in the literature dating back many years. In 2004, LeBlanc and Morin (2004) discovered that children with ADHD were more likely to experience depressive symptoms than non-ADHD children on the Children's Depression Inventory scale (3.88 ± 2.28 vs. 2.53 ± 1.64, $p < 0.01$). At that time, the authors concluded that health care professionals working with children who are diagnosed with ADHD should consistently consider the possibility of a depressive comorbidity. A decade later, Di Trani et al. (2014) demonstrated that children with ADHD and a co-occurring depression had higher inattentive scores. Specifically, in their sample of 366 children diagnosed with ADHD, 42 had depression as a comorbid condition. These 42 had higher scores on the inattentive scale compared to the children with ADHD without depressive symptoms ($F = 2.39$, $p = 0.05$). Another interesting finding in the literature was the research conducted by Jerrell, McIntyre, and Park (2015). These researchers looked at the risk factors for children with ADHD developing depression as a comorbidity. In the cohort of 22,624 children with ADHD, 1529 (5.6%) had a diagnosis of a major depressive disorder. The authors found that two of the predictor variables for developing depression in this ADHD population were coexisting conduct disorder (OR 3.45, CI 3.02 – 3.94, $p < 0.0001$) and anxiety (OR 3.53, CI 3.11 – 4.01, $p < 0.0001$). Similar results were found by Chen et al. (2013) in a cohort of 1,277 adolescents with ADHD or ADHD and a comorbid condition. The authors' research

showed that children with ADHD who had a co-occurring conduct disorder had an earlier onset of depression compared to children with ADHD and no comorbid condition.

Children with ADHD are frequently diagnosed with a depressive disorder (DiTrani, et al. 2014; Gunther et al., 2011; Leirbakk et al., 2015; Masi et al., 2015). This is often seen in childhood and can persist into adulthood. ADHD and comorbid depression can increase the medications and therapies needed to treat this population (Gunther et al., 2011; Kemper et al., 2013). This has the potential to lead to an increased financial burden to the families and health care and public health care systems. More research is needed to understand the relationship between ADHD and comorbid depression so that interventions can be developed to help alleviate these burdens.

ADHD and behavioral issues. Behavioral issues for children with ADHD are characterized in many different ways in the literature. However, more frequent terminology includes externalizing disorders that include oppositional defiant disorder (ODD) and conduct disorders (CD). These are also known as disruptive behavioral disorders, Hickey (2009) explains that, according to the American Psychological Association, conduct disorder is a repetitive and consistent pattern of breaking the rules. The author also defines ODD as a recurring pattern of defiant, negative, hostile, disobedient behavior towards individuals in authority. Behavior issues for children with ADHD tend to manifest in the early childhood (Masi & Gignac, 2015) and are the leading cause of child and adolescent referrals to mental health facilities (Nordstrom et al., 2013). The significance of co-occurring behavioral issues with ADHD cannot be understated because research has shown that these two conditions coexisting in the same child lead to

antisocial behavior, problematic delinquency, criminality, lower quality of life, and premature death (Schei et al., 2015; Sibley et al., 2011). The prevalence of co-occurring ADHD and behavior issues for children ranges in the literature from 15% to 84% (Becker, et al., 2012; Chen et al., 2013; Freitag et al., 2012).

Data from research conducted by Freitag et al. (2012) showed that the severity of ADHD hyperactive-impulsive symptoms to be strongly associated with ODD and CD ($p = 0.0002$). Other risk factors for behavior issues in children with ADHD included household income (β -0.207, SE 0.074, $p \leq 0.001$) and parental employment (β -0.182, SE 0.074, $p \leq 0.05$) according to research by Shelleby and Kolko (2015). AHDH with a CD comorbidity, as shown in research by Chen et al. (2013), leads to higher incidence of mood disorders including depression compared to ADHD alone and control a control group (23.0% vs. 13.0% vs. 8.7%, $p < 0.001$). This is particularly significant because Sibley et al. (2011) discovered that children with ADHD plus CD were at the greatest risk for delinquency (β 0.94, SE 0.17, $p < 0.01$).

The data in the literature for the comorbidity of ADHD and behavioral issues has clinical implications because these two conditions together lead to more problematic behavior than either condition alone (Nordstrom et al., 2013). This comorbid combination can lead to long-term delinquency (Sibley et al., 2011) and potential mood disorders in adulthood (Chen et al., 2013). ADHD and behavioral issues lead to more mental health referrals (Nordstrom et al., 2013). Thus, these co-occurring conditions may be increasing the financial burden to the families and the health care system. Also, because the combination of behavioral disorders and ADHD may lead to long-term health issues,

delinquency, criminality, and poorer quality of life it makes this a serious public health and societal concern. The literature stresses the need for more research in children and adolescents with these two comorbid conditions.

Confounding Variables

ADHD and Gender

Gender differences in the diagnosis rate for ADHD have been well documented in the published literature. Worldwide, the estimated prevalence ratio of males to females diagnosed with ADHD is 3:1 in population or community-based samples (Arnett et al., 2016; Lundervold et al., 2016; Pastor et al., 2015; Skogli et al., 2013). Gender bias may occur with this condition because of the greater prevalence in boys than girls. Potential explanation for the gender-based diagnosis discrepancy include girls being under identified due to a difference in the way they express the disorder and a lower referral rate from teachers for girls than boys (Skogli et al., 2013). What appears to be unclear in the literature is whether there is a true difference among the genders in behavioral or etiological characteristics (Arnett et al., 2016). Also, there seems to be some ambiguity in the literature regarding the severity of ADHD among the genders and the symptoms of comorbid neuropsychological condition (Arnett et al., 2016).

Gender differences or bias may also occur in the reporting of comorbid conditions for children with ADHD. ADHD boys often exhibit early externalizing behaviors such as hyperactivity and behavioral issues that lead to the attention-deficit hyper activity disorder diagnosis (Skogli et al., 2013). The acting out by boys may be one of the explanations for the more frequent referral by teachers and subsequent ADHD diagnosis.

This can potentially mask other underlying comorbidities such as anxiety and depression. Girls with ADHD tend to exhibit greater internalizing disorders such as depression and anxiety which leads to them being misdiagnosed or under identified for ADHD (Skogli et al., 2013). It is documented that girls have a two-fold higher diagnosis rate for depression than boys and this may account for some of the gender discrepancies in ADHD (Lundervold et al., 2016). It is these potential gender differences that may confound the results of household socioeconomics and the reporting of comorbid conditions in children with ADHD.

ADHD and Medication Usage

From 2000 to 2005 the use of medications for the treatment of ADHD increased from 2.8–4.4% in the United States (Beau-Lejdstrom et al., 2016). Data from the 2011-2012 NSCH estimated that of the 99,567 households surveyed there were approximately 11% of children between the ages of 4 and 17 who had ever received a diagnosis of ADHD, and 69% of those with current ADHD were taking medications for the condition (Visser et al., 2014). It is becoming widely accepted that medications are the treatment of choice for ADHD because they are highly effective and are better received than behavioral interventions (Charach et al., 2014; Yeh et al., 2014). The benefits of stimulant treatment for ADHD has shown in studies looking at academic achievement, emotional functioning, and social functioning (Yeh et al., 2014), although, there is some controversy as to the validity of these claims (Currie et al., 2014).

Medication use for the treatment of children is ultimately the decision of a parent or guardian after the recommendation is made by the physician. Charach et al. (2014)

explained that parents are more likely to accept the physicians recommendation for medication if they have an understanding of the underlying neurobiological causes of the condition and they belief the stimulants are safe. This may have implications for this current study if parental lower education, and lower employment status impact the ability to comprehend the information from the physician or simply lack of insurance leading to decreased access to sound medical advice and explanations. Also, many physicians have noted that poor family functioning or parenting issues may lead to discontinuation of medication use by the child with ADHD.

Another consideration with medication use for the treatment of ADHD is the potential to mask underlying comorbid conditions. Stimulant use for a boy with externalizing behaviors may lead to a depression or anxiety diagnosis being missed. Or, one could argue the opposite, that taking a medication for a comorbid condition could mask and underlying ADHD condition. This would be relevant in girls being medicated for depression which may mask and underlying ADHD diagnosis It is for these reasons that medication use for the treatment of ADHD may be considered a confounding variable for this current project.

Summary

The current study is designed to examine the impact of parental SES on the reporting of comorbid conditions. The objective is to better understand the relationships, if any, between SES and comorbidities so that disparities can be discovered and resources allocated to better serve the families, communities, health care, and public health systems. The project was guided by Bronfenbrenner's EST which has been used

historically to examine ADHD and socioeconomic issues. All levels of the EST can potentially have an impact on a child with ADHD making this theory ideal for guiding the project.

The historical literature review has shown an association between socioeconomic disadvantage and the diagnosis and symptoms of the condition. Researchers demonstrated that parental education level, parental employment, and household income all play a significant role in children with ADHD. ADHD is one of the most common conditions afflicting children worldwide, and now researchers are claiming that ADHD with a comorbid condition is more the norm than ADHD alone. The more common comorbidities in children with ADHD are anxiety, depression, and behavioral issues. The extensive amount of literature looking at ADHD and these three comorbid conditions demonstrates a significant disadvantage concerning the quality of life and long-term well-being for these individuals. Also, the literature illuminated the fact that having one comorbid condition may increase the odds of developing a second comorbid condition in the future. This makes ADHD and comorbidities a serious long-term public health concern.

The literature review demonstrated a correlation between ADHD and SES and between ADHD and comorbidities, but little can be found on the impact of SES and the reporting of comorbid conditions for children with ADHD. Children with ADHD alone have many negative consequences compared to their non-ADHD counterparts. Add a comorbid condition such as anxiety, depression, or a behavioral issue and they are now at an even greater disadvantage. It is for these reasons that there needs to be a greater

understanding in regard to the risk factors that are associated with ADHD and the development of comorbidities. Because SES has been shown to be associated with ADHD, this would be a logical starting point and was the focus of this project. Understanding any disparities that may exist in the population of children affected by this common affliction may lead to future projects for better diagnosis, treatment, and outcomes.

In Chapter 3 I will discuss the design of this study and the rationale to support it. The methodology will be examined as it pertains to the population being studied and the NSCH sampling and data collecting procedures. I will also explain the data analysis plan which will include descriptive and inferential statistics. The chapter will conclude with a discussion of threats to validity and ethical considerations.

Chapter 3: Research Method

Introduction

This quantitative study was undertaken to look for relationships between household SES and the reporting of comorbid conditions for children diagnosed with ADHD. The goal was to determine whether there are any associations between household SES challenges and comorbidities for children with ADHD so that programs and interventions could be developed to address any disparities. Understanding the impact of household SES on the comorbid conditions for these individuals will allow for the focusing or refocusing of public health and health care resources to help alleviate the problems. Although the current study may not directly address the risk factors associated with ADHD and comorbid conditions, it is expected to add to the current body of knowledge for this growing, longitudinal, public health issue. Also, this current research may help clarify additional factors that have a relationship to children with ADHD and their parents and caregivers.

This chapter covers the following topics: (a) the research design and rationale for conducting this project; (b) the variables being addressed and the research design's connection to the research questions; (c) the target population, sampling and sampling procedures, and the power analysis for sample size; (d) an explanation of recruitment procedures; (e) the instrumentation used to collect the data in this secondary dataset; (f) potential threats to validity, and (g) ethical procedures.

Research Design and Rationale

For this project, the independent research variables were household education, household employment, and household income. Household education was the highest grade or year of school completed by anyone in the home and was categorized as less than high school, high school graduate, and more than high school. Household employment was dichotomized to yes or no based on anyone in the home being employed for 50 out of the previous 52 weeks. The %FPL for this study was calculated from reported household income levels to a percent poverty level based on the Department of Health and Human Services guidelines. This group was divided into three categories, < 100% the FPL, 100% – 200% the FPL, and > 200% the FPL.

The dependent variable was the reporting of a comorbid condition. A study subject was considered as having a comorbid condition if she or he had ever been told of anxiety, depression, or behavioral issues. For the survey, the participant was asked, "For each condition, please tell me if a doctor or other health care provider ever told you that [Study Subject] had the condition, even if [he/she] does not have the condition now." This was a dichotomous dependent variable. The comorbid conditions to be included were anxiety, depression, and behavioral issues. Behavioral issues included oppositional defiant disorder and conduct disorder.

Potential confounding variables were gender and the use of ADHD treatment medications. Confounding variables may have direct or indirect influence on the direction and strength of relationship between the independent variables and the dependent outcome (Sullivan, 2012). Gender is a confounding variable because of the nearly 3:1

ratio of ADHD diagnosis for boys to girls. The level of measurement for gender in the NSCH data is categorical-nominal where 1 = Male, 2 = Female, 77 = Don't Know, and 99 = Refused. Medication use for ADHD is also a potential confounding variable that was examined. The use of medication to treat ADHD is not universal and may mask comorbidities. The NSCH asks the question, "Is [S.C.] currently taking medication for ADD or ADHD?" The level of measurement for medication in the NSCH data is categorical-nominal where 1 = Yes, 2 = No, 77 = Don't Know, and 99 = Refused. With these variables being considered, the following research questions were addressed:

1. Is there a relationship between household income (% FPL) and the prevalence of a comorbid condition (anxiety, depression, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?
2. Is there a relationship between household education level and the prevalence of a comorbid condition (anxiety, depression, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?
3. Is there a relationship between household unemployment and the prevalence of a comorbid condition (anxiety, depression, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

This study will employ quantitative research methodologies. Quantitative methodology is being used because the dependent and independent variables are

available in a quantifiable format from a publically accessible secondary dataset. The secondary dataset is from the NSCH Study (CAHMI, 2011-2012). Specifically, a cross-sectional study design was undertaken. According to Crosby (2013), a cross-sectional study design is often used for survey-based research and analysis. The cross-sectional research can be employed to look for associations between dispositions and properties (Frankfort-Nachmias & Nachmias, 2008).

Using a publically available secondary dataset limits potential time and resource constraints. Access to the NSCH dataset can be obtained by filling out and submitting the appropriate forms, and the complete dataset with source materials were supplied at no cost. The data were downloaded into SPSS for statistical analysis. By using the NSCH dataset, a larger amount of data can be extracted and analyzed with relative ease and limited costs. Employing a cross-sectional design for this project has several advantages. It allows for a snapshot to be taken of a large, targeted population (children with ADHD) and allows for the examination of associations between household SES and the reporting of a comorbid condition. The data included in the NSCH has been collected from all 50 states and the District of Columbia which allow for a broader sampling than from an independent study project and analysis. The data, because it is from a large, broad sample, may be generalizable to the greater population of children with ADHD. This will allow the current project to add to the existing body of knowledge regarding the factors associated with ADHD and the impact they may have on the child and caregiver's quality of life and needed resources. Also, the cross-sectional design and multiple logistic

regression analysis will provide a reliable methodology to determine if there is any statistical significance to associations that may exist.

Methodology

Population

The population for this research project consisted of non-institutionalized children with ADHD in the United States between the ages of 24 months and 17 years and the parents or caregivers taking care of them. The original data for this study were collected by the CDC's National Center for Health Statistics, State and Local Area Integrated Telephone Survey program between 2011 and 2012. The researchers reached out via telephone landlines or cell phones to 847,881 U.S. households (CAHMI, 2011-2012). Of this total, 187,422 reported having age-eligible children in the household, and of this number 95,677 detailed child-level interviews were completed. It is estimated that prevalence rate for ADHD in the United States is between 4% and 12% in school-aged children (Hinojosa et al., 2012a). Based on these percentages it can be estimated that the NSCH survey should have between 3,827 and 11,481 school-aged children with a diagnosis of ADHD. For this study, the estimated number of children with ADHD may be slightly higher because it will include children not yet in school (ages 0-5 years) as well.

Sampling and Sampling Procedures

The sample that was used for this current ADHD project was from a secondary data analysis of the NSCH dataset. The goal of the NSCH was to assess the physical and emotional health of U.S. children (CAHMI, 2011-2012). The sampling frame for the

NSCH was from the CDC's National Immunization Survey (NIS) which optimized efficiency and costs. This sampling frame included a random digit dial of U.S. landline and cell telephone numbers. The survey design called for stratification by sample type (landline or cell phone) and by individual state. Because the NSCH data were drawn from all 50 states and the District of Columbia, it allows for the current project to have a fair representation of the U.S. child population. Also, using this secondary dataset limits the cost and resources needed for this study.

Power analysis. The following is a power analysis for this project which was completed in anticipation of using a multiple logistic regression statistical approach. G*Power version 3.1 was used to calculate the sample size needed for this cross-sectional analysis. Effect size is the magnitude of an observed effect based on and objective and often standardized measure (Field, 2013). The effect size can be used to determine the strength of the relationship between the dependent, independent, and confounding variables. Based on the prevalence of childhood ADHD in the U.S., 4%–12% (Hinojosa et al., 2012a), and the large number of surveys completed in the NSCH, 95,677 (CAHMI, 2011-2012), it is estimated that between 3,827 and 11,481 children in the sample will have a diagnosis of ADHD. Because this is a potentially large sample size, a smaller effect size can be used for the sample calculations. Using the *z* test family and the logistic regression statistical test a power analysis was run for a priori to compute required sample size given alpha (α), power, and effect size. The odds ratio was estimated to be 1.3, the statistical significance level was an α of 0.05, and the power (1-β err prob) was

set at 0.95 (95% Confidence Interval). Using these parameters, G*Power calculated the estimated sample size to be n = 1,188.

NSCH Recruitment, Participation, and Data Collection

The NSCH was led by the National Center for Health Statistics at the CDC and was sponsored by the federal Maternal and Child Health Bureau (Data Resource Center for Child and Adolescent Health, 2016). The NSCH was initially conducted in 2003, again in 2007, and a third time in 2011/2012. It is being conducted now in 2016/2017. For this study, the data from the 2011/2012 survey were used. The survey was conducted to garner information on non-institutionalized children between the ages of 0-17 years regarding the topics of emotional and physical health and factors related to general well-being. These factors included family issues, parental well-being, neighborhood safety, medical home, and experiences at school (Data Resource Center for Child and Adolescent Health, 2016). The complete flow chart for recruitment, participation, and data collection that has been adapted from Data Resource Center for Child and Adolescent Health (2013) can be found in Appendix A.

Recruitment. Recruitment for the NSCH was established using the same sampling frame as the National Immunization Survey (NIS) conducted by the CDC. The State and Local Area Integrated Telephone Survey (SLAITS) used a Random-Digit-Dial (RDD) that was employed by the NIS to survey homes in all 50 states and the District of Columbia (CDC, 2015). The NIS sampling frame screens approximately one million households per year. The landline and cell phone numbers selected for the survey were randomly generated and selected by a computer and void of human or organization

influence (CDC, 2015). The random sampling was from all potential landline and cell phones in the United States including unlisted numbers and numbers that may be on the Federal Do Not Call List. Final recruitment, once telephone contact was made was based on the household associated with that number having at least one child between 0-17 years in residence.

Participation. The randomly selected telephone numbers lead to the completion of 95,677 interviews. When a number was called participation in the survey was offered if the respondent confirmed that one or more children ages 0-17 lived in the household. Participation in the NSCH was strictly voluntary, and those participating could opt out of answering any of the questions for any reason during the interview (Health Resources and Services Administration, 2016). If the household had more than one child between the ages of 0-17, then a single child was randomly selected for participation. The adult in the household who knew the most information about the child and their health and health care was asked the interview questions. Financial incentives were offered to qualified participants based on a prespecified detailed incentive plan. The maximum paid out to any household was $15, and a total of 18,728 participants received some level of compensation (CDC, 2015).

Data collection. Sampling and data were collect for the NSCH by SLAITS, the State and Local Area Integrated Telephone Survey program, which was developed by National Center for Health Statistics (CDC, 2013). Data were collected for this survey between February 28, 2011, and June 25, 2012. One parent or guardian from each household who knew the child was asked to complete the interview. Respondents

consisted of 7.2% guardians, 24.2% fathers, and 68.6% mothers (CDC, 2013). The average interview time was 33 minutes, 6 seconds for landline calls, and 34 minutes, 14 seconds for cell phone calls. A total of 847,881 households in the United States were screened with 95,677 qualifying and completing child-level interviews (CDC, 2013). The response rate, defined by completion through section 6 of the questionnaire for children 0-5 years and section 7 for children 6-17 years, for households reporting one or more qualifying child, was 54.1% for landlines and 41.2% for cell phones (CDC, 2013). It should also be noted that the questionnaire was translated into Mandarin, Cantonese, Vietnamese, Korean, and Spanish, and translators were available and used if needed.

Accessing the NSCH Data

The NSCH dataset is publically available upon request from the Data Resource Center for Child and Adolescent Health. To obtain the full dataset with all records and variables from the survey, a data request form was completed (Appendix B). By requesting the full dataset officially from the Data Resource Center for Child and Adolescent Health, a properly formatted and labeled data set specifically for use in SPSS can be obtained. After the data request form has been received the researcher receives a data usage agreement form that is filled out and returned (Appendix C). Once approved, an email confirmation is sent to the requester with information on how to access the data (Appendix D). The data can then be downloaded directly into SPSS and copies of relevant material including code books can be accessed.

Instrumentation

The NSCH uses a questionnaire that was developed, pretested, and validated for use in the original 2003 NSCH project (Blumberg et al., 2009). Revisions were made for future NSCH surveys, and the newly proposed and significantly revised questions were pretested and finalized for use (Blumberg et al., 2009). The survey conducted by SLAITS used the Computer-Assisted Telephone Interview (CATI) system. The CATI system software navigated the interviewer through the screens with automatic routing to the appropriate next question based on the participant's response. Responses were entered directly into the computer. All programming for the CATI system was pretested using the questionnaire and based on the results the questionnaire was revised for flow and content and finalized (Blumberg et al., 2009). Also, interviewers for the pretests and the survey were trained through mock trials and tested for accuracy. Data that were obtained for the NSCH project through the use of this instrumentation was used for this current ADHD project. Only specific data pertinent to the project's research questions were analyzed.

Data Analysis Plan

The data analysis for this current project was conducted using the SPSS (IBM Corporation, 2013). Upon request, the NSCH data can be obtained from the Data Resource Center for Child and Adolescent Health, and this agency has cleaned the data for download and use in SPSS. For the ADHD project, only data from Section 2, Subdomain 3 (Health and Functional Status, Common Chronic Conditions respectively), and Section 11, Subdomain 2 and Subdomain 5 (Additional Demographics, Education of

Parents, and Employment and Income respectively) were used. This project will test three sets of questions and hypothesis that are as follows:

RQ1: Is there a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use?

H_0: There is no relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

H_a: There is a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

RQ2: Is there a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use?

H_0: There is no relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

H_a: There is a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

RQ3: Is there a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use?

H_0: There is no relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

H_a: There is a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

A descriptive statistical analysis was conducted looking at frequencies and confidence intervals for the multiple variables. These variables included ADHD diagnosis, comorbid conditions, SES, and the confounding variables (gender, medication use). The descriptive analysis helped to quantify these variables as they exist in this U.S. population. Next, an inferential analysis was conducted to test the null hypothesis of each research question. The inferential analysis consisted of a simple logistic regression with an unadjusted odds ratio and a multiple logistic regression analysis and an adjusted odds ratio, where a *p*-value of 0.05 or below will show a significant relationship using Wald statistics. Also, the Hosmer-Lemeshow goodness-of-fit statistic was used to assess how well the regression model fits the data. A regression analysis is used to examine associations between a dependent variable and one or more independent variables (Sullivan, 2012). The simple logistic regression was completed to look at unadjusted odds ratios between the individual independent variables and the outcome variable. Any of the

regressions that are non-significant in the simple logistic regression should also be non-significant in the multiple logistic regression analysis. A multiple logistic regression analysis is undertaken when there is a dichotomous dependent variable and multiple independent variables (Sullivan, 2012). The odds ratio is the effect size that is used to quantify relationships between the variables (Field, 2013). Simply put, the odds ratio is a representation of the odds that a given variable or outcome will occur when exposed to a different or separate variable (Szumilas, 2010). Specifically, for this project, the multiple logistic regression analysis was conducted to determine the predictive relationship and adjusted odds ratio between each independent variable (parental education, parental employment, household income) and the reporting of comorbid conditions for children with ADHD. The reference scale for the independent variables was high school graduate or less, unemployed for 50 of the previous 52 weeks, and an income of less than 200% the FPL.

Threats to Validity

Validity is the degree to which the items of the survey or the variables one is examining and the associated response choices measure what is intended to be measured (Crosby, 2013). Because the NSCH used a telephone survey including landlines and cell phones, external validity may be called into question. The current ADHD project looked to examine the impact of SES on the reporting of comorbid conditions and some households, especially in the lower SES stratum, may not own or have access to a phone. This threat and the issue of this being a cross-sectional design may limit the generalizability of the project to the broader population.

Internal validity threats may involve cognitive and situational processes. Because this was a survey that required comprehension, inaccuracies may arise when asking a parent or guardian to recall something that may have occurred as many as 17 years in the past. The situational process may impact internal validity by the respondents reporting what they believe the interviewer wants to hear rather than a more accurate response. These threats to internal validity are a concern with survey research in general. It is also important to note that any associations found between the variables may not be an indication of causality. All of these threats to validity must be taken into consideration when interpreting the results of the research project.

Steps that can be taken to help reduce the threats to validity include ensuring that the measurement tool has been validated, interviewers are properly trained for consistency and standardization, and that interpretation of the data is based strictly and accurately on the statistical analysis. For the NSCH, the survey tool was tested and validated before use and also when questions were added, and significant revisions were made (Blumberg et al., 2009). Also, all interviewers were required to go through multiple training and practice sessions before going live with the survey (Blumberg et al., 2009). Having sufficient information about the questionnaire and the data collection process helps to address any potential threats to validity.

Ethical Procedures

The NSCH, while geared towards obtaining data on children 0-17 years of age, was administered to adults and caregivers of those children. All data were classified, and nicknames, first name only, or initials were to be used by responders and interviewers

when referring to the target subject. The following statement was required to be read to all study participants before initiation of the questioning:

> All information which would permit identification of any individual, a practice, or an establishment will be held confidential, will be used for statistical purposes only by NCHS staff, contractors, and agents only when required and with necessary controls, and will not be disclosed or released to other persons without the consent of the individual or the establishment in accordance with section 308(d) of the Public Health Service Act (42 USC 242m) and the Confidential Information Protection and Statistical Efficiency Act (PL-107-347) (Child and Adolescent Health Initiative, 2016, p. 1).

Also, all individuals contacted were informed that participation was voluntary and that responders could refuse to answer any or all questions without giving a reason (Health Resources and Services Administration, 2016). For the original NSCH data collection, researcher bias was controlled for through the use of a computerized script and survey protocol. For the current project, research bias should be at a minimum because it is an examination of secondary data. Also, Institutional Review Board (IRB) approval through Walden University was obtained prior to the study being conducted. All ethical and compliance protocols were strictly adhered to.

Summary

A quantitative research project using a cross-sectional analysis of secondary data from the NSCH was undertaken. The original 2011/2012 NSCH data surveyed 95,677 households that had one child in residence between the ages of 0-17. The current study

was conducted to examine associations between SES and the reporting of comorbid conditions for children with ADHD embedded within the original NSCH cohort. A power analysis was completed to determine sample size and based on an effect size of 0.02, and alpha of 0.05, and power of 0.95. The calculated sample size for this project will need to be 863 subjects. The secondary data were downloaded into SPSS for descriptive and inferential statistical analysis. Specifically, a simple logistic regression analysis was completed to address the pre-established research questions. Because a secondary dataset was used, informed consent was not be needed. Walden University IRB approval was necessary to continue, and all ethical and compliance protocols were followed.

In Chapter 4 I review the results of this study. I explain the data collection procedures used by the NSCH and share the descriptive statistics from the data analysis. The results of the inferential analysis are shown for the simple logistic regression and the multiple logistic regression. I also included a discussion about the statistical assumptions for this project.

Chapter 4: Results

Introduction

The purpose of this quantitative, cross-sectional study was to examine any relationships between household SES and the reporting of comorbid conditions in children with ADHD. By understanding associations that may exist children with ADHD, it may be possible to address disparities, develop targeted interventions, and focus resources on areas of need. An analysis of secondary data obtained from the 2011/2012 NSCH was used for this project. In this chapter, there is an explanation of the data collection for the survey, a descriptive analysis including baseline demographics, and a look at how representative the study participants are to the larger population. The results are reported for the inferential statistical analysis as they relate to the research questions and hypotheses. The chapter concludes with a summary of the important findings.

Research Questions and Hypotheses

The following research questions and hypotheses were established to examine potential relationships between household socioeconomics and the reporting of comorbid conditions for children with attention-deficit hyperactivity disorder:

RQ1: Is there a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues)

among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

RQ2: Is there a relationship between household employment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household employment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household employment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

RQ3: Is there a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

Data Collection

For this project, data were obtained from the NSCH (NSCH) 2011-2012 study (CAHMI, 2011-2012). The original data for this study were collected by the CDC's National Center for Health Statistics, State and Local Area Integrated Telephone Survey program between February 28, 2011, and June 25, 2012. The researchers reached out via telephone landlines or cell phones to 847,881 U.S. households (CAHMI], 2011-2012). Of this total, 187,422 reported having age-eligible children in the household, and of this number 95,677 detailed child-level interviews were completed (CAHMI, 2011-20120).

Before the data were downloaded into SPSS, Institutional Review Board (IRB) approval was obtained from Walden University (IRB approval No. 07-06-17-0496926). The NSCH data were structured and coded to address the research questions examining potential associations between household socioeconomics and the reporting of comorbid conditions for children with ADHD. Following are important baseline descriptive and demographic characteristics for the 2011-2012 NSCH (CAHMI, 2011-2012). The

number of households interviewed per state ranged from a low of 1,811 in South Dakota to 2,200 in Texas (includes all 50 states and the District of Columbia). The respondents for the completed interviews consisted of mothers (68.6%), fathers (24.2%), and relatives or guardians (7.2%). The NSCH was completed for children between the ages of 0 and 17, and the gender breakdown was 51.4% Male and 48.4% Female. English was the primary language of those surveyed (92.1%) and the represented ethnicities consisted of White/non-Hispanic (64.2%), Hispanic (13.3%), Black/non-Hispanic (9.3%), and other (10.9%).

The covariates included from the NSCH dataset were children with ADHD, comorbid conditions , parental education, parental employment, household income (as a percentage of the FPL), gender, and medication use for ADHD. Table 1 shows the frequencies for these covariates from the total NSCH sample population. For this project, the three comorbid conditions, anxiety, depression, and behavioral issues were combined and coded as having or not having one or more of the three comorbidities. Household income was collected in the survey and coded based on a percentage of the FPL.

It is estimated that prevalence rate for ADHD in the United States is between 4% and 12% (Hinojosa et al., 2012a). As can be seen in Table 1, the ADHD population was 8.9% of the NSCH survey which is aligned with the estimates for the U.S. population. The large, equitable sampling is representative of the U.S. population. There are no discrepancies with the data collection as described in chapter 3.

Results

Descriptive Statistics

The NSCH was completed for 95,677 households with equitable distribution across the 50 States and the District of Columbia (CAHMI, 2011-2012). A descriptive analysis was undertaken that includes frequencies and percentages of the total population, as well as the targeted population of children with ADHD with and without the reporting of a comorbid condition. Included in the descriptive analyses was children with ADHD, ADHD with or without one or more comorbidity, household education level, parental employment status, and income level expressed as a percentage of the FPL. Descriptive statistics are also described for the covariates of gender and ADHD medication usage. ADHD was reported for 8,528 of the survey study subject participants (Table 1). The 8,528 children having ever been diagnosed with ADHD in the NSCH was used as the target population for this analysis.

Table 1

NSCH Demographics for Study Covariates

Covariate	Frequency	%
Total Population	95,677	100
Gender		
Male	49,219	51.4
Female	46,349	48.4
ADHD	8,528	8.9
Medication Use for ADHD	4,746	5.0

Comorbid Condition		
Anxiety	5,098	5.3
Depression	3,321	3.5
Behavioral Issue	3,236	3.4
Household Highest Education	12,837	13.4
Less than High School	30,691	32.1
High School	46,688	48.8
More than High School		
Household Employment		
<50 weeks in previous year	11,434	12.0
≥50 weeks in previous year	82,255	86.0
Household Income		
0-199% FPL	28,646	29.9
200-399% FPL	26,740	27.9
≥400% FPL	31,435	32.9

Comorbid Conditions

Because three of the more common comorbid conditions for children afflicted with ADHD are anxiety, depression, and behavioral issues, these three variables are described individually but were used collectively for the logistic regression. Table 1 reports the frequencies and percentages of the children from the total population who report having anxiety, depression, or a behavioral issue. To answer the research questions posed by this project looking at children with ADHD with and without a comorbid condition, the data were recoded to make this the target population. Table 2 shows the frequencies and percentages for children with ADHD without a comorbidity and children with ADHD who reported having one or more comorbid conditions.

Table 2

ADHD and Comorbid Conditions

Category	Frequency	%
ADHD and no comorbidity	4,622	4.8
ADHD and one or more comorbidities	3,844	4.0
ADHD Population	8,528	8.9
Total Population	95,677	100

Note. ADHD = Attention-Deficit Hyperactivity Disorder

Socioeconomic Status

SES of the household was based on parental or guardian education level (less than high school, high school, greater than high school), household employment status (someone in the household was employed for 50 weeks or greater during the previous 12 months), and household income. Household income was converted in the NSCH to a percentage of the FPL and divided into four groups (0-199%, 200%-299%, 300-399%, ≥400%). Table 1 reports the frequencies and percentages for education level, employment status, and income as a percentage of the FPL as they occur in the total NSCH study sample. For this project, the derived FPL percentages were recoded into three categories as described in Table 1.

Covariates

Two covariates were considered and adjusted for in this project. They are gender and medication use to treat or manage the symptoms of ADHD. Because boys report a

higher incidence of ADHD (Pastor et al., 2015), this was considered to be variable to adjust for. Medication use may potentially impact the signs and symptoms of ADHD and possibly impact the reporting of a comorbid condition, so it was adjusted for as well (Gipson et al., 2015). Table 1 reports the frequencies and percentages of gender and medication use for ADHD that were reported in the total NSCH population.

Statistical Assumptions

Simple logistic regression and multiple logistic regression analysis were undertaken for this study. Logistic regression modeling is subject to similar biases as linear regression which include linearity, normality, homogeneity of variance, and independence (Field, 2013). Of particular interest with logistic regression models are linearity and independence of error. For ordinary regression models, it is assumed that the outcome variable will have a linear relationship with the predictor variables. However, for logistic regression, the variables are categorical, so the assumption is violated. To control for this, the logit or log of the data is used. The Hosmer and Lemeshow test was completed to examine if the interaction between the predictor variables and their log transformation was significant. The independence of error assumption is that there should not be a strong correlation between two observations (Field, 2013).

Logistic Regression

Simple Logistic Regression

A simple logistic regression analysis was completed to determine if the independent variables of parental education level, parental employment, and household income (% of the FPL) are predictors of the reporting of a comorbid condition among

children with ADHD. Significance levels were set a $p < 0.05$ and the confidence intervals (CI) was set as a 95% CI with lower and upper limits reported for the individual results. Nagelkerke R^2 values and Cox and Snell R Square were used in calculating the variations. For this study, the Nagelkerke R^2 was reported.

Parental Education and ADHD Comorbidities

RQ1: Is there a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder?

H_0: There is no relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder.

H_a: There is a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder.

A simple logistic regression analysis to investigate the relationship between household education level and the prevalence of a comorbid condition among children with ADHD was conducted. The predictor variable, parental education, was tested a priori to verify there was no violation of the assumption of linearity of the logit. The predictor variable, parental education, in the simple logistic regression analysis was found to contribute to the model. Using greater than high school education level for the reference standard, the unstandardized Beta weight for the predictor variable high school were; $B = .121$, $S.E. = .050$, $Wald = 5.932$, $p < 0.015$. The unstandardized Beta weight for

the predictor variable < high school were $B = .492$, $S.E. = .066$, $Wald = 55.558$, $p < 0.001$. The estimated unadjusted odds ratio indicates significantly higher odds of approximately 13% [Exp (B) = 1.128, 95% CI (1.024, 1.243)] for reporting a comorbid condition based on having a high school education compared to having greater than a high school education. The estimated unadjusted odds ratio indicates significantly higher odds of approximately 64% [Exp (B) = 1.635, 95% CI (1.437, 1.861)] for reporting a comorbid condition based on having less than a high school education compared to having greater than a high school education. These results are reported with the Constant in Table 3.

Table 3

Simple Logistic Regression Predicting Education and ADHD Comorbidity (N = 7,935)

	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI
H.S.	.121	.050	5.932	1	P=0.015	1.128	1.024, 1.243
Less than H.S.	.492	.066	55.558	1	P<0.001	1.635	1.437, 1.861
Const.	-.320	.034	90.671	1	P<0.001	.726	

Note. H.S. = High School, B = Beta, S.E. = Standard Error, df = degrees of freedom, Sig = Significance, CI = Confidence Interval

Household Employment and ADHD Comorbidities

RQ2: Is there a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder?

H_0: There is no relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

A simple logistic regression analysis to investigate the relationship between household employment and the prevalence of a comorbid condition among children with ADHD was conducted. The predictor variable, household employment, was tested a priori to verify there was no violation of the assumption of linearity of the logit. The predictor variable, household employment, in the simple logistic regression analysis was found to contribute to the model using not being employed for 50 out of the previous 52 weeks as the reference standard. The unstandardized Beta weight for the predictor variable; B = -.603, *S.E.* = .058, *Wald* = 107.23, $p < 0.001$. The estimated unadjusted odds ratio indicates significantly lower odds of nearly 45% [Exp (B) = .547, 95% CI (.488-.613)] for reporting a comorbid condition based on someone in the household having been employed for $\geq$ 50 of the previous 52 weeks. These results are reported with the Constant in Table 4.

Table 4

Simple Logistic Regression Predicting Employment and ADHD Comorbidity (N = 8,309)

	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI
Employ	-.603	.058	107.225	1	P<0.001	.547	.488-.613
Constant	.311	.053	34.561	1	P<0.001	1.365	

Note. Employ = employment, B = Beta, S.E. = Standard Error, df = degrees of freedom, Sig = Significance, CI = Confidence Interval

Household Income and ADHD Comorbidities

RQ3: Is there a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder?

H_0: There is no relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder.

H_a: There is a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder.

A simple logistic regression analysis to investigate the relationship between household income (% FPL) and the prevalence of a comorbid condition among children with ADHD was conducted. The predictor variable, household income, was tested a priori to verify there was no violation of the assumption of linearity of the logit. The predictor variable, household income, in the simple logistic regression analysis was found to contribute to

the model. Using an FPL of >400% as the reference, the unstandardized Beta weight for the predictor variable FPL 200%-399% were; B = -.241, *S.E.* = .060, *Wald* = 16.250, $p <$ 0.001. The estimated unadjusted odds ratio indicates significantly higher odds of approximately 27% [Exp (B) = 1.272, 95% CI (1.132, 1.430)] for reporting a comorbid condition based on having an income between 200% and 399% of the FPL compared to having an income of ≥400% of the FPL. The unstandardized Beta weight for the predictor variable FPL <199% were; B = .727, *S.E.* = .055, *Wald* = 172.548, $p < 0.001$. The estimated unadjusted odds ratio indicates significantly higher odds of approximately 200% [Exp (B) = 2.069, 95% CI (1.856, 2.306)] for reporting a comorbid condition based on having an income of <199% the FPL compared to having an income of ≥400% of the FPL. These results are reported with the Constant in Table 5.

Table 5

Simple Logistic Regression Predicting FPL and ADHD Comorbidity (N = 7,793)

FPL	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI
200 - 399%	.241	.060	16.250	1	P<0.001	1.272	1.132, 1.430
<199%	.727	.055	172.548	1	P<0.001	2.069	1.856, 2.306
Constant	.532	.042	160,907	1	P<0.001	.588	

Note. FPL = FPL, B = Beta, S.E. = Standard Error, df = degrees of freedom, Sig = Significance, CI = Confidence Interval

Multiple Logistic Regression

A multiple logistic regression analysis was completed to determine if the independent variables of parental education level, parental employment, and household

income (% of the FPL) are predictors of the reporting of a comorbid condition among children with ADHD when adjusting for gender and ADHD medication usage. Significance levels were set a $p < 0.05$ and the confidence intervals (CI) was set as a 95% CI with lower and upper limits reported for the individual results. Nagelkerke R^2 values and Cox and Snell R Square were used in calculating the variations. For this study, the Nagelkerke R^2 was reported.

Parental Education and ADHD Comorbidities

RQ1: Is there a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household education level and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

A multiple logistic regression was conducted to investigate if parental education level, gender, and ADHD medication use predict if a child with ADHD will have a comorbid condition as reported in the NSCH survey. The outcome of interest was the reporting of a

comorbid condition for children with ADHD in the survey. The possible predictor variables were: education level, gender, and ADHD medication use. The Hosmer-Lemeshow goodness-of-fit was not significant ($p = .727$) indicating the model is correctly specified. Additionally, the *-2 log Likelihood* = 8619.124 and the *Nagelkerke R Squared* = .015. The model resulted in the independent variables gender and ADHD medication use showing non-significance ($p = 0.095$ and $p = 0.151$ respectively). Controlling for gender and ADHD medication use, the predictor variable high school education level, in the multiple logistic regression analysis was found to contribute to the model. Using greater than high school education as the reference standard, the unstandardized Beta for high school education were $B = .147$, *S.E.* = .055, *Wald* = 7.047, $p = 0.008$. The estimated odds ratio indicates significantly higher odds of nearly 16% [*Exp (B)* = 1.158, 95% CI (1.039, 1.291)] for reporting a comorbid condition based on having a high school education compared to having greater than a high school education level when controlling for gender (female was used as the reference category) and ADHD medication use. The unstandardized Beta weight for less than a high school education were $B = .606$, *S.E.* = .075, *Wald* = 64.705, $p < 0.001$. The estimated odds ratio indicates significantly higher odds of approximately 83% [*Exp (B)* = 1.833, 95% CI (1.581, 2.124)] for reporting comorbid condition based on having less than a high school education compared to having greater than a high school education when controlling for gender and ADHD medication use. The results are reported in Table 6.

Table 6

Multiple Logistic Regression for Education and ADHD/Comorbidity Controlling for Gender and Medication Use (N = 6,280)

Category	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for OR
Greater than H.S. (reference)			55.581	2			
H.S.	.147	.0.55	7.047	1	P=0.008	1.158	1.039, 1.291
Less than H.S.	.606	.075	64.705	1	P<0.001	1.833	1.581-2.124
Male Gender	.093	.055	2.791	1	P 0.095	1.097	.984-1.223
Medication Use	.080	0.56	2.064	1	P 0.151	1.083	.971-1.208
Constant	-.429	.091	22.281	1	P<0.001	.651	

Note. B = Beta, S.E. = Standard Error, df = degrees of freedom, Sig = Significance, CI = Confidence Interval, H.S. = High School

Household Employment and ADHD Comorbidities

RQ2: Is there a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use?

H_0: There is no relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

H_a: There is a relationship between household unemployment and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with ADHD when accounting for gender and medication use.

A multiple logistic regression was conducted to investigate if household employment, gender, and ADHD medication use predict if a child with ADHD will have a comorbid condition as reported in the NSCH survey. The outcome of interest was the reporting of a comorbid condition for children with ADHD in the survey. The possible predictor variables were: household employment, gender, and ADHD medication use. The Hosmer-Lemeshow goodness-of-fit was not significant (p = .559) indicating the model is correctly specified. Additionally, the *-2 log Likelihood* = 8996.546 and the *Nagelkerke R Squared* = .020. The model resulted in the independent variables gender and ADHD medication use showing non-significance (p = 0.093 and p = 0.077 respectively). Controlling for gender (female was used as the reference category) and ADHD medication use, the predictor variable household employment, in the multiple logistic regression analysis was found to contribute to the model. The unstandardized B = -.625, *S.E.* = .065, *Wald* = 91.436, p = 0.000. The estimated odds ratio indicates significantly lower odds of nearly 47% [*Exp (B)* = .535, 95% CI (.471, .608)] for reporting a comorbid condition if the household employment was $\geq$ 50 out of 52 weeks in the previous 12 months compared to less than 50 of 52 weeks for the previous 12 months. The results are reported in Table 7.

Table 7

Multiple Logistic Regression for Employment and ADHD/Comorbidity Controlling for Gender and Medication Use (N = 6,570)

Category	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for OR
Employment	-.625	0.65	91.436	1	P<0.001	.535	.471-.608
Male Gender	.091	.054	2.815	1	P 0.093	1.095	.985-1.218
Medication Use	.097	0.55	3.132	1	P 0.077	1.101	.990-1.226
Constant	.240	.101	5.687	1	P 0.017	1.271	

Note. B = Beta, S.E. = Standard Error, df = degrees of freedom, Sig = Significance, CI = Confidence Interval

Household Income and ADHD Comorbidities

RQ3: Is there a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use?

H_0: There is no relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

H_a: There is a relationship between household income (% FPL) and the prevalence of a comorbid condition (depression, anxiety, behavioral issues) among children with attention-deficit hyperactivity disorder when accounting for gender and medication use.

A multiple logistic regression was conducted to investigate if household income (% FPL), gender, and ADHD medication use predict if a child with ADHD will have a comorbid condition as reported in the NSCH survey. The outcome of interest was the reporting of a comorbid condition for children with ADHD in the survey. The possible predictor variables were: household income, gender, and ADHD medication use. The Hosmer-Lemeshow goodness-of-fit was not significant (p = .103) indicating the model is correctly specified. Additionally, the *-2 log Likelihood* = 8369.841 and the *Nagelkerke R Squared* = .040. The model resulted in the independent variable gender as not significant (p = 0.080), however, the independent variable ADHD medication was found to be significant (p = 0.040). Controlling for gender (female was used as the reference category) and ADHD medication use, the predictor variable household income, in the multiple logistic regression analysis was found to contribute to the model. Using FPL ≥400% as the reference standard, the unstandardized Beta for FPL 200%-399% was B = .274, *S.E.* = .067, *Wald* = 16.822, $p < 0.001$. The estimated odds ratio indicates significantly higher odds of nearly 32% [*Exp (B)* = 1.316, 95% CI (1.154, 1.500)] for reporting a comorbid condition for having an income between 200%-399% of the FPL compared to having an income of ≥400% of the FPL after adjusting for gender and ADHD medication use. The unstandardized Beta weight for the predictor variable FPL

<199% were *B* = .808, *S.E.* = .062, *Wald* = 170.231, $p < 0.001$. The estimated odds ration indicates significantly higher odds of approximately 200% [Exp (*B*) = 2.243, 95% CI (1.987, 2.533)] for reporting a comorbid condition based on having an income of <199% the FPL compared to having an income of ≥400% of the FPL. The results are reported in Table 8.

Table 8

Multiple Logistic Regression for FPL and ADHD/Comorbidity Controlling for Gender and Medication Use (N = 6,179)

Category	B	S.E.	Wald	df	Sig.	Exp(B)	95% CI for OR
FPL >400% (reference)			184.721	2			
FPL 200-399%	.274	.067	16.822	1	P<0.001	1.316	1.154, 1.500
FPL <199%	.808	.062	170.231	1	P<0.001	2.243	1.987, 2.533
Male Gender	.099	.056	3.067	1	P 0.080	1.104	.988-1.233
Medication Use	.117	0.57	4.211	1	P 0.040	1.124	1.005-1.256
Constant	-.682	.098	48.661	1	P<0.001	.505	

Note. FPL = FPL, B = Beta, S.E. = Standard Error, df = degrees of freedom, Sig = Significance, CI = Confidence Interval

Summary

This study examined the concept that the independent variables of parental education, household employment status, and household income are associated with the reporting of a comorbid condition for children with ADHD in the NSCH study. All three independent variables were significantly associated with the dependent variable of having a comorbid condition with ADHD. The adjusted odds ratio demonstrated a positive relationship between the independent variable of parental education and the outcome variable of reporting a comorbid condition for children with ADHD. This supports the alternative hypothesis that there is a relationship between household education level and the prevalence of a comorbid condition among children with ADHD when accounting for gender and medication use. The same result was found for the independent variable of household employment. The adjusted odds ratio indicated a positive relationship between the independent variable of household income and the dependent variable of reporting a comorbid condition for children with ADHD. Thus, the alternative hypothesis, there is a relationship between household unemployment and the prevalence of a comorbid condition among children with ADHD when accounting for gender and medication use, is supported. For the independent variable household income, which was expressed as a percentage of the FPL, the adjusted odds ratio showed a positive relationship with the outcome variable of reporting a comorbid condition for a child with ADHD. This result supports the alternative hypothesis that there is a relationship between household income (% FPL) and the prevalence of a comorbid condition among children with ADHD when accounting for gender and medication use.

In conclusion, the findings from this research project demonstrated that SES (parental education, household employment, %FPL) has a significant relationship with the reporting of a comorbid condition for children with ADHD. Because it has been reported that boys have a higher incidence of ADHD than girls, gender was considered as a moderating variable. Gender was not significantly associated with the reporting of a comorbidity in this study. Medication use to treat the signs and symptoms of ADHD was also hypothesized as being a moderating variable because of the potential for the drugs to mask a comorbidity. While there was no association found for the impact of medication use on the reporting of a comorbid condition for parental education or household employment, there was a weak association with household income. Overall, the data supports that parental education levels, household employment status, and household income are associated with children afflicted with ADHD reporting a comorbid condition.

In Chapter 5 I will interpret these findings and evaluate the implications for social change. I review conclusions from this project, and recommendations are made for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

ADHD, a neurodevelopmental condition, has been discussed in the literature for over 200 years (Efron, 2015), yet little is understood about the underlying causes. Some believe that genetics is the cause; others believe it is environmental in nature; many feel it is a combination of the two. The prevalence of ADHD among school-aged children is between 4% and 12% (Hinojosa et al., 2015a), afflicting approximately 6.4 million children in the United States. From 2003 to 2011, ADHD increased about 5% per year (CDC, 2016). Adding to this public health concern is the fact that between 50% and 60% of children with ADHD will carry the condition into adulthood (Vingilis et al., 2015). Exacerbating this malady is the fact that approximately two-thirds of children with ADHD report having one or more comorbid conditions such as anxiety, depression, or behavioral issues (French, 2015). Socioeconomic factors, such as parental education, employment, and income, may impact the diagnosis and treatment of ADHD (Law et al., 2014; Lingineni et al., 2012; Russel et al., 2015; Tillman et al., 2015). What is not well understood is the influence of SES on the reporting of comorbid conditions for children with ADHD. It is understood that more studies are needed to identify modifiable risk factors and predictors for this affliction (Efron, 2015).

The purpose of this quantitative, descriptive, nonexperimental study was to investigate the association of household SES and the reporting of a comorbid condition for children with ADHD. SES is often characterized in the literature as a combination of education level, employment status, and income. These three indices were used for this

project. SES has been associated with a greater risk of negative life outcomes for children in the general population (Russel et al., 2015). For children with ADHD, parental education, parental employment status, and household income can impact the diagnosis and treatment of the condition (Law et al., 2014; Lingineni et al., 2012; Russel et al., 2015; Tillman et al., 2014). Children with ADHD report higher rates of comorbid conditions such as anxiety, depression, and behavioral disorders (Hinojosa et al., 2012a; Schei et al., 2015; Vingilis et al., 2015). It is estimated that 66% of children with ADHD have one or more comorbidities (French, 2015). What is not clear in the literature is the association between socioeconomic challenges on the reporting of comorbid conditions for children with ADHD. It is imperative to understand the relationship between SES and comorbid conditions because children with ADHD who report a comorbidity are at risk of lower educational attainment, antisocial behaviors, and an overall poorer quality of life (Schei et al., 2015; Vingilis et al., 2015). This project examined the possibility that socioeconomic challenge may influence the reporting of comorbid conditions for children with ADHD.

This project was undertaken using a secondary dataset, the NSCH (Child and Adolescent Health Measurement Initiative, 2011-2012), which has been completed at three different times: 2003, 2007, and 2011/2012. For this study, the 2011-2012 data were used to look for relationships between SES and the reporting of comorbid conditions among children with ADHD. While associations have been made between SES and ADHD, little is known about the impact of SES on the reporting of comorbidities in these same children. This research project demonstrated that parental

SES plays a significant role in the reporting of comorbid conditions for children with ADHD. Specifically, when parents or guardians of children with ADHD had a high school education or less, there was significantly higher odds of the child reporting a comorbid condition compared to children with ADHD who lived in households where the parent or guardian had greater than a high school education. The employment status of the parents or guardian of a child with ADHD also proved to be significant to the reporting of a comorbidity. If a member of the household was employed for 50 out of 52 weeks of the given year, the data demonstrated the odds of reporting a comorbid condition were significantly less than when parents or guardians were employed for fewer than 50 weeks week during the same timeframe. And finally, household income expressed as a percentage of the FPL, was significantly associated with the reporting of a comorbid condition. Children with ADHD reported having a comorbidity at a higher percentage if the household income was at 199% FPL or less compared to households where the FPL was equal to or greater than 400%.

Interpretation of the Findings

According to childhood ADHD prevalence numbers, it is estimated that between 4-12% of school aged children are afflicted with this condition (Hinojosa et al., 2012a). Based on the sample size (95,677) from the 2011/2012 NSCH (CAHMI, 2011-2012), it can be estimated that between 3,827 and 11,481 children will have a diagnosis of ADHD. Table 1 shows that the population from the NSCH with ADHD was 8.9% (8,528) which is aligned with the anticipated estimates for the U.S. population.

From the existing literature, it can be seen that SES is associated with ADHD in children (Lingineni et al., 2012, Russel et al., 2014). It is also clear from previous research that children with ADHD are at a higher risk of developing a comorbid condition than children without ADHD (Hinojosa et al., 2015b). According to work by French (2015), nearly two-thirds of children with ADHD have one comorbid condition, and approximately 20% have three or more comorbidities. Based on the descriptive statistics from the current project, approximately 45% of the children with ADHD reported having one or more comorbid conditions which is slightly lower than the percentage described in the literature. However, this project limited the comorbid conditions to include anxiety, depression, and behavioral issues and the work by French (2015) included any comorbidity which may explain the lower number of children with ADHD reporting a comorbidity in this project.

The statistical analysis from this study demonstrated that household SES is associated with the reporting of comorbid conditions for children with ADHD. The multiple logistic regression analysis showed that parental or guardian education level was significantly associated with the reporting of a comorbidity for a child with ADHD in the household when adjusting for gender and ADHD medication use. If the parent or guardian had an education of less than high school, the odds of the child with ADHD having a comorbidity were 83% higher (p <0.001)when compared to children with ADHD whose parents had greater than a high school education,

For household employment status, the multiple logistic regression analysis controlling for gender and ADHD medication use also showed a significant association

with the reporting of a comorbidity for children with ADHD. If a parent in the household had worked for equal to or greater than 50 weeks out of the previous 52 weeks, the data demonstrated that the child with ADHD had a 47% less likelihood of reporting a comorbid condition (p <0.001). The same was seen when the multiple regression analysis examined the impact of household income, expressed as a percentage of the FPL when controlling for gender and ADHD medication use. There was a statistically significant association between the %FPL and the reporting of a comorbid condition for a child in the household with ADHD. Specifically, the data showed that if the household income was less than 199% of the FPL, the child with ADHD had an approximately 200% chance of reporting a comorbidity (p <0.001) when compared to children with ADHD in households where the income was greater than 400% of the FPL.

The findings from this study suggest that when children diagnosed with ADHD live in a socioeconomic challenged environment, there is an increased probability of reporting a comorbid condition such as anxiety, depression, or behavioral issues. The theoretical framework, EST, acted as the guide for this project. EST is based on postulates by Bronfenbrenner that the environments in which a child is raised and interacts may impact behavior and development (Eamon, 2001). Socioeconomic challenges of the household in which the child with ADHD lives was shown in this project to impact the health of the child by increasing the risk of developing a comorbid condition. A lower income level for the household was shown to increase the probability of reporting a comorbid condition which is the microsystem of the EST. Parental education levels also impact the child at the microsystem level. In this study, lower levels

of education for parents or guardians of children with ADHD were associated with the child's reporting of a comorbid condition. Being employed has an impact on the exosystem of the EST, and in the context of this study, employment status was associated with reporting of comorbidities for children with ADHD. While all levels of the EST, including the mesosystem, macrosystem, and the chronosystem may influence child health and development, this study demonstrated that microsystem and the exosystems were significantly involved in the health of a child with ADHD.

Limitations of the Study

Because of the nature of this study, it is not without several limitations. Due to the study being cross-sectional in design, it is not possible to determine causation for the outcome variable. The current study determined there was an association between SES and the reporting of comorbid conditions for children with ADHD, but it does not determine if socioeconomic challenge causes or impacts the risk of comorbidities in this cohort of patients. This may decrease the internal validity of the study. Also, this project using secondary data may be biased by the fact that it cannot be determined if the child still has ADHD or had ADHD and the comorbid condition at the same time, once again decreasing internal validity. Another limitation of this project is the fact that the survey was based on self-reported socioeconomic and health data. According to Crosby (2013), self-reporting may decrease the external validity of a study because of selective recall on behalf of the responder or response bias where the individual attempts to answer the question in a manner they believe the researcher would like as opposed to responding

with a factual answer. Recall bias may lead to overestimation or underestimation for the outcomes reported in this project.

It also important to consider that the data retrieved from the NSCH is limited by the types of questions asked, how they were worded, and the total number of questions. Random digit dialing was used for the telephone survey which also brings in the potential for selection bias. Individuals with low SES may not have the means to own a landline telephone or a cell phone, thus, biasing the sample towards a higher income population. A final potential limitation was that the survey was limited to include only one randomly selected child from each household, thus incorporating an element of sampling bias into the project.

Recommendations

Future research is warranted to verify the findings of this research study as it relates to the role of SES being associated with the reporting of comorbid conditions for children with ADHD. While this research demonstrated that parental education, household employment status, and household income were statistically significantly associated with comorbidities in this cohort of children with ADHD when controlling for gender and medication use, a broader study is merited to examine other risk factors that may be involved. These include age, race, and ethnicity. Also, medication use for ADHD demonstrated a slight but significant association with the reporting of comorbidities when controlling for household income and gender. This warrants further research to determine the significance of this finding. The fact that unemployment was shown to be associated with a probability of reporting comorbidities may lead to future research to understand

the relationship. Is it because unemployed parents do not have insurance to get regular health care that leads to this finding? Future research could help address this question.

For this study, having a comorbid condition was identified by the presence of anxiety, depression, or a behavioral issue. Further research should be conducted to determine if other comorbidities were included, such as autism, learning disabilities, or sleep disorders, would differ from the results of the current findings. Any associations between socioeconomics and comorbid conditions for children with ADHD will require further investigation to determine causality. Because of the cross-sectional nature of this project, it was not possible to determine if there was a causal link between the SES and having a comorbid condition in these children with ADHD.

If SES are factors that are associated with comorbidities in children with ADHD, then it may be possible to develop interventions that may have a positive impact on these risks and potentially reduce the number of comorbid conditions. Public health professionals can have a significant role in reducing the disparities that may exist for socioeconomically challenged families with children who have been diagnosed with ADHD. Based on this research and the work of others, public health experts may look at intervention programs geared towards health education efforts which include regular physicals with a health care provider, ADHD coping strategies, and counseling opportunities.

Implications

This study has helped to address a gap in the current literature regarding the role of SES plays in the reporting of comorbid conditions for children with ADHD. It has

been established that children with ADHD who report having one or more comorbid conditions are at an increased risk of exposure to crime, poverty, and psychosocial issues (Pliszka, 2015), and it can lead to an increase in ADHD severity with decreased responsiveness to treatment (Gipson et al., 2015). French (2015) pointed out that socioeconomic factors may lead to the under-identification of health conditions because disadvantaged households have limited access to public health resources and general health care. Now, based on the findings of this project, it is known that there is a relationship between socioeconomic challenge and the prevalence of comorbidities in children with ADHD. With this knowledge, public health and health care resources may be directed or redirected to projects focused on children with ADHD from low-income households where parental education levels are lower than normal, and no member of the household is employed consistently. These activities could lead to a positive social change if they help to decrease the number of children with ADHD who develop a comorbid condition. This could potentially decrease the number of children with ADHD who are exposed to psychosocial issues, poverty, and crime.

It is also a concern that ADHD costs in the United States are estimated to be between $21 and $44 billion annually to the health care system with an additional $33 to $43 billion spillover costs to families (Doshi et al., 2012). Adding to this financial burden is the fact that between 50% and 60% of children with ADHD carry this condition into adulthood (Vingilis et al., 2015). In adulthood, the economic impact is estimated to be approximately three times greater than in children (D'Amico et al., 2014). By eliminating or reducing the number of comorbidities for children with ADHD, it may be possible to

reduce the financial challenge to the individual, the families, and the public health system.

Another potential positive social impact of the findings from this study is the opportunity to decrease the stress for caregivers of children with ADHD. Previous research has demonstrated that in families with a child who has ADHD have a decreased quality of life, increased caregiver stress, and this is exacerbated when the child has a comorbid condition (Rockhill et al., 2013). By understanding that socioeconomic factors impact the comorbidities of children with ADHD, interventions can be undertaken to decrease these disparities and improve the quality of life for the child and the families, and decrease the stress of the caregivers.

Conclusion

Findings and results of this research project were based on a secondary data analysis of the 2011-2012 NSCH. The study results demonstrated that specific socioeconomic factors, parental education level, employment, and household income are statistically significantly associated with the reporting of a comorbidity for children with ADHD. The comorbid conditions included in this analysis were anxiety, depression, and behavioral issues; three conditions that are commonly linked to ADHD. Having a parent with a lower education level (less than high school), and living in a household where the income was less than 199% of the FPL was associated with significantly higher odds of having a comorbidity for children with ADHD. Employment of a member of the household for 50 or more weeks out of the previous 52 weeks was associated with significantly lower chances of a child with ADHD reporting a comorbid condition.

While it has been known that lower SES has an impact on the diagnosis and quality of life for children with ADHD (Russel et al., 2015), existing interventions targeted at reducing disease burden have not proven useful for low socioeconomic families, specifically those of racial and ethnic minorities (Hinojosa et al., 2012b). This research study adds to the body of knowledge regarding the potentially harmful impact of living in a socioeconomically challenged environment, and as the EST espouses, the environment in which a child lives and interacts plays a role in their health and well-being. Thus, it is imperative to have public health interventions targeted at reducing health care disparities in these disadvantaged populations.

Although this study does not examine how to address specific risk factors associated with ADHD and comorbid conditions, it may help to further the understanding of this growing public health problem. More research is needed to determine if there are other risk factors associated with the development of comorbidities for children with ADHD, and considerably more research is needed on interventions to reduce or eliminate these risk factors. It is hoped that this research may lead to positive social change by increasing the awareness and knowledge of the role of socioeconomic disparities and lead to the redirecting of current public health resources to the development of new programs and interventions.

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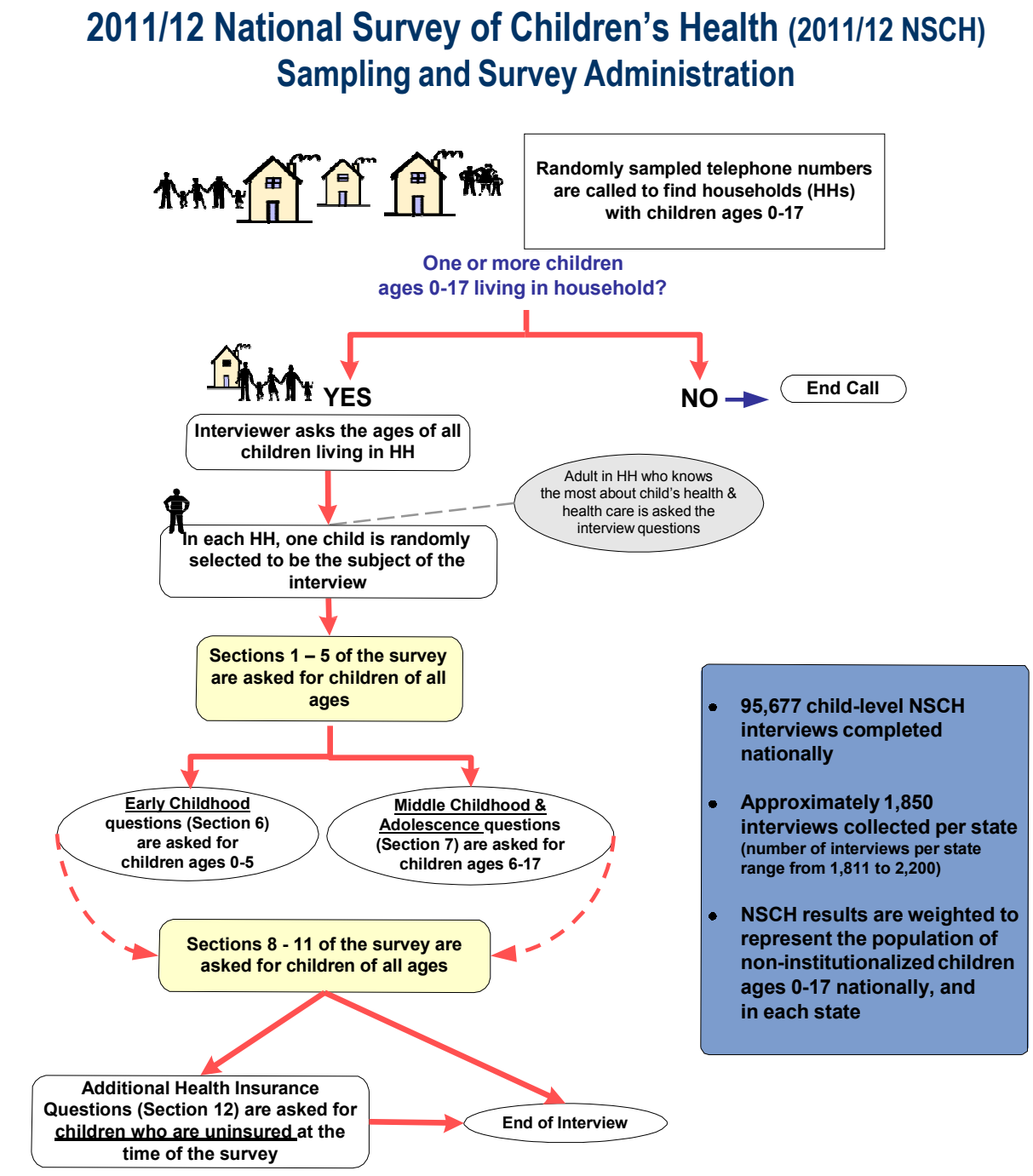
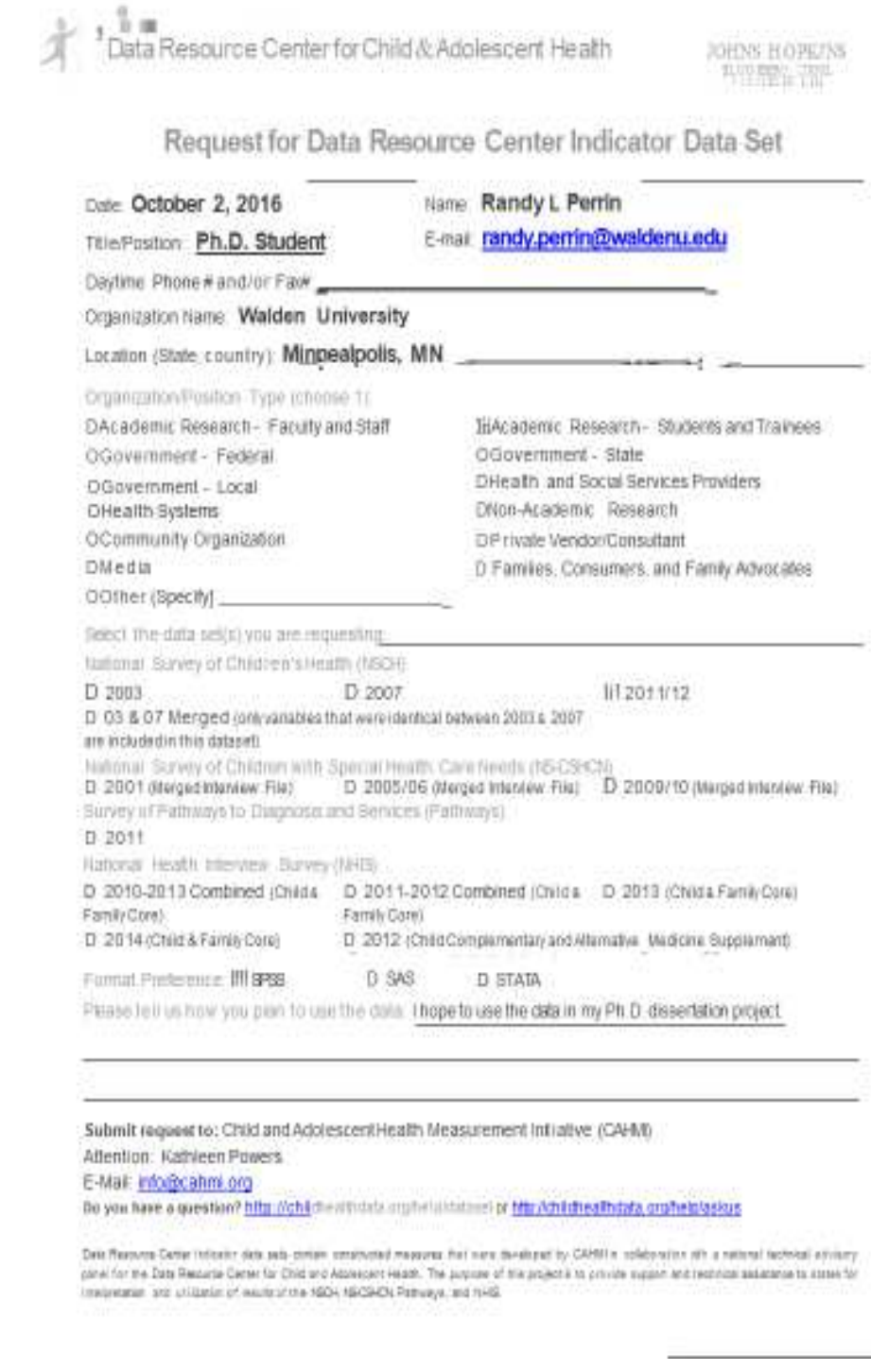
Appendix A: NSCH Flow Chart



Adapted: Data Resource Center for Child and Adolescent Health. (2013). 2011/12 National Survey of Children's Health (2011/12 NSCH) Sampling and Survey Administration. Retrieved from http://childhealthdata.org/docs/drc/2011-12-nsch-sampling-and-administration.pdf?sfvrsn=1

Appendix B: Data Usage Request Form



Data Resource Center for Child & Adolescent Health

JOHNS HOPKINS

Request for Data Resource Center Indicator Data Set

Date: **October 2, 2016** Name: **Randy L Perrin**

Title/Position: **Ph.D. Student** E-mail: **randy.perrin@waldenu.edu**

Daytime Phone # and/or Fax: _____

Organization Name: **Walden University**

Location (State, country): **Minpealpolis, MN**

Organization/Position Type (choose 1):

DAcademic Research - Faculty and Staff
IiiAcademic Research - Students and Trainees
OGovernment - Federal
OGovernment - State
OGovernment - Local
DHealth and Social Services Providers
DHealth Systems
DNon-Academic Research
OCommunity Organization
DPrivate Vendor/Consultant
DMedia
D Families, Consumers, and Family Advocates
OOther (Specify) _____

Select the data set(s) you are requesting:

National Survey of Children's Health (NSCH)

D 2003 D 2007 Iii 2011/12

D 03 & 07 Merged (only variables that were identical between 2003 & 2007 are included in this dataset)

National Survey of Children with Special Health Care Needs (NS-CSHCN)

D 2001 (Merged Interview File) D 2005/06 (Merged Interview File) D 2009/10 (Merged Interview File)

Survey of Pathways to Diagnosis and Services (Pathways)

D 2011

National Health Interview Survey (NHIS)

D 2010-2013 Combined (Child & Family Core) D 2011-2012 Combined (Child & Family Core) D 2013 (Child & Family Core)

D 2014 (Child & Family Core) D 2012 (Child Complementary and Alternative Medicine Supplement)

Format Preference: Iiii SPSS D SAS D STATA

Please tell us how you plan to use the data: I hope to use the data in my Ph D dissertation project

Submit request to: Child and Adolescent Health Measurement Initiative (CAHMI)

Attention: Kathleen Powers

E-Mail: info@cahmi.org

Do you have a question? http://childhealthdata.org/help/askus or http://childhealthdata.org/help/askus

Data Resource Center indicator data sets contain constructed measures that were developed by CAHMI in collaboration with a national technical advisory panel for the Data Resource Center for Child and Adolescent Health. The purpose of the project is to provide support and technical assistance to states for interpretation and utilization of results of the NSCH, NS-CSHCN, Pathways, and NHIS.

Appendix C: Data Use Agreement Form

www.childhealthdata.org

Data Resource Center for Child & Adolescent Health

JOHNS HOPKINS BLOOMBERG SCHOOL of PUBLIC HEALTH

Data Use Agreement Data Resource Center Indicator Data Sets

2014 National Health Interview Survey, Child and Family Core
2013 National Health Interview Survey, Child and Family Core
2010-2013 National Health Interview Survey, Child and Family Core Combined
2012 National Health Interview Survey, Child Complementary and Alternative Medicine Supplement
2011-2012 National Health Interview Survey, Child and Family Core Combined
2011/2012 National Survey of Children's Health
2009 /2010 National Survey of Children with Special Health Care Needs
2003 & 2007 National Survey of Children's Health Merged
2007 National Survey of Children's Health
2005/2006 National Survey of Children with Special Health Care Needs
2003 National Survey of Children's Health
2001 National Survey of Children with Special Health Care Needs

Definitions

1. Licensee: Randy L Parrin
2. Licensor: Child and Adolescent Health Measurement Initiative (CAHMI), The Johns Hopkins Bloomberg School of Public Health, Department of Population, Family & Reproductive Health, 615 North Wolfe Street, Baltimore, MD 21205
3. Data Set: DRC Indicator Refined Data Set for: 2014 National Health Interview Survey, Child and Family Core, 2013 National Health Interview Survey, Child and Family Core, 2010-2013 National Health Interview Survey, Child and Family Core Combined, 2012 National Health Interview Survey, Child Complementary and Alternative Medicine Supplement, 2011-2012 National Health Interview Survey, Child and Family Core Combined, 2011-2012 National Survey of Children's Health, 2009-2010 National Survey of Children with Special Health Care Needs, 2003 & 2007 National Survey of Children's Health Merged, 2007 National Survey of Children's Health, 2005-2006 National Survey of Children with Special Health Care Needs, 2003 National Survey of Children's Health and/or 2001 National Survey of Children with Special Health Care Needs.
4. Ownership: CAHMI is the owner of Data Set which was developed in the course of research at CAHMI.
5. Public Benefit: CAHMI wants this Data Set to be utilized for the public benefit to the fullest extent possible.
6. Publications: Recipient agrees to acknowledge the Provider with appropriate citations in any publications or presentations using results from this Data Set. The suggested citation format is:

   Child and Adolescent Health Measurement Initiative (CAHMI). *(Year and name of NSCH)* Indicator Data Set. Data Resource Center for Child and Adolescent Health. Web: childhealthdata.org

   Please initial here to acknowledge citation request RLP _ _ _ _
7. Field of Use (how you intend to use these data): I am a Ph.D. student at Walden University and I hope to analyze the data as a part of my dissertation project.

Terms

1. Grant of License: Subject to the terms and conditions of this license, Licensor grants to Licensee a non exclusive, non-sub licensable, non transferable license to use the Data Set provided herein and any associated documentation. Licensor is not obligated to provide upgrades to the Data Set or technical support beyond assistance in installing the Data Set.
2. Ownership of Data Set: This License gives the Licensee limited use of the Data Set. This License is not a sale of the Data Set and Licensor retains all title to all rights and interests in the Data Set. The Data Set is

protected by U.S. Copyright laws, international treaty provisions and applicable laws of the country in which it is being used.

3. **Permitted Use:** Licensee may use the Data Set in the Field of Use for academic and research purposes only.

4. **Non-permitted Uses:** Licensee may not
   a. Use the data in the Data Set for any purpose other than statistical reporting and analysis;
   b. Make any effort to determine the identity of any reported case in the Data Set;
   c. Disclose or make use of the identity of any person or establishment discovered inadvertently, and will advise the Director, National Center for Health Statistics (NCHS), of any such discovery;
   d. Link this Data Set with individually identifiable data from any other Data Sets;
   e. Use the Data Set at any other location than that specified above;
   f. Rent, lease, lend, sell, transmit or otherwise distribute or dispose of the Data Set temporarily or permanently without written consent of Licensor;
   g. Create or permit third parties to create derivative works based on the Data Set;
   h. Remove, modify, alter or obscure the copyright notices or any other proprietary notices contained in or on the Data Set;
   i. Sell derivative works based on the Data Set.

5. **Term and Termination:** This License shall commence on the date of delivery of the Data Set to Licensee and shall terminate automatically upon breach of this License by Licensee.

6. **Confidentiality:** Recipient and Recipient Scientist agree to hold the Data in confidence and not disclose to anyone except to such of its employees, consultants and agents as may be necessary to make the determination required under this agreement, providing said employees, consultants and agents are bound by the terms of this Agreement.

7. **Publications:** Recipient agrees to acknowledge the Provider with appropriate citations in any publications or presentation using results from this Data Set.

8. **Warranty:** Licensor warrants that it has the lawful right to grant the license set forth in this Agreement.

9. **NO REPRESENTATIONS OR WARRANTIES:** Except as expressly provided in section 8, the parties acknowledge and agree that licensor, its trustees, directors, officers, employees, and affiliates make no representations and extend no warranties of any kind, either express or implied, including but not limited to warranties of merchantability, fitness for a particular purpose, non-infringement and the absence of latent or other defects, whether or not discoverable. Nothing in the license agreement shall be construed as a representation made or warranty given by licensor that the practice by licensee of the license granted hereunder shall not infringe the patent rights or copyright rights of any third party. In no event shall licensor, its trustees, directors, officers, employees and affiliates be liable for incidental or consequential damages of any kind, including economic damage or injury to property and lost profits, regardless of whether licensor shall be advised, shall have other reason to know, or in fact shall know of the possibility. Licensee assumes the entire risk associated with licensee's use of the Data Set.

10. **Complete Agreement:** This License is a complete and exclusive statement of the terms and conditions of the agreement between Licensee and Licensor.

LICENSEE:

Signature _____ Date 07 Oct 201

Name Randy L Perrin

Title Student

Email randy.perrin@waldenu.edu

Address _____

Send completed DUA by email - info@cahmi.org

Appendix D: E-mail Confirmation of Data Access

Randy Perrin <randy.perrin@waldenu.edu>

Data Request. ATTN: Ms. Kathleen Powers

Info Box <info@cahmi.org> Mon, Oct 10, 2016 at 10:37 AM
To: Randy Perrin <randy.perrin@waldenu.edu>

Hi Randy

Thank you for sending in the DUA.

In order to access these data, please visit:

2011/12 NSCH FTP

Each site has compressed folders containing the DRC Indicator Datasets. In addition to the data files, the folders for the surveys also contain supplemental documents and information. For this reason, the Dataset must be extracted from the compressed folder before it can be opened in SAS, SPSS, or other statistical software.

Further resources for data analysis, including methodology information, codebooks and the full-length survey instruments, can be found on our website for the NSCH, NS-CSHCN, NHIS-CAM, NHIS-Child and Pathways surveys.

If your colleagues or students will be working with any data files received from the Data Resource Center, be mindful that you are responsible for assuring that they have first read and consented to abide by the terms of the data use agreement you signed. This can be done by you independently, or by requiring them to make separate applications through the DRC.

Referencing the DRC Indicator Datasets

Please be sure to use appropriate citation in any materials you publish, distribute or display, which report results from datasets provided by the Data Resource Center and CAHMI. (We never get tired of reminding people to do this!) Citation language for each survey is listed here:

2011/12 National Survey of Children's Health. Maternal and Child Health Bureau in collaboration with the National Center for Health Statistics. 2011/12 NSCH [Insert SPSS/SAS/Stata] Indicator Data Set prepared by the Data Resource Center for Child and Adolescent Health, Child and Adolescent Health Measurement Initiative. www.childhealthdata.org