Penn Libraries
UNIVERSITY of PENNSYLVANIA

University of Pennsylvania
ScholarlyCommons

Publicly Accessible Penn Dissertations

2016

Biological, Psychological, And Social Profiles That Predict Depression And/or Anxiety In Adolescents Aged 12-17 Years Identified Via Secondary Analysis Of The 2011-2012 National Survey Of Children's Health

Lakeetra Mcclaine Josey

University of Pennsylvania, lakeetra@nursing.upenn.edu

Follow this and additional works at: https://repository.upenn.edu/edissertations

Part of the Nursing Commons

Biological, Psychological, And Social Profiles That Predict Depression And/or Anxiety In Adolescents Aged 12-17 Years Identified Via Secondary Analysis Of The 2011-2012 National Survey Of Children's Health

Abstract

Depression and/or anxiety among adolescents aged 12-17 year are on the rise and increase the risk of negative outcomes that persist into adulthood. Current prevalence reports of depression in adolescents are based on dated analyses and do not include the often comorbid anxiety. The purpose of the study was to identify biological, psychological, and social factors that predict depression and/or anxiety in adolescents aged 12-17 years through a secondary analysis of data from the 2011-2012 National Survey of Children's Health. The sample size for this study was 34,601 adolescents aged 12 – 17 of which, 2,405 had current depression and/or anxiety. One hundred four (104) of the total six hundred sixty-five (665) variables were identified for inclusion in the analysis through review of the literature and known clinical relevance. Variables were analyzed first through bivariate logistic regression to obtain c-statistics, followed by multiple logistic regression and classification and regression tree (CART) analysis. One subsample consisting of 60% of the original observations was used for modeling and generating the classification and regression tree; the other sample consisting of the other 40% of the original sample was used for validation purposes. Odds ratios were calculated based on the profile risk groups identified by the decision tree to quantify the odds of depression and/or anxiety in adolescents that met those specific profiles. The prevalence of depression and/or anxiety among adolescents with two or more chronic conditions, a behavioral problem, and whose mother's mental health was rated as "poor" was 94% as compared to 7% in the general population. Additionally, the odds of depression and/or anxiety were 234.34 (95% CI: 225.78, 243.23, p < .0001) times the odds of depression and/or anxiety than those that did not have this profile. Implications for future work are discussed.

Degree Type
Dissertation

Degree Name
Doctor of Philosophy (PhD)

Graduate Group
Nursing

First Advisor
Patricia D'Antonio

Keywords
Adolescent, Anxiety, CART, Depression, Mental Health

Subject Categories
Nursing

BIOLOGICAL, PSYCHOLOGICAL, AND SOCIAL PROFILES THAT PREDICT DEPRESSION

AND/OR ANXIETY IN ADOLESCENTS AGED 12-17 YEARS IDENTIFIED VIA SECONDARY

ANALYSIS OF THE 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

LaKeetra M. Josey

A DISSERTATION

in

Nursing

Presented to the Faculties of the University of Pennsylvania

in

Partial Fulfillment of the Requirements for the

Degree of Doctor of Philosophy

2016

Supervisor of Dissertation

_____

Patricia D'Antonio, PhD, RN, FAAN

Killebrew-Censits Term Professor in Undergraduate Education

Graduate Group Chairperson

_____

Eileen Lake, PhD, RN, FAAN, Jessie M. Scott Term Chair in Nursing and Health Policy

Dissertation Committee

Bridgette M. Brawner, PhD, Assistant Professor of Nursing

Alexandra L. Hanlon, PhD, Research Professor of Biostatistics

BIOLOGICAL, PSYCHOLOGICAL, AND SOCIAL PROFILES THAT PREDICT DEPRESSION AND/OR ANXIETY IN ADOLESCENTS AGED 12-17 YEARS IDENTIFIED VIA SECONDARY ANALYSIS OF THE 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

Dedication

This dissertation is dedicated to my family. To my husband, Lamont - thank you for being my best friend, my source of grounding, and my biggest fan. To my girls, Simone and Morgan – in everything, I hope to set a positive example for both of you. You encourage me to be a woman that I hope you are proud to call, "Mom."

ACKNOWLEDGMENTS

ABSTRACT

BIOLOGICAL, PSYCHOLOGICAL, AND SOCIAL PROFILES THAT PREDICT DEPRESSION
AND/OR ANXIETY IN ADOLESCENTS AGED 12-17 YEARS IDENTIFIED VIA SECONDARY
ANALYSIS OF THE 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

LaKeetra M. Josey

Patricia D'Antonio

Depression and/or anxiety among adolescents aged 12-17 year are on the rise and increase the
risk of negative outcomes that persist into adulthood. Current prevalence reports of depression in
adolescents are based on dated analyses and do not include the often comorbid anxiety. The
purpose of the study was to identify biological, psychological, and social factors that predict
depression and/or anxiety in adolescents aged 12-17 years through a secondary analysis of data
from the 2011-2012 National Survey of Children's Health. The sample size for this study was
34,601 adolescents aged 12 – 17 of which, 2,405 had current depression and/or anxiety. One
hundred four (104) of the total six hundred sixty-five (665) variables were identified for inclusion in
the analysis through review of the literature and known clinical relevance. Variables were
analyzed first through bivariate logistic regression to obtain c-statistics, followed by multiple
logistic regression and classification and regression tree (CART) analysis. One subsample
consisting of 60% of the original observations was used for modeling and generating the
classification and regression tree; the other sample consisting of the other 40% of the original
sample was used for validation purposes. Odds ratios were calculated based on the profile risk
groups identified by the decision tree to quantify the odds of depression and/or anxiety in
adolescents that met those specific profiles. The prevalence of depression and/or anxiety among
adolescents with two or more chronic conditions, a behavioral problem, and whose mother's
mental health was rated as "poor" was 94% as compared to 7% in the general population.
Additionally, the odds of depression and/or anxiety were 234.34 (95% CI: 225.78, 243.23, p <

.0001) times the odds of depression and/or anxiety than those that did not have this profile.

Implications for future work are discussed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

x

CHAPTER 1: Introduction and Specific Aims

Background of the Study

The prevalence of depression in adolescents is rising. Based on data from the 2013-2014 National Survey of Drug Use and Health, 11% of adolescents aged 12-17 had a major depressive episode in the past year as compared to 9% of adolescents in the 2012-2013 survey (Lipari, Hughes, & Williams, 2016). Translated to numbers, 11% of adolescents, or approximately 2.7 million of the 24.9 million adolescents in the United States experienced a major depressive episode (Lipari, Hughes, & Williams, 2016). Depression is a mood state characterized by depressed mood or loss of interest or pleasure for at least two weeks. In children and adolescents, a depressed mood may present as more irritable and angry, than sad or downcast. Additional symptoms may include weight changes (loss or gain), sleep fluctuations (excessive sleep or insomnia), fatigue, feelings of guilt or worthlessness, difficulty concentrating, and thoughts of death or suicidal ideation and at the extreme, suicide attempts (American Psychiatric Association, 2013). Along with depressed mood, a significant number of youth also experience impairment in their daily lives including an inability to function at home, school, and in their social lives (Center for Behavioral Health Statistics and Quality, 2015). This is particularly concerning as the presence of a major depressive episode may predispose an adolescent to self-medicate with illicit substances such as marijuana, alcohol, opiates, and ultimately develop substance use disorders (Mangerud, Bjerkeset, Holmen, Lydersen, & Indredavik, 2014). Illicit substance use among adolescents was higher in those with a major depressive episode (33%) when compared to adolescents with substance use disorder without a major depressive episode (15.2%) (CBHSQ, 2015). In addition to increased risk of substance use disorders, clinically many adolescents also experience anxiety in conjunction with depression.

Depression and anxiety have been studied together (McLaughlin & King, 2015; Wittchen, Kessler, Pfister, & Lieb, 2000), however national data on anxiety in adolescents is not routinely

collected and reported. Anxiety is excessive fear or worry about an anticipated threat and can impact adolescents in a variety of domains including school, home and social settings. Symptoms can include excessive worry, restlessness, irritability, difficulty concentrating, muscle tension, somatic symptoms (headaches, nausea, gastrointestinal upset) and sleep disturbances (APA, 2013). The most frequently cited anxiety prevalence data is based on data collected between 2001 and 2004. The National Comorbidity Survey: Adolescent Supplement (NCS-A) reported anxiety as the most prevalent lifetime mental health disorder, affecting 30% of the 10,000 youth of surveyed (Merikangas et al., 2010). Comparatively more recent, though still dated, is prevalence data based on the 2007 National Survey of Children's Health, which estimates current anxiety prevalence to be approximately 4% of the total youth population (Centers for Diseases Control and Prevention, 2013). Identification of the primary issue (depression or anxiety) often comes over time, with repeated evaluation and clinical consideration (APA, 2013; Wittchen et al., 2000). In clinical practice comprehensive psychiatric evaluations are conducted to identify precipitants for current issues. Anxiety is a common precursor for depression, and somewhat less frequently but still common, depression can be a precursor for anxiety. Unfortunately, those adolescents that need mental health care do not often receive treatment (N. M. Brown, Green, Desai, Weitzman, & Rosenthal, 2014). The Centers for Disease Control and Prevention (CDC) indicate that mental health issues affect 13% to 20% of children and adolescents each year, and of those, only 20%-33% received any type of mental health treatment (CDC, 2013). Untreated or undertreated depression and/or anxiety increases risk of other issues including substance use (Brawner, Gomes, Jemmott, Deatrick, & Coleman, 2012; CBHSQ, 2015), risky sexual behavior (Brawner et al., 2012; Vasilenko & Lanza, 2014), and can complicate comorbid medical issues (Butwicka, Frisen, Almqvist, Zethelius, & Lichtenstein, 2015; Shomaker et al., 2011). Additionally, research indicates that mental health issues in childhood are linked with adverse functional outcomes in adulthood such as inability to maintain employment, residential instability, addictions, suicide attempts, and incarceration, even if the

mental health issue does not persist into adulthood, or is considered subthreshold for treatment (Copeland, Wolke, Shanahan, & Costello, 2015).

Distressingly, the suicide rate has increased in general and among adolescents between 1999 and 2014 with the largest percent increase (200%) among females age 10-14 (Curtin, Warner, & Hedegaard, 2016). While this report does not include mental health diagnoses, suicide attempts are not likely in people that are not struggling with depression or anxiety. Literature suggests that there are biological, psychological, and social factors that contribute to depression and/or anxiety. Biological factors such as genetic predisposition, specific genes related to depression and/or anxiety and medication response (e.g. pharmacogenomics), and the presence of comorbid medical conditions are among some factors related to depression and/or anxiety. Psychological factors such as limited resilience, or the inability to cope or overcome adversity, and the presence of other mental health conditions contribute to depression and/or anxiety. Social factors such as school and home environment, adverse childhood experiences (ACEs), and family structure are among those social factors most frequently studied. These factors are studied in isolation of each other in an attempt to identify the relationships between the individual factor and the outcome, in this case, depression and/or anxiety. However, in clinical practice, clinicians cannot isolate the factors that make up an adolescent's life. Clinicians must navigate the complex interactions between the biological, psychological, and social factors that contribute to the clinical symptom manifestation that brings the adolescent to their office, clinic, or practice. The adolescent and their life circumstances, their biology, developmental stages, their social contexts, school, and family lives all must be taken into consideration when attempting to make a diagnosis and develop a plan for intervention. Given the rise in suicide rates among adolescents, timely identification of adolescents that either currently have or are at highest risk for depression and/or anxiety by clinician/providers is essential for providing medical and non-medical therapeutics.

Statement of the Problem and Specific Aims

The prevalence of depression and anxiety among adolescents is rising. A comprehensive assessment of biological, psychological, and social factors that are most connected with depression and/or anxiety in adolescents is needed as this is most consistent with an adolescent's clinical presentation. Available research is dated. The most comprehensive examination of child and adolescent mental health was released in 2013 (Prevention, 2013) and was based on data from the 2007 National Survey of Children's Health. A relatively more recent examination reported only on the prevalence of a major depressive episode in adolescents in the past year and did not examine factors associated with the depressive episode (Administration, 2015). The 2016 American Academy of Pediatrics Recommendations for Preventive Pediatric Health Care recommends annual screening for depression beginning at age 11 (American Academy of Pediatrics, 2016). The identification of biopsychosocial factors associated with depression and/or anxiety in adolescents has the potential to improve and enhance the early diagnosis of these conditions and expedite treatment; such actions by providers may decrease adverse outcomes associated with these conditions. This study provides an examination of adolescent depression and/or anxiety using currently available data in the 2011-2012 National Survey of Children's Health. The specific aims of this study are to:

Aim 1: Identify biological, psychological, and social factors that predict depression and/or anxiety in adolescents aged 12-17.

Hypothesis 1: Adolescents with complex interactions of adverse biological, psychological, or social factors will have higher odds of depression and/or anxiety.

Aim 2: Using Classification and Regression Tree (CART) analysis, identify profiles of adolescents that have higher odds of depression and/or anxiety.

Significance of the Current Study

This examination has the potential to have a direct impact in clinical practice, where those at-risk adolescents, perhaps will be more easily and readily identified. Most importantly, for

4

those adolescents who either have depression and/or anxiety, or are at highest risk for it, this study lays the foundation for future work on targeted interventions to prevent or treat depression and/or anxiety. It is the first step for interventions and may have longstanding and potentially life-saving effects. Such interventions have the potential to improve adolescents' quality of life, decease risks for the aforementioned adverse outcomes of unidentified/under-treated adolescent depression and/or anxiety, and ameliorate adult functional issues and suffering.

CHAPTER 2: Conceptual Framework and Review of the Literature

The conceptual framework guiding this study is Engel's (1977) Biopsychosocial (BPS) Model. The BPS model is a framework for understanding the complex interaction between the biological, psychological, and social factors that affect a person's health. Unlike other health/illness frameworks (e.g., the traditional biomedical model), this model provides a more comprehensive understanding of a person's life experiences that contribute to their health status, not just the biological basis of illness/disease (Elliott & Richardson, 2014; Engel, 1977). In his discussion of the BPS Model, Engel describes how perceived illness and wellness can exist on spectrum (Engel). A person can be physically "ill" as evidenced by certain biochemical markers, such as elevated blood sugars, and insulin deficiency as in diabetes, but believe and feel like they are "well." While in depression or anxiety, the diagnosis is based primarily on self-report or the report of others (e.g. parents, guardians, significant others). Social factors such as educational level may impact a person's ability to understand or discuss their issues. Biologically or physically a person may look "well." Lab values may not have abnormalities, yet the person does not feel "well." Reliance solely on either how person reports they feel or only on a biomedical diagnostic procedure would lead to a missed diagnosis in both cases listed above. Through the inclusion of the illness and the person, their lifestyle and circumstances, the clinician gains a richer understanding of their patient and may glean some insight as to how to best intervene. For the purpose of this study the original BPS model was adapted depression and/or anxiety in adolescents. What follows is a brief discussion of the modifications made to the model.

Biological factors that can affect depression and/or anxiety in adolescents include genetics, neurochemistry, age, race, gender, medical diagnoses, sleep, and nutrition. Psychological factors include mental health/psychiatric diagnoses such as ADHD or behavioral issues, emotions, temperament, attitudes, coping skills, belief systems, and resilience. And finally, social factors can include family structure, socioeconomic status, social support, education, and access to health care. Collectively these factors exert influence on each other; a person's mental health (or absence of good mental health) can have an impact on each of the

individual factors.   A representation of the adapted BPS model for this study is presented in

Figure 1, where the presence of depression and/or anxiety is the outcome of interest. The

intersecting circles represent how each component (biological, psychological, and social)

overlaps with the others and all three overlap to create an adolescent's depressed and/or anxious

mental health status. The bidirectional arrows illustrate reciprocity between each component

(biological, psychological, and social) and the outcome (depression and/or anxiety). A detailed

list of the variables included in this analysis and their operationalizations is presented in the

Appendix Table A1, however a table of the variable categories is listed in table 2.1.

Figure 1. Adapted Biopsychosocial Modal of Depression and/or Anxiety
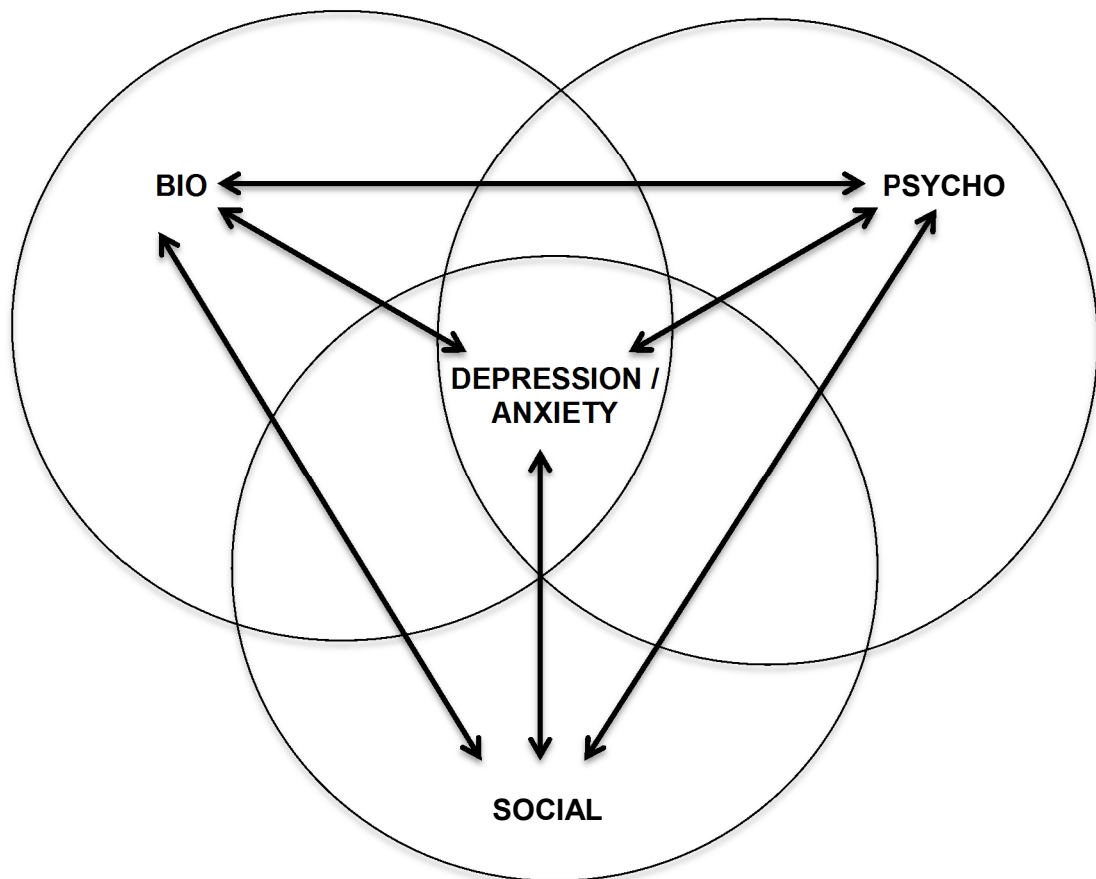
Table 2.1 Variable Categories

Biological	Psychological	Social
Age	ADHD Diagnosis	Family Structure
Gender	Behavioral Problem Diagnosis	ACEs
Race	Resilience	Count of ACEs
Chronic Conditions		Parental Physical Health
Count of Chronic Conditions		Parental Mental Health
BMI		School
Sleep		Social / Community Engagement
Premature Birth		Social Support
		Media / Technology
		Socioeconomic Status
		Unmet Need for Care

Note. ADHD = Attention deficit hyperactivity disorder; ACEs = Adverse Childhood Experiences

Review of the Literature

This study explores the associations between biological, psychological, and social variables to identify profiles of adolescents most at risk for experiencing depression and/or anxiety. The following sections detail the current evidence for biological, psychological, and social variables of the adapted BPS model as they relate to depression and/or anxiety in adolescents aged 12-17 years and that are able to be measured, either directly or by proxy, in the 2011-2012 National Survey of Children's Health. Articles were identified for inclusion through literature searches in PubMed, Cumulative Index of Nursing and Allied Health Literature (CINAHL), and PsycINFO using terms "depression AND adolescent" and "anxiety AND adolescent." When possible, searches were limited to articles published within the last five years, however, seminal articles were also included for reference. The nature of the National Survey of Children's Health is to examine broad health categories, thus available data is limited in some areas and are not explored with the depth and breadth that they might be in other studies. There may be important associations or interactions not examined in the data set and therefore not able to be included in this study.

Biological Factors

Numerous biological factors can contribute to depression and/or anxiety in adolescents. This section highlights key biological factors identified in the literature that are examined in the National Survey of Children's Health.

Age, gender, and race. Adolescence, is a period of life marked by transition and can be a tumultuous time. Changes occur across multiple domains, physical, cognitive, psychological, within the family and the peer group. Adolescence is traditionally separated into three stages: early, middle, and late, while understanding there is some individual variability. Early adolescence is approximately from the ages of 10-13; middle adolescence is from ages 14-17; and late adolescence is from ages 17-21.

9

Early adolescence is physiologically is marked by the beginning of puberty. These are the middle school years. Thought processes are generally concrete. There can be preoccupation with the beginning changes in the body that can cause physical and emotional discomfort. Peer relationships tend to be with same sex peers, and there is often comparison between peers for a sense of normality (Sherer & Radzik, 2016).

By middle adolescence most adolescent females will have started menstruation. Cognitively, adolescents are beginning to develop capabilities in abstract thought, and able to perceive future consequences of current actions. However, under stress they can revert back to more concrete thought processes. There is a move towards more independence and further development of self-identity. Peer relationships are important for guidance on acceptable behaviors. Sexual identity is beginning to be established and sexual experimentation is common (Sherer & Radzik, 2016).

By late adolescence physical and reproductive growth is complete. Abstract thought process are fully developed and there is orientation towards the future. Relationships with parents change from child-parent to adult-adult relationships. Peer group relationships become less important in favor of individual friendships and intimate relationships. Romantic relationships and intimacy involve more commitment and there is often a future orientation in thinking about marriage and/or family (Sherer & Radzik, 2016).

Studies have consistently shown higher prevalence of depression and anxiety in adolescent females as compared to males (Avenevoli, Swendsen, He, Burstein, & Merikangas, 2015; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Merikangas et al., 2010; CDC, 2013; Wade, Cairney, & Pevalin, 2002). Data suggest higher prevalence rates of depression and anxiety among White non-Hispanic and multiracial, non-Hispanic adolescents (Avenevoli et al., 2015; Merikangas et al., 2010; CDC, 2013). In multi-race adolescents, the identity formation, which is already challenging, can be even more challenging when faced with deciding which, if any, race to identify with. There can be experiences of discrimination based on how one looks,

whether one is "black enough," or "white enough" or "whichever race enough" to fit in with peers that identify with that race. The oldest age of adolescents studied in the National Survey of Children's Health is 17. Thus, this study examines depression and/or anxiety in those in early and middle adolescence.

Premature birth. Premature birth predisposes an individual to developmental challenges and other medical conditions. In a nationally representative sample, there was a 22% prevalence rate of mental disorders among those children and adolescents that were born prematurely. Compared to those born full-term, there were higher odds of both depression and anxiety in participants that were born pre-maturely, and the prevalence of depression and anxiety were both higher in adolescents ages 12-17 years (Singh, Kenney, Ghandour, Kogan, & Lu, 2013).

Chronic medical conditions. Chronic illnesses have been linked to depressive symptoms in children as young as age three years and can continue into adolescence (Curtis & Luby, 2008). The normal developmental tasks that are often challenging to adolescents are further complicated by chronic illnesses. Peer relationships, educational experiences, changes in physical appearance (sometimes due to medical treatments) can all be more challenging to navigate due to interruptions and complications caused by medical appointments, treatments, and hospitalizations (Taylor, Gibson, & Franck, 2008). As identified in the BPS model, there is interplay between mental health symptoms and medical conditions. For example, depressive symptoms have corresponded to impaired insulin resistance in adolescents (Shomaker et al., 2011) and poor glycemic control in adolescents (Bernstein, Stockwell, Gallagher, Rosenthal, & Soren, 2013), and among those with diabetes there have been increased rates of depression and suicide attempts (Butwicka et al., 2015). Adolescents with a history of concussions are also at higher risk of depression (Chrisman & Richardson, 2014).

Body mass index. Nutritional status is not measured directly in this data set, but examined by proxy via the body mass index (BMI). Obesity, or excess adipose tissue mass, is

defined by the CDC in children as those with a BMI greater than the 95th percentile (Flegal, 2002; Himes & Dietz, 1994). Obesity is a complex, multifactorial condition. The prevalence of obesity is high with 17% of children and adolescents in the United States classified as obese (Ogden, Carroll, Kit, & Flegal, 2014). Obese children and adolescents are more likely to have depression and negative emotions (Lu et al., 2012; Marmorstein, Iacono, & Legrand, 2014; Tevie & Shaya, 2015) and depressed adolescents are more likely to become obese (Marmorstein et al., 2014). In addition, the self-perception of being obese outside of actual physical weight status can have significant negative impact on mental health and depression, particularly in adolescent females (Ali, Fang, & Rizzo, 2010).

Sleep. Sleep disturbances are diagnostic symptoms of both depression and anxiety (APA, 2013). Sleep difficulties in childhood have been reported to correspond with adolescent depression and anxiety (Ong, Wickramaratne, Tang, & Weissman, 2006; Shanahan, Copeland, Angold, Bondy, & Costello, 2014) and oppositional defiant disorder (Shanahan et al., 2014). Sleep issues related to depression and anxiety can persist into adulthood, where adults are more likely to have insomnia when there were issues with depression and anxiety in childhood and adolescence (Goldman-Mellor et al., 2014).

Psychological Factors

There are numerous psychological factors that contribute to depression and/or anxiety in adolescents. This section highlights psychological factors identified in the literature that are examined in the National Survey of Children's Health.

Psychiatric/mental health diagnoses: ADHD and behavioral issues. As adolescents spend the majority of their time in school, issues that impact functioning in the academic setting tend to be noticed first. Attention deficit hyperactivity disorder (ADHD) is a common psychiatric/mental health diagnosis in childhood and adolescence because the inability to maintain focus and concentration, restlessness, and sometimes irritability cause issues in the

academic setting. Some students experience a high level of impairment in the school setting and require an individualized education plans (IEPs) to support them academically and emotionally. An IEP is a plan to provide accommodations and other supports for a student that is struggling with a physical, emotional, or learning disability to facilitate their academic success.

A number of adolescents diagnosed with ADHD or other behavioral disturbances have comorbid depression and/or anxiety or go on to develop depression later in adulthood (Meinzer et al., 2013). As discussed previously, the use of psychotropic medications can contribute symptoms of anxiety and depression. As with determining whether the primary issue is depression or anxiety, determining whether the primary issue is ADHD vs. depression and/or anxiety requires time and skilled clinical assessment (APA, 2013).

ADHD diagnosis and subsequent treatment with medication have increased significantly with over 2 million more children and adolescents diagnosed in 2011 than in 2003. The increase in diagnosis coincides with a 30% increase in the use prescription medications for treatment of ADHD (Visser et al., 2014). The first-line treatment for ADHD in children and adolescents are the stimulant medications. Known potential side effects of these medications include sleep disruption, decreased appetite and subsequent weight loss, headaches, and stomachaches (Correll, Kratochvil, & March, 2011; Leahy & Kohler, 2013). Some can experience increased anxiety, mood lability and irritability while others experience an affective flattening, or suppression of their emotions which can "look" like depression (Leahy & Kohler, 2013).

Additionally, there has been a sharp increase in the prescription of antipsychotic medications such as risperidone, quetiapine, and others, in children and adolescents, increasing from 201,000 in 1993 to 1,224,000 in 2002 (Olfson, Blanco, Liu, Moreno, & Laje, 2006). Medications that were once relegated to only the most severe psychotic psychiatric conditions are now being commonly prescribed for behavioral disturbances like Attention Deficit Hyperactivity Disorder (ADHD), mood disturbances, intellectual disabilities, behavioral issues, aggressive behaviors, and anxiety (Olfson et al., 2006; Olfson, Blanco, Liu, Wang, & Correll, 2012; Scheifes

13

et al., 2013). Treatment with these medications in children and adolescents is often considered "off-label," which means that the use of the medication is not approved by the Food and Drug Administration (FDA) (Leahy & Kohler, 2013). Of particular concern with antipsychotic medications are the possibilities of significant negative metabolic effects that can include obesity and increases in blood sugar and lipid levels. The limited studies that have been conducted indicate increased weight gain (obesity) and elevated cholesterol levels (Correll et al., 2009) and a three-fold increase in cases of the chronic medical condition type two diabetes (Bobo, Cooper, Stein, & et al., 2013) in children and adolescents prescribed antipsychotics. The onset of obesity during childhood and adolescence is particularly troublesome as it tends to be harder to treat due to a variety of factors and is likely related to an emotional disturbance as well as a medication complication (Sadock, Sadock, & Ruiz, 2014).

Resilience. Characteristics of resilience are those factors that contribute to better psychological outcomes despite risk factors for negative outcomes. Factors that contribute to resilience in adolescents are divided into three categories: individual characteristics, family support and social support (Skrove, Romundstad, & Indredavik, 2013). Strengths in these categories such as personal ability to overcome challenges, positive familial relationships, security in relationships, close friendships and peer networks have been shown to be protective from depression and anxiety in adolescents (Skrove, Romundstad, & Indredavik, 2013).

Social Factors

There are numerous social factors that contribute to depression and/or anxiety in adolescents. This section highlights key social factors identified in the literature that are examined in the National Survey of Children's Health.

Parental mental health status. Adolescents of parents with mental illnesses are more likely to exhibit symptoms of depression and anxiety and to have diagnoses of depression and/or anxiety in childhood, adolescence and in adulthood compared to offspring of parents without

mental illnesses (Chrisman & Richardson, 2014; Rasic, Hajek, Alda, & Uher, 2014). As parental mental health worsens, the prevalence of mental health conditions in children and adolescents increases (Bennett, Brewer, & Rankin, 2012). Depression in mothers has a more significant impact on children and adolescents compared to depression in fathers; these children and adolescents can have lower academic performance (Shen et al., 2016) and have significantly higher odds of depression and anxiety (Pilowsky et al., 2014; Pilowsky et al., 2006; Vidair et al., 2011). Among depressed mothers, comorbid anxiety predicts higher rates of psychiatric diagnoses in children and adolescents (Batten et al., 2012). However, adolescents do not necessarily develop the same mental health/psychiatric conditions as those of their parents as they age; they are susceptible to a variety of other mental health/psychiatric issues such as substance abuse (Dean et al., 2010). There is also evidence of an interconnection between parental, in particular maternal, depression and child temperament and future depression and anxiety in the child and adolescent; a child with a more difficult temperament contributes to higher depression in mothers and later higher levels of anxiety and depression in childhood and adolescence (Bruder-Costello et al., 2007).

Adverse Childhood Experiences. Adverse Childhood Experiences (ACEs) are negative experiences and can include experiences such as physical, emotional, sexual abuse or neglect. Adverse experiences such as poverty, racism, witnessing domestic violence or threat of violence in the neighborhood, and parental mental health issues and substance abuse can all traumatize and contribute to mental health issues for adolescents and have been linked to mental and physical health problems in adulthood (Anda et al., 2007; Chapman et al., 2004; Dube, Felitti, Dong, Giles, & Anda, 2003; Felitti et al., 1998; Sugaya et al., 2012) and premature mortality (D. W. Brown et al., 2009). The experience of traumatic events can contribute to symptoms of post-traumatic stress disorder (PTSD) and also depressive symptoms. Multiple traumatic events further increases the risk of depressive symptoms (Berg, Shiu, Msall, & Acharya, 2015), particularly among lower-income racial and ethnic minority adolescents (Andrews et al., 2015). The experience of racial discrimination in adolescence, particularly for African American youth

has been shown to coincide with depressive symptoms over time (Cheng, Cohen, & Goodman, 2015; English, Lambert, & Ialongo, 2014). A recent study exploring adverse childhood experiences, family functioning and emotional and physical health reported more adverse experiences and poor family functioning were associated with poorer physical and mental health in adolescents (Balistreri & Alviar-Hammond, 2015).

Family support, social support, and physical activity engagement. Family and peer relationships and social support are important to adolescents (Braet, Van Vlierberghe, Vandevivere, Theuwis, & Bosmans, 2013; McPherson et al., 2014). The presence of social support and engagement in physical activities can facilitate the development of resilience and are protective against depression and anxiety in adolescents (Skrove et al., 2013). Young adults that have more social support and engage in more physical activity in adolescence are less likely to become depressed as young adults (Colman et al., 2014; Jewett et al., 2014).

Media and Technology Usage. Longer screen time, particularly television viewing in adolescence has been associated with depression in young adulthood (Grøntved, et al., 2015). While the 2011-2012 National Survey of Children's Health questions focus on time spent watching TV, videos, or using electronic devices and whether or not the child or adolescent has a TV or electronic devices in their room, future surveys will need to explore the time spent on social media. The effects of social media use on adolescent mental health are just beginning to be explored. While social media can serve a vehicle for connection and building of relationships, there is also the potential for harm. Using social comparison for feelings of normality is developmentally appropriate for adolescents. Social media is another mode through which adolescents compare themselves to each other and can lead to increased depressive symptoms in adolescents when the comparison and feedback-seeking is excessive (Nesi & Prinstein, 2015). The potential of malicious behaviors is increased by the anonymity of the Internet. Victims of bullying behaviors carried out through social media outlets, also known as cyberbullying, have shown higher levels of depression and elevated reports of anxiety (Hamm, et al., 2015).

16

Additionally, there is an association between nighttime social media use and increased levels of anxiety and depression, poor sleep quality, and lower self-esteem among a sample of Scottish adolescents (Woods & Scott, 2016).

Gaps in the Literature

A number of gaps exist in our knowledge of depression and/or anxiety in adolescents. First, the most currently available reports are based on data collected as far back as 2001. This study addresses this gap by using the most currently available data from the 2011-2012 National Survey of Children's Health to examine multiple factors associated with depression and/or anxiety in adolescents. Second, anxiety is not routinely measured or studied in adolescents; this study is the first that I am aware of that explores anxiety in adolescents in the context of the BPS model. As anxiety is not routinely measured or reported in adolescents this study adds the examination of one of the most prevalent mental health issues in adolescents in conjunction with the often comorbid depression. Additionally, this examination has the potential to have a direct impact in clinical practice, where those at-risk adolescents, perhaps will be more easily and readily identified.

CHAPTER 3: Study Design and Methodology

The purpose of this study is to identify biological, psychological, and social factors that predict depression and/or anxiety in adolescents aged 12-17 years. This chapter outlines the study design and methodology. The data analysis plan is also presented.

Data Source: The 2011-2012 National Survey of Children's Health

The 2011-2012 National Survey of Children's Health was sponsored by the United States Department of Health and Human Services (HHS), Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau. Additional funding was provided by HHS, Office of the Assistant Secretary for Planning and Evaluation. The CDC's National Center for Health Statistics conducted the survey using the State and Local Area Integrated Telephone Survey program.

The goal of the National Survey of Children's Health was to assess children and adolescent's physical and emotional health and factors that may be related to their health and well being. The sample design was a cross-sectional telephone survey of US households with at least one child aged 0-17 years at the time of the interview. Survey respondents were a parent or guardian with knowledge about the health and health care of the child or adolescent. Data were collected from February 28, 2011 through June 25, 2012. The total number interviews completed were 95,677. For the completed interviews, 68.6% of the respondents were mothers, 24.2% were fathers, and 7.2% were other relatives or guardians. The target number of 1,800 completed interviews for each state and Washington, DC was achieved. The NSCH results were then weighted to represent the population of non-institutionalized children aged 0-17 years nationally and in each state (CDC, 2013).

Dataset

The current dataset contained publicly available de-identified data from the 2011-2012 NSCH and was obtained from the Child and Adolescent Health Measurement Initiative through a signed data use agreement.

Sample

The subset of adolescents aged 12-17 years (36%; n = 34,601) was taken from the total sample of all children and adolescents (n = 95,677). The subset aged 12 – 17 years were selected to coincide with the CDC and Substance Abuse Mental Health Services (SAMHSA) reporting categories for adolescents. Preliminary frequencies indicated that the number of adolescents with current depression and/or anxiety was 2,405 (7%).

Power analysis

With 34,601 adolescents in the sample statistical power was not a concern. As evidenced by prior work conducted within the University of Pennsylvania School of Nursing with other datasets, the large number of adolescents provides ample statistical power (Aiken, Clarke, Cheung, Sloane, & Silber, 2003; Aiken, Clarke, Sloane, Lake, & Cheney, 2008; Aiken, Clarke, Sloane, Sochalski, & Silber, 2002). For Aim 1, with 34,601 adolescents and an overall incidence rate of 0.070 of adolescents with depression and/or anxiety, there was enough statistical power (>80%) to detect an odds ratio as small as 1.13 (Effect size = 0.069) to be statistically significant at the alpha = 0.05. Furthermore, the total sample was randomly divided using at 60/40 split to create a training sample and a validation sample to confirm that any finding can be replicated in an independent sample. In the training sample n = 20,731 with an incidence rate of 0.0671 of adolescents with depression and/or anxiety there was enough statistical power to detect an odds ratio as small as 1.163 (Effect size = 0.0834) to be statistically significant at the alpha = 0.05. In the validation sample, n = 13,870 and incidence rate of 0.0735, the odds ratio is 1.193 (Effect

size = 0.0975). The power analyses were conducted using PASS 11 (Hintze, 2011). The large

sample populations, overall and in the training and validation sets may yield statistically

significant p-values for effects that are not clinically relevant, especially when the sample weights

are applied, thus other more objective measures of statistical importance were observed, such as

the receiver operating characteristic curve or area under the curve (AUC).

Variables

There are 665 variables in the subsetted dataset. One hundred four (104) variables were

selected for consideration in these analyses based on those factors identified from the literature

and deemed to be most relevant to clinical practice. A list of variables included in this analysis is

presented in the Appendix Table A1. The outcome variable, "anx_dep," is dichotomous ("yes/no")

and was defined as those adolescents with current depression and/or anxiety. The predictor

variables are divided into biological, psychological, and social variables. Nominal variables such

as race and school setting were converted into dichotomous variables to be included in the

statistical model with the reference group excluded.

The **_biological variables_** were: age, gender, race, Body Mass Index (BMI), presence of

chronic medical conditions, sleep and premature birth. The **_psychological variables_** were the

diagnosis of ADHD, diagnosis of behavioral issues, and resilience that was defined as the ability

to stay calm when facing a challenge. The **_social variables_** were: nine (9) adverse childhood

experiences (ACEs) modified from Felitti's (1998) work by a Technical Expert Panel for the

National Survey of Children's Health, socio-economic status, family structure, parental physical

and mental health status, social support (presence of an adult mentor), school environment

(public, private, home-schooled), grade repetition, the need for an Individualized Education Plan

(IEP), neighborhood, and participation in physical and social activities. Appendix Table A1 details

the variables' operationalizations.

Data Analysis

This study used a retrospective, cross-sectional secondary analysis design to identify biological, psychological and social factors that predicted depression and/or anxiety in adolescents aged 12-17 years. All statistical analyses were performed using SAS 9.4 (SAS Institute, 2013) or JMP PRO 12 (Grayson, Gardner, & Stephens, 2015). A subset of the complete dataset was taken with only the adolescents aged 12-17 years. This subset was randomly divided into two sets using a SAS randomization program. One subsample consisting of 60% of the original observations was used for modeling and generating the classification and regression tree; the other sample consisting of the other 40% of the original sample was used for validation purposes. Frequencies were generated using the actual raw data, however, the sampling weight variable (NSCHWT) used in the regression and CART analyses. The sampling weight variable was produced from the inverse probability of the selection of the respondent's phone number. Adjustments for non-resolution of released phone numbers, incomplete cell phone screeners, incomplete age eligibility screeners, subsampling within the household, nonresponse to the NSCH interview, multiple cell phone lines, trimming of extreme weights, combined landline and cell phone sample and non-covered children, and raking adjustments based on the 2011 American Community Survey, were applied to the base sampling weight and were applied to landline and cell-phone samples independently prior to them being combined in the data set (Centers for Disease Control and Prevention, 2013).

To identify predictors of depression and/or anxiety, each of the 104 biological, psychological, and social variables were analyzed with the outcome of depression and/or anxiety through bivariate regression analysis. The analyses for building the prediction model were performed through several steps. The differences between the depressed and/or anxious adolescents and the general adolescent population were examined using contingency table (dichotomous predictor variables) and logistic regression analysis (continuous predictor variables). Models yielding a c-statistic of 0.7 or higher were considered clinically relevant (Austin

& Steyerberg, 2012; Cook, 2007; Kansagara et al., 2011; Steyerberg et al., 2010). A multiple

logistic regression model was then built to determine the relative strength of any group

associations with adjustment for significant demographic covariates:

$$\log\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots + \beta_p X_{ip} + \varepsilon_i$$

Where p_i is the probability that a patient is diagnosed with depression and/or anxiety,

$\beta_0, \beta_1, \beta_{2,} \dots \beta_p$ are the regression model coefficients, which are exponentiated to obtain the odds

ratios of having depression and/or anxiety,

$X_{i1,} X_{i2} \dots X_{ip}$ are the predictor variables, and ε_i is on a logit scale and normally distributed

with a mean of 0 and variance of σ^2.

The potential variables were entered into a logistic regression model based on several

criteria: a) if the variable occurred in a large enough sample (generally >5%); b) if the variable

was found to be statistically significant in unadjusted analyses with a c-statistic of 0.7 or higher; or

c) the variable had been specified *a priori*, on the basis of previous research, as a variable that

tends to be associated with depression and/or anxiety.

For Aim 2, using CART analysis a decision tree was generated on the test sample first

considering primarily those variables found to be significant in the bivariate analyses, using JMP

Pro version 12 to visualize associations among risk factors and explore the profiles of

adolescents aged 12-17 years most at risk for depression and/or anxiety, using the tree-building

technique. CART is a machine learning method of data analysis that can allow the computer to

recognize patterns and interactions without being explicitly programmed to do so. Within CART,

the 10-fold cross validation procedure in JMP Pro was employed to create the decision tree. In

the 10-fold cross validation process, the data was divided into 10 folds: a training dataset that

represents nine folds was used to create the model being tested on the last fold. This step was

repeated until each fold has been used as a validation set (Westra et al., 2011). The final results

were averaged across the ten repetitions (Westra et al., 2011). Then the models were evaluated

based on the AUC, which is plotted based on the sensitivity against 1-specifity for different cut-

points based on a varying probability of the outcome (Austin & Steyerberg, 2012; Cook, 2007; Steyerberg et al., 2010). The AUC is the concordance (c) statistic (Austin & Steyerberg, 2012; Cook, 2007; Steyerberg et al., 2010). In this study, the true positive rate represented the probability of positives that are correctly classified as having depression and/or anxiety, while the false positive rate represented the probability of positives that are incorrectly recorded for having depression and/or anxiety when they actually did not have depression and/or anxiety. The true positive rate and the false positive rate range from 0 to 1 (Westra et al., 2011). The c-statistic is a rank-based test to measure how well a model discriminates between two groups (i.e. those with and without depression and/or anxiety) based on the outcome of interest, which reflects the discriminative ability of the model (Cook, 2007). If the value of the c-statistic is greater than 0.7, the model is considered accurate; the closer the value is to 1.0, the better the model (Austin & Steyerberg, 2012; Cook, 2007; Kansagara et al., 2011; Steyerberg et al., 2010). If the value is 0.5, the model lacks predictive accuracy and has "no discrimination" (Cook, 2007; Kansagara et al., 2011). If the true positive rate is close to 1, and the false positive rate is close to 0, the results indicate a better decision tree (Westra et al., 2011). To maximize the full potential of CART analysis, a final model using the selected 104 variables of the original 665 variables was generated and is discussed in the results section.

Finally, odds ratios were calculated from the profiles identified in the decision tree to quantify the odds of depression and/or anxiety for adolescents aged 12-17 years that met each specific profile risk group.

Human Subjects

This study used publicly available de-identified data from the National Survey of Children's Health obtained from the Data Resource Center for Child & Adolescent Health through a data use agreement. The de-identified data is stored on a password-protected server maintained by the University of Pennsylvania School of Nursing Information Technology Services.

This study is Institutional Review Board exempt (Protocol #824675) as this study does not meet the definition of "Human Subject" research.

CHAPTER 4: Results

This dissertation study was a cross-sectional secondary analysis of adolescents' data from the 2011-2012 National Survey of Children's Health. The total sample for this study was 34,601 adolescents ages 12-17. Of these, 2405 (7%) adolescents had current depression and/or anxiety. Of the 2405 with depression and/or anxiety, 566 adolescents had depression only; 1045 adolescents had anxiety only; and 794 adolescents had both depression and anxiety. The proportion of adolescents with depression and/or anxiety was similar in both the training and validation samples, weighted and unweighted. Frequencies are provided based on the raw data to describe the actual sample. The multiple logistic regression, decision tree, and odds ratios were analyzed with the sampling weight variable as recommended by the National Center for Health Statistics to be more reflective of the national sample (CDC, 2013).

Demographics

A summary of demographic characteristics for the whole sample including age, gender, family structure, whether or not the adolescent lived in a "working poor" household, insurance status, and educational setting is presented in Table 4.1. Depression and/or anxiety was more prevalent among females (7.1% vs. 6.8% for males), and the prevalence of depression and/or anxiety was higher among older adolescents ages 16 and 17 (8.3%) as compared to those in early adolescence, ages 12 and 13 (5.9%). The prevalence of depression and/or anxiety was highest among White, non-Hispanic adolescents at 7.4%, closely followed by multi-race, non-Hispanic adolescents (7%).   The highest percent of depressed and/or anxious adolescents lived in either single mother, no father present (11.5%) or in "other" family structure settings (11.2%). Of the 2391 adolescents living in "working poor" households, 215 (8.8%) were depressed and/or anxious.

Table 4.1 Demographics by outcome (n = 34,601)

Demographic Variable	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-statistic
Sex			
Male	1238 (6.8%)	16828 (92.9%)	
			0.506
Female	1165 (7.1%)	15243 (92.7%)	
Race			
Hispanic	243 (6.4%)	3529 (93.6%)	
White, Non-Hispanic	1741 (7.4%)	21897 (92.6%)	
Black, Non-Hispanic			0.524
	161 (5.1%)	3023 (94.9%)	
More than one race, Non-Hispanic			
	223 (7.0%)	2985 (93.1%)	
Age			
12	324 (5.5%)	5462 (94.3%)	
13	311 (6.2%)	4673 (93.6%)	
14	349 (6.5%)	5003 (93.2%)	
			0.542
15	415 (7.2%)	5333 (93.6%)	
16	473 (7.5%)	5771 (92.1%)	
17	533 (8.3%)	5865 (91.4%)	

Table 4.1 cont. Demographics by outcome (n = 34,601)

Demographic Variable	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-statistic
Age groups			
12-13 (Early)	635 (5.9%)	10135 (93.9%)	
14-15 (Middle)	764 (6.7%)	10336 (92.8%)	0.537
16-17 (Older)	1006 (7.9%)	11636 (91.8%)	
Family Structure			
Two-parent	1140 (5.1%)	21113 (94.7%)	
Two-parent, step family	289 (8.1%)	3261 (91.7%)	
			0.597
Single mother – no father present	642 (11.5%)	4917 (88.2%)	
Other family type	314 (11.2%)	2464 (88.2%)	
"Working Poor" Household			
Yes	215 (8.8%)	2176 (90.1%)	0.512
No	2152 (6.82%)	29334 (92.9%)	

Table 4.1 cont. Demographics by outcome (n = 34,601)

Demographic Variable	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-statistic
Insurance Status			
Public Insurance (Medicaid or CHIP)	1064 (13.3%)	6912 (86.4%)	
Private Health Insurance			0.610
	1250 (5.1%)	23280 (94.7%)	
Uninsured			
	75 (4.5%)	1581 (95.2%)	
School Setting			
Public	2039 (6.9%)	27508 (93.1%)	
Private	234 (6.1%)	3631 (94%)	
Home-Schooled	104 (11.2%)	821 (78.1%)	0.519
Not in School	23 (21.9%)	82 (78.1%)	

Chronic Conditions

A summary of the chronic conditions covered in the National Survey of Children's Health is presented in Table 4.2.

Body Mass Index

The majority of adolescents (23,025) were considered to be of healthy weight. The highest prevalence of depression and/or anxiety was among those adolescents categorized as obese (11.5%), followed by those that were categorized as being overweight (7.7%).

Chronic Medical Conditions

Among the other chronic health issues, the highest prevalence of depression and/or anxiety was among those adolescents with Tourette syndrome (46.7%), followed by those with Autism (43.9%). The lowest prevalence was among those with diabetes (19.7%).

Psychological Conditions

The highest overall prevalence of depression and/or anxiety was among those with behavioral problems (57.2%). Among adolescents with ADHD the prevalence of depression and/or anxiety was 24.9%.

Table 4.2. Summary of Chronic Conditions by Outcome

Condition	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-Statistic
BMI			
Underweight <5th Percentile	119 (7.0%)	1573 (92.8%)	
Healthy weight 5th – 84th Percentile	1391 (6.0%)	21634 (94%)	
Overweight 85th – 94th Percentile	363 (7.7%)	4359 (92.1%)	0.556
Obese < = 95th Percentile	483 (11.5%)	3700 (88.2%)	
Autism			
Yes	357 (43.9%)	457 (56.1%)	
No	2019 (6.0%)	31,623 (94.0%)	0.567
Developmental Delay			
Yes	603 (30.2%)	1392 (69.8%)	0.604
No	1789 (5.5%)	30,676 (94.5%)	
Intellectual Disability			
Yes	223 (37.3%)	375 (62.7%)	
No	2171 (6.4%)	31,718 (93.6%)	0.540

Table 4.2 cont. Summary of Chronic Conditions by Outcome

Condition	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-Statistic
Cerebral Palsy			
Yes	32 (23.5%)	104 (76.5%)	
			0.504
No	2371 (6.9%)	31,994 (93.1%)	
Diabetes			
Yes	57 (19.7%)	232 (80.3%)	
			0.506
No	2344 (6.9%)	31,866 (93.2%)	
Learning Disability			
Yes	1079 (23.8%)	3449 (76.2%)	
			0.670
No	1305 (4.4%)	28,570 (95.6%)	
Asthma			
Yes	505 (14.5%)	2990 (85.6%)	
			0.558
No	1896 (6.1%)	29,037 (93.9%)	
Vision problems not correctable by glasses or contacts			
Yes	107 (18.6%)	469 (81.4%)	
			0.515
No	2296 (6.8%)	31,609 (93.2%)	

Table 4.2 cont. Summary of Chronic Conditions by Outcome

Condition	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-Statistic
Joint Problems			
Yes	284 (21.6%)	1034 (78.5%)	0.540
No	2114 (6.4%)	31,037 (93.6%)	
Traumatic Brain Injury / Concussion			
Yes	58 (35.3%)	106 (64.6%)	0.510
No	2341 (6.8%)	31,990 (93.2%)	
Speech Problems			
Yes	269 (29.2%)	630 (70.1%)	0.542
No	2129 (6.3%)	31,461 (93.7%)	
Tourette Syndrome			
Yes	42 (46.7%)	48 (53.3%)	0.510
No	2357 (6.9%)	32,045 (93.2%)	
Seizure Disorder			
Yes	80 (30.6%)	181 (69.4%)	0.515
No	2321 (6.8%)	31,917 (93.2%)	

Table 4.2 cont. Summary of Chronic Conditions by Outcome

Condition	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-Statistic
Hearing Problems			
Yes	108 (21.8%)	387 (78.2%)	
			0.522
No	2293 (6.7%)	31,708 (93.3%)	

Psychological Condition	n (%) with Current Depression and/or Anxiety	n (%) No Depression or Anxiety	Bivariate c-statistic
Behavior Problems			
Yes	649 (57.2)%	485 (42.8%)	
			0.625
No	1742 (5.2%)	31,606 (94.8%)	
ADHD			
Yes	1201 (24.9%)	3620 (75.1%)	
			0.698
No	1165 (3.9%)	28,386 (96.1%)	

Note. ADHD = Attention deficit hyperactivity disorder

Multiple Logistic Regression

Guided by the BPS model and the literature, the following variables were selected for inclusion in the regression analysis (c-statistics in parentheses). The biological variables were age (c = 0.542), gender (c = 0.506), race (c = 0.524), and the count of medical conditions (c = 0.729). The count of the medical conditions was selected for inclusion over the individual chronic medical conditions because the individual conditions did not yield clinically relevant c-statistics. Though age, gender, and race did not reach the clinically significant c-statistic of 0.7 they are

included because of evidence of their relevance in the literature and for consistency in data reporting.

The psychological variables included in the regression were the diagnosis of a behavioral problem diagnosis ($c = 0.625$), diagnosis of ADHD ($c = 0.698$), and the resilience question ($c = 0.732$). As above, the individual diagnosis did not reach the clinically significant c-statistic of 0.7, however, their c-statistics are higher than the other chronic conditions, and their inclusion is supported by the literature.

The social variables with the highest c-statistics and support from the literature were the count of the adverse childhood experiences (ACEs) ($c = 0.686$), the paternal physical health ($c = 0.621$), paternal mental health ($c = 0.653$), maternal physical health ($c = 0.636$) and maternal mental health ($c = 0.660$). In the regression analysis, the paternal mental health and the maternal physical health variables needed to be excluded due to issues with multicollinearity and confounding, thus, only the paternal physical health and maternal mental health variables could be included in the regression model. Table 4.3 presents the odds ratios for the regression model. With the exception of race, all variables were treated as continuous. The c-statistic for this multivariate regression model was 0.855, which indicates clinically significant results.

Table 4.3. Biological, Psychological, and Social Variables in Regression Model

Variable (Reference group)	OR (95% CI)	p Value
Age	1.211 (1.209, 1.213)	< .0001
Gender (male)	1.814 (1.805, 1.823)	< .0001
Race – Hispanic (White)	0.665 (0.661, 0.669)	< .0001
Race – Black, non-Hispanic (White)	0.381 (0.378, 0.384)	< .0001
Race – Multi-race, Other, non-Hispanic (White)	0.575 (0.570, 0.581)	< .0001
Count of medical conditions	1.439 (1.437, 1.442)	< .0001
Behavioral Problem Diagnosis	3.571 (3.546, 3.597)	< .0001
ADHD Diagnosis	3.478 (3.459, 3.497)	< .0001
Resilience	0.663 (0.661, 0.664)	< .0001
Count of ACEs	1.254 (1.253, 1.256)	< .0001
Paternal Physical Health	0.908 (0.906, 0.910)	< .0001
Maternal Mental Health	1.404 (1.400, 1.407)	< .0001

Note. OR = odds ratio; CI = confidence interval; ADHD = attention deficit hyperactivity disorder; ACEs = adverse childhood experiences

The odds from the multivariate regression analysis are interpreted as follows. In the biological variables, for every one unit increase in age (1 year) the odds of depression and/or anxiety increased by 21%. Female adolescents had 81% higher odds of depression and/or anxiety than males. For race, Hispanic adolescents had 34% lower odds of depression and/or anxiety than White adolescents; Black, non-Hispanic adolescents had 62% lower odds of depression and/or anxiety than Whites; and multi-race, or "other" non-Hispanic adolescents had 43% lower odds of depression and/or anxiety than White adolescents. For chronic health

conditions, every one unit increase in the number of conditions increased the odds of depression and/or anxiety by 44%.

In the psychological variables, the presence of a behavioral problem diagnosis yielded 3.571 higher odds of depression and/or anxiety; and the presence of an ADHD diagnosis yielded 3.478 higher odds of depression and/or anxiety. In the resilience variable with each unit increase ("Never," "Rarely," "Sometimes," "Usually," "Always") in the ability to stay calm when facing a challenge resulted in a 44% decrease in the odds of depression and/or anxiety.

In the social variables, the odds of depression and/or anxiety increase by 25% for every one unit (1 experience) increase in the number of Adverse Childhood Experiences. With each one unit decrease ("Excellent," "Very Good," "Good," "Fair," "Poor") in the father's physical health the odds of depression and/or anxiety decreased by 9%. With each one unit decrease ("Excellent," "Very Good," "Good," "Fair," "Poor") the mother's mental health the odds of depression and/or anxiety increased by 40%.

Classification and Regression Tree

Of the 665 variables in the dataset 104 variables were selected for consideration in this decision tree based on their c-statistics, the literature review, and clinical relevance. The area under the curve (c-statistic) for the decision tree was 0.74, which is considered clinically significant.   Figure 2 presents the decision tree that was most predictive of depression and/or anxiety in adolescents. Each end node or "leaf" of the tree is a clinical profile risk group. Odds ratios were calculated for each profile and are presented in Tables 4.4 and 4.5 for both the training and validation samples. The overall proportion of depression and/or anxiety was 7%; in the training sample was 6.6% and in the validation sample was 6.6%. The most significant predictor of the presence of depression and/or anxiety in adolescents was the presence of two or more chronic health conditions, next was behavioral problems, and third was mother's mental health status.

Figure 2. Decision Tree
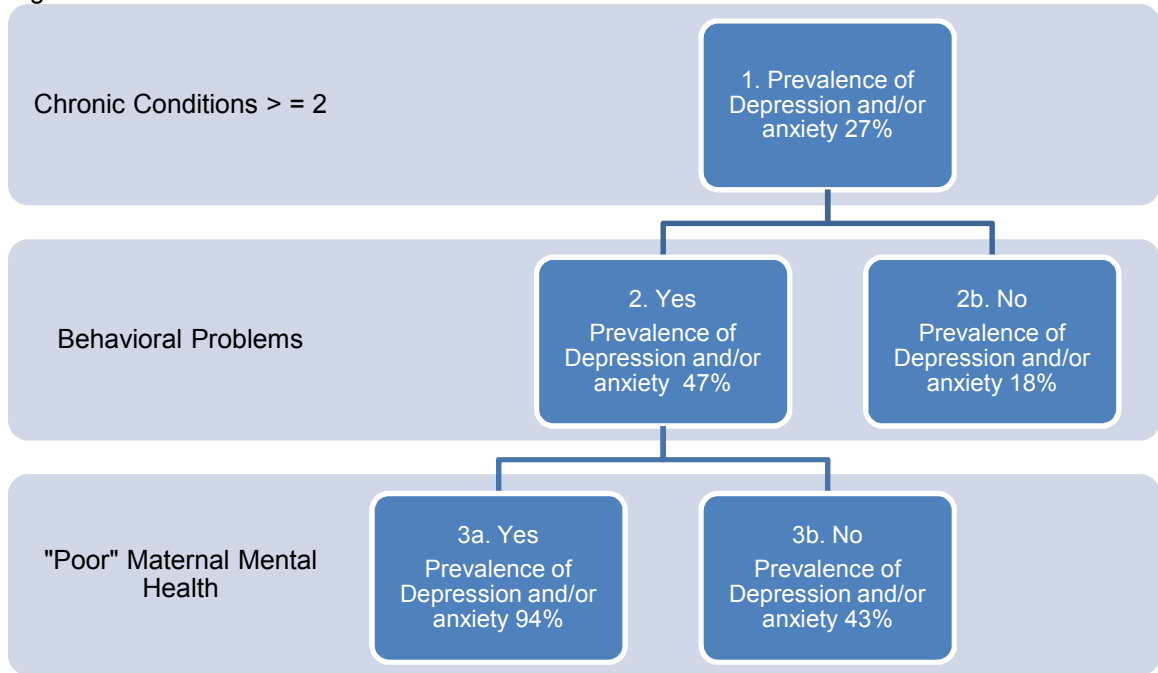
The profile 1 risk group is those adolescents with two or more chronic conditions (weighted n = 2,080,112). The prevalence of depression and/or anxiety among those with two or more chronic conditions in the training sample was 27%, as compared to 7% in the general population. More specifically, among adolescents with two or more chronic conditions, the odds of depression and/or anxiety were 10.47 (95% CI: 10.43, 10.52, p < .0001) times the odds of those who have zero or one chronic condition. The odds ratio in the independent validation sample (weighted n = 1,384,834) was 11.01 (95% CI: 10.95, 11.06, p < .0001). Although the confidence intervals do not overlap, the odds ratios of 10.47 in the training sample and 11.01 in the validation sample are clinically consistent and clinically significant.

The profile 2 risk group is those adolescents with two or more chronic conditions, one of them being a behavioral problem (weighted n = 622,555). The prevalence of depression and/or anxiety among those with two or more chronic conditions, one of them being a behavioral problem in the training sample was 47% in the training sample as compared to 7% in the general population. Further, the odds of depression and/or anxiety were 17.20 (95% CI: 17.11, 17.30, p <

.0001) times the odds of depression and/or anxiety than those that were not in the profile 2 risk group. The odds ratio in the independent validation sample (weighted n = 328,740) was 19.51 (95% CI: 19.36, 19.65, p < .0001). Although the confidence intervals do not overlap, the odds ratios of 17.20 in the training sample and 19.51 in the validation sample are clinically consistent and clinically significant.

The Profile 3 risk group is those adolescents with two or more chronic conditions, a behavioral problem, and whose mother's mental health was rated as "poor" (weighted n = 49,815). The prevalence of depression and/or anxiety among adolescents with two or more chronic conditions, a behavioral problem, and whose mother's mental health was rated as "poor" was 94% as compared to 7% in the general population. More importantly, the odds of depression and/or anxiety were 234.34 (95% CI: 225.78, 243.23, p < .0001) times the odds of depression and/or anxiety than those that were not in the Profile 3 risk group. The odds ratio in the independent validation sample (weighted n = 13,505) was 117.39 (95% CI: 111.19, 123.93, p < .0001). Although the confidence intervals do not overlap, the odds ratios of 234.34 in the training sample and 117.39 in the validation sample are clinically consistent and clinically significant.

Alternate profiles were also considered. The profile 2b risk group is those adolescents with two or more chronic conditions and whose parent/guardian reported that they did not have behavioral problems (weighted n = 1,457,557). The prevalence of depression and/or anxiety among adolescents with two or more chronic conditions but no behavioral problem was 18% as compared to 7% in the general population, and the adolescents in this profile risk group had 3.92 (95% CI: 3.90, 3.94, p < .0001) times the odds of depression and/or anxiety than those that were not in this profile risk group. The odds ratio in the independent validation sample (weighted n = 1,056,093) was 3.92 (95% CI: 3.90, 3.94, p < .0001). The profile 3b risk group is those adolescents with two or more chronic conditions, a behavioral problem, and whose mother's mental health was rated as anything other than "poor" (weighted n = 572,740); the prevalence of depression and/or anxiety was 43% as compared to 7% in the general population. Adolescents

38

in this profile risk group had 13.62 (95% CI: 13.54, 13.70, p < .0001) times the odds of depression

and/or anxiety than those that were not in this profile risk group. The odds ratio in the

independent validation sample (weighted n = 315,236) was 18.34 (95% CI: 18.21, 18.49, p <

.0001).

Table 4.4 Training Sample Profile Risk Groups

Profile	Weighted N (%) with Depression and/or Anxiety	OR (95% CI)	p-Value
General Population	15,026,902 (6.6%)	N/A	N/A
1. Chronic Condition > = 2	2,080,112 (27%)	10.47 (10.43, 10.52)	< .0001
2. Chronic Condition > = 2 and Behavior Problem	622,555 (47%)	17.20 (17.11, 17.30)	< .0001
3. Chronic Condition > = 2, Behavior Problem, and Poor Maternal Mental Health	49,815 (94%)	234.34 (225.78, 243.23)	< .0001
2b. Chronic Condition > = 2 No Behavior Problem	1,457,557 (18%)	3.92 (3.90, 3.94)	< .0001
3b. Chronic Condition > = 2, Behavior Problem, Maternal Mental Health rated as other than "Poor"	572,740 (43%)	13.62 (13.54, 13.70)	< .0001

Note. OR = odds ratio; CI = confidence interval

Table 4.5 Validation Sample Profile Risk Groups

Profile (Validation Sample)	Weighted N (%) with Depression and/or Anxiety	OR (95% CI)	P Value
General Population	10,083,308 (6.6%)	N/A	N/A
1. Chronic Condition > = 2	1,383,834 (27%)	11.01 (10.95, 11.07)	< .0001
2. Chronic Condition > = 2 and Behavior Problem	328,740 (51%)	19.50 (19.36, 19.65)	< .0001
3. Chronic Condition > = 2, Behavior Problem, and Poor Maternal Mental Health	13,505 (89%)	117.38 (111.19, 123.93)	< .0001
2b. Chronic Condition > = 2 No Behavior Problem	1,056,093 (20%)	4.67 (4.65, 4.70)	< .0001
3b. Chronic Condition > = 2, Behavior Problem, Maternal Mental Health rated as other than "Poor"	315,236 (50%)	18.34 (18.21, 18.49)	< .0001

Note. OR = odds ratio; CI = confidence interval

Model Validation

The specificity of the classification regression tree in the training sample was 0.891. The sensitivity of the classification regression tree in the training sample was 0.564. The overall accuracy rate was 0.936, and the misclassification rate was 0.0633. Consistent results were observed for sensitivity, specificity, overall accuracy rate, and misclassification rate for the validation sample. The specificity of the classification regression tree in the validation sample was 0.891. The sensitivity of the classification regression tree in the training sample was 0.589. The overall accuracy rate was 0.934 and the misclassification rate was 0.0653.

CHAPTER 5: Discussion

The purpose of this study was to conduct a secondary analysis of the 2011-2012 National Survey of Children's Health to identify biological, psychological, and social factors that predict depression and/or anxiety in adolescents aged 12-17 years and to use classification and regression tree (CART) analysis to identify profiles of adolescents who have higher odds of depression and/or anxiety. The following chapter provides discussion of key findings from this study.

Biological

The author recognizes current discussions of race and gender as social constructs rather than biological, but for the purposes of this study, they were considered biological factors. Consistent with the literature reviewed, white, non-Hispanic adolescents had the highest prevalence of depression and/or anxiety, followed by multi-race, non-Hispanic adolescents. Prevalence was higher among female adolescents than male adolescents. Highest prevalence was seen among older adolescents, ages 16 and 17.

Chronic Conditions. Interestingly, no specific medical condition predicted depression and/or anxiety. The best predictor of the outcome was the count of conditions, where 2 or more chronic conditions was the most significant predictor of depression and/or anxiety. This indicates that while there may be some conditions where depression and/or anxiety are more likely (e.g. Tourette Syndrome), it is the number of chronic conditions that is most predictive over the individual conditions themselves. This is helpful for clinicians, in that they can focus on the more general count rather than a variety of combinations of conditions, knowing that having two or more chronic conditions has higher odds of depression and/or anxiety.

Psychological

Psychiatric Diagnoses. The presence of behavioral problems such as oppositional defiant disorder was a significant predictor of depression and/or anxiety in adolescents. In clinical practice it is not uncommon to see behavioral disturbances when an adolescent is experiencing feelings of depression and/or anxiety. As discussed previously, adolescents tend to present as more irritable and angry than as sad when they are struggling with depression, which may lead to acting out behaviors. Anxiety is often described as a hyperaroused state, where the body's natural "fight or flight" response is activated. People tend to focus on the "flight" part of anxiety, for example, the worry, nervousness, or avoidance behaviors, paying less attention to the other side, the "fight." It is physically uncomfortable and emotionally unsettling to be in a hyperaroused state for a consistent period of time. Developmentally, as discussed previously, when stressed, adolescents may revert to more concrete ways of thinking and coping, being more externalizers and lashing out exhibiting irritability, anger, and aggressive behavior instead of withdrawing.

Social

There was a higher prevalence of depression and/or anxiety among those adolescents living in "Working Poor" households and among those adolescents with publicly funded insurance such as CHIP or Medicaid. As this is cross-sectional data, there is not the ability to track the trajectory of the depression and/or anxiety in these adolescents over time. Testing of the model on longitudinal data could be beneficial for further validation of the model.

Adverse childhood experiences (ACEs). Similar to the chronic conditions, the count of ACEs was most predictive of depression and/or anxiety in adolescents. One could argue that the maternal mental health variable could correspond to the adverse childhood experience of living with a parent with a mental illness variable. However, this result indicates particular importance of maternal mental health over the more general parental mental health. It is also possible that by having more categories (Excellent, Very Good, Good, Fair, Poor) in the maternal mental health

question vs. the dichotomous "yes or no" of the ACE question allowed the decision tree to determine a split that optimizes discrimination between those with and without depression and/or anxiety.

Results in the Context of the Biopsychosocial Model

The adaptation of Engel's Biopsychosocial Model was instrumental in framing this study, as it laid what was a helpful foundation on which to consider variables that would be important for identifying adolescents most at risk for depression and/or anxiety. The BPS model is consistent with psychiatric practice, in that in order to come to a psychiatric diagnosis, one must consider potential biological, other psychological, and social factors. In this study one variable from each category – the count of chronic conditions (biological), behavioral issue (psychological) and mother's mental health (social) were the variables that led to the highest odds of depression and/or anxiety. Neglecting any one of these categories could and did lead to different models with decreased predictive ability. The inclusion of all of the selected variables was important because each variable on it's own may not have been predictive of depression and/or anxiety, but in combination with each other, the most important relationships were expressed. This is similar to clinical practice, where clinicians may not know everything about the patients that present to the office or clinic. In the limited time of an appointment or session, clinicians cannot ask everything, but by identifying key questions to ask, or key factors that contribute to the higher odds of depression and/or anxiety in adolescents, the potential to intervene is increased.

Translation to Clinical Practice

The findings from this study have direct clinical implications. The American Academy of Pediatrics recommends screening all adolescents for depression beginning at age 11. The PHQ-2 is a suggested screening measure. Perhaps knowing the profiles identified in this study would suggest the need for a higher level of screening, for example, the full PHQ-9. Also, because of the cyclical nature of depression and/or anxiety, incorporating a screening measure for anxiety

may also be helpful. Given the significance of maternal mental health, clinicians' office lobbies could contain resource materials with information on places where parents could find support or access services so that parents/guardians can find ways to obtain treatment if needed.

Limitations

There are some limitations to this study. As this was a secondary analysis of existing data, the ability to measure various concepts, for example resilience, was limited to what questions were asked and the way they were asked. For example, information about whether or not the adolescent was prescribed medication for depression and/or anxiety could have been helpful. The medication question in the survey asked whether or not the child or adolescent took medication for mood or behavioral issues, not specifically stating depression or anxiety. The reliance on self-report may have resulted in under or over-reporting of issues, especially since the parents or guardians, not the adolescents' themselves were the respondents. There was potential for respondent bias in that parents or guardians may report issues as viewed through their experiences, which may be different from the adolescents' actual experiences. It should also be noted that the entire weighted data set is representative of non-institutionalized youth in the United States aged 0-17. The subset of adolescents does not necessarily translate to being representative of non-institutionalized adolescents aged 12-17 in the United States.

Scholarly Contribution

This study contributes to the science of adolescent mental health in a variety of ways. Through frequency analysis, it provides an update on current prevalence of depression and/or anxiety in adolescents. Through the use of CART analysis a more comprehensive effective analysis was conducted, that moved beyond the limitations of traditional multiple logistic regression to identify clear profiles of adolescents that have higher odds of depression and/or anxiety. Finally, there is direct applicability to clinical practice, which has the potential to identify those adolescents with highest risk for depression and/or anxiety.

Next Steps

This study provided the foundation for further study of depression and/or anxiety in adolescents aged 12-17 years. Funding will be sought to further this line of scientific inquiry with the plan to develop and test targeted interventions in clinical practice to reduce depression and/or anxiety in adolescents.

APPENDIX

Table A1. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Outcome	Depression and/or Anxiety	Parental report of current depression and/or anxiety	Dichotomous: Yes No
Biological	Age	Report of age, to the full year	Continuous: Age in years, 12-17
Biological	Race	Report of race	Categorical: Hispanic White, non-Hispanic Black, non-Hispanic Multi-race / other, non-Hispanic
Biological	Gender	Report of gender	Categorical: Male Female
Biological	Chronic Conditions	Report of diagnosis of autism	Dichotomous: Yes No

Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Biological	Chronic Conditions	Report of diagnosis of developmental delay	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of intellectual disability	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of cerebral palsy	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of diabetes	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of learning disability	Dichotomous: Yes No

Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Biological	Chronic Conditions	Report of diagnosis of asthma	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of vision problems not correctable with glasses or contacts	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of joint / musculoskeletal issues	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of traumatic brain injury / concussion	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of speech problems	Dichotomous: Yes No

Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Biological	Chronic Conditions	Report of diagnosis of Tourette Syndrome	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of hearing problems	Dichotomous: Yes No
Biological	Chronic Conditions	Report of diagnosis of seizure disorder	Dichotomous: Yes No
Biological	Count of Chronic Conditions	Count of the number of chronic medical conditions	Continuous: 0 - 14

Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Biological	Body Mass Index	Classification of adolescent's BMI calculated from reported height and weight	Categorical: Underweight -- less than 5th percentile Healthy weight -- 5th to 84th percentile Overweight -- 85th to 94th percentile Obese -- 95th percentile or above
Biological	Sleep	Report on the number of nights adolescent got enough sleep in the past week	Continuous: 1 – 7 nights
Biological	Premature Birth	Report of whether or not the adolescent was born premature	Dichotomous: Yes No
Psychological	Attention Deficit Hyperactivity Disorder (ADHD)	Report of diagnosis of ADHD	Dichotomous: Yes No

Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Psychological	Behavioral Problems	Report of diagnosis of behavioral or conduct problems, such as oppositional defiant disorder or conduct disorder	Dichotomous: Yes No
Psychological	Resilience	Report of whether or not adolescent stays calm and in control when faced with a challenge	Categorical: Never Rarely Sometimes Usually Always
Social	Adverse Childhood Experiences	How often has it been hard to get by on your family's income - hard to cover basics like food or housing?	Derived/Dichotomous: Very Often / Somewhat Often / Rarely Never
Social	Adverse Childhood Experiences	Child lived with parent who got divorced/separated after he/she was born	Dichotomous: Yes No

Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Adverse Childhood Experiences	Child lived with parent who died	Dichotomous: Yes No
Social	Adverse Childhood Experiences	Child lived with parent who served time in jail after he/she was born	Dichotomous: Yes No
Social	Adverse Childhood Experiences	Child saw parents hit, kip, slap, punch or beat each other up	Dichotomous: Yes No
Social	Adverse Childhood Experiences	Child was a victim of violence or witness violence in his/her neighborhood	Dichotomous: Yes No
Social	Adverse Childhood Experiences	Child lived with anyone who was mentally ill or suicidal, or severely depressed for more than a couple of weeks	Dichotomous: Yes No

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Adverse Childhood Experiences	Child lived with anyone who had a problem with alcohol or drugs	Dichotomous: Yes No
Social	Adverse Childhood Experiences	Child was ever treated or judged unfairly because of his/her race or ethnic group	Dichotomous: Yes No
Social	Count of Adverse Childhood Experiences	Count of the number of adverse childhood experiences	Continuous: 0 - 9
Social	Maternal Physical Health Status	Would you say that, in general, [[S.C.]'s [MOTHER TYPE]'s / your] health is excellent, very good, good, fair, or poor?	Catergorical: Excellent Very Good Good Fair Poor

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Paternal Physical Health Status	Would you say that, in general, [[S.C.]'s [FATHER TYPE]'s / your] health is excellent, very good, good, fair, or poor?	Catergorical: Excellent Very Good Good Fair Poor
Social	Maternal Mental Health Status	Would you say that, in general, [[S.C.]'s [MOTHER TYPE]'s / your] mental and emotional health is excellent, very good, good, fair, or poor?	Catergorical: Excellent Very Good Good Fair Poor

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Paternal Mental Health Status	Would you say that, in general, [[S.C.]'s [FATHER TYPE]'s / your] mental and emotional health is excellent, very good, good, fair, or poor?	Catergorical: Excellent Very Good Good Fair Poor
Social	School Setting	Report of type of school setting	Categorical: Public Private Home-schooled Not in school
Social	School Grade Repetition	Since starting kindergarten, has child repeated any grades?	Dichotomous: Yes No
Social	Need for Individualized Education Plan	Does adolescent have a health problem, condition, or disability for which he/she has a written intervention plan called an Individualized Education Program or IEP?	Dichotomous: Yes No

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Social / Community Engagement	During the past 12 months… Participate in sports team or lessons?	Dichotomous: Yes No
Social	Social / Community Engagement	During the past 12 months… Participate in any clubs or organizations after school of on weekends?	Dichotomous: Yes No
Social	Social / Community Engagement	During the past 12 months… Participate in any other organized activities or lessons, such as music, dance, language, or other arts?	Dichotomous: Yes No
Social	Social / Community Engagement	During the past 12 months… Participate in community service activities?	Dichotomous: Yes No
Social	Social / Community Engagement	During the past week, did adolescent work for pay?	Dichotomous: Yes No

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Social / Community Engagement	Religious Service attendance?	Dichotomous: Yes No
Social	Social Support	Adolescent has at least one adult mentor outside of the home.	Dichotomous: No adult mentors One or more adult mentors
Social	Media / Technology Usage	Time spent watching TV or videos on average weekday	Report of hours used per day
Social	Media / Technology Usage	Time spent using electronic devices average weekday	Categorical: Does not Use Electronic Devices Uses Electronic Devices 1 hour or less per day Uses Electronic Devices more than 1 hour but less than 4 hours per day Uses Electronic Devices 4 hours or more per day

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social	Media / Technology Usage	Is there a television or electronic devices in his/her bedroom?	Dichotomous: Yes No
Social	Socioeconomic Status	Type of insurance coverage	Categorical: Public insurance such as Medicaid or SCHIP Private health insurance Currently uninsured
Social	Socioeconomic Status	Adolescent living in working poor household: Parents employed full-time but living 100% below poverty level	Dichotomous: Yes No
Social	Unmet need for care	Medical care delayed or not received	Dichotomous: Yes No
Social		Dental care delayed or not received	Dichotomous: Yes No

Appendix Table A1 cont. Analysis Variables

Factor	Factor Being Measured	How Factor is Measured	Variable Type / Values
Social		Vision care delayed or not received	Dichotomous:
			Yes
			No

Note. Unmet need for mental health care excluded from analysis, as it is a direct confounder for those with mental health issues.

BIBLIOGRAPHY

Aiken, L. H., Clarke, S. P., Cheung, R. B., Sloane, D. M., & Silber, J. H. (2003). Educational levels of hospital nurses and surgical patient mortality. *JAMA, 290*(12), 1617-1623. doi:10.1001/jama.290.12.1617

Aiken, L. H., Clarke, S. P., Sloane, D. M., Lake, E. T., & Cheney, T. (2008). Effects of hospital care environment on patient mortality and nurse outcomes. *The Journal of Nursing Administration, 38*(5), 223-229. doi:10.1097/01.NNA.0000312773.42352.d7

Aiken, L. H., Clarke, S. P., Sloane, D. M., Sochalski, J., & Silber, J. H. (2002). Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. *JAMA, 288*(16), 1987-1993.

Ali, M. M., Fang, H., & Rizzo, J. A. (2010). Body weight, self-perception and mental health outcomes among adolescents. *The Journal of Mental Health Policy and Economics, 13*(2), 53-63.

American Academy of Pediatrics. (2016). 2016 Recommendations for Preventive Pediatric Health Care. *Pediatrics, 137*(1). doi: http://dx.doi.org/10.1542/peds.2015-390

Anda, R. F., Brown, D. W., Felitti, V. J., Bremner, J. D., Dube, S. R., & Giles, W. H. (2007). Adverse Childhood Experiences and Prescribed Psychotropic Medications in Adults. *American Journal of Preventive Medicine, 32*(5), 389-394. doi:http://dx.doi.org/10.1016/j.amepre.2007.01.005

Andrews, A., III, Jobe-Shields, L., López, C., Metzger, I., de Arellano, M. R., Saunders, B., & G. Kilpatrick, D. (2015). Polyvictimization, income, and ethnic differences in trauma-related mental health during adolescence. *Social Psychiatry and Psychiatric Epidemiology, 50*(8), 1223-1234. doi:10.1007/s00127-015-1077-3

Association, A. P. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (Fifth Edition ed.). Arlington, VA: American Psychiatric Association.

Austin, P. C., & Steyerberg, E. W. (2012). Interpreting the concordance statistic of a logistic regression model: relation to the variance and odds ratio of a continuous explanatory variable. *BMC Medical Research Methodology, 12*(1), 82. doi:10.1186/1471-2288-12-82

Avenevoli, S., Swendsen, J., He, J. P., Burstein, M., & Merikangas, K. R. (2015). Major depression in the national comorbidity survey-adolescent supplement: prevalence, correlates, and treatment. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(1), 37-44.e32. doi:10.1016/j.jaac.2014.10.010

Balistreri, K. S., & Alviar-Hammond, M. (2015). Adverse childhood experiences, family functioning and adolescent health and emotional well-being. *Public health*. doi:http://dx.doi.org/10.1016/j.puhe.2015.10.034

Batten, L. A., Hernandez, M., Pilowsky, D. J., Stewart, J. W., Blier, P., Flament, M. F., . . . Weissman, M. M. (2012). Children of treatment-seeking depressed mothers: a comparison with the sequenced treatment alternatives to relieve depression (STAR*D) child study. *Journal of the American Academy of Child & Adolescent Psychiatry, 51*(11), 1185-1196. doi:10.1016/j.jaac.2012.08.020

Bennett, A. C., Brewer, K. C., & Rankin, K. M. (2012). The association of child mental health conditions and parent mental health status among U.S. Children, 2007. *Maternal Child Health Journal, 16*(6), 1266-1275. doi:10.1007/s10995-011-0888-4

Berg, K. L., Shiu, C. S., Msall, M. E., & Acharya, K. (2015). Victimization and depression among youth with disabilities in the US child welfare system. *Child: care, health and development, 41*(6), 989-999. doi:10.1111/cch.12233

Bernstein, C. M., Stockwell, M. S., Gallagher, M. P., Rosenthal, S. L., & Soren, K. (2013). Mental health issues in adolescents and young adults with type 1 diabetes: prevalence and impact on glycemic control. *Clinical Pediatrics, 52*(1), 10-15. doi:10-5. doi: 10.1177/0009922812459950

Bobo, W. V., Cooper, W. O., Stein, C., & et al. (2013). Antipsychotics and the risk of type 2 diabetes mellitus in children and youth. *JAMA Psychiatry, 70*(10), 1067-1075. doi:10.1001/jamapsychiatry.2013.2053

Braet, C., Van Vlierberghe, L., Vandevivere, E., Theuwis, L., & Bosmans, G. (2013). Depression in early, middle and late adolescence: differential evidence for the cognitive diathesis-stress model. *Clinical Psychology & Psychotherapy, 20*(5), 369-383. doi:10.1002/cpp.1789

Brawner, B. M., Gomes, M. M., Jemmott, L. S., Deatrick, J. A., & Coleman, C. L. (2012). Clinical depression and HIV risk-related sexual behaviors among African-American adolescent females: Unmasking the numbers. *AIDS Care, 24*(5), 618-625. doi:10.1080/09540121.2011.630344

Brown, D. W., Anda, R. F., Tiemeier, H., Felitti, V. J., Edwards, V. J., Croft, J. B., & Giles, W. H. (2009). Adverse childhood experiences and the risk of premature mortality. *American Journal of Preventive Medicine, 37*(5), 389-396. doi:10.1016/j.amepre.2009.06.021

Brown, N. M., Green, J. C., Desai, M. M., Weitzman, C. C., & Rosenthal, M. S. (2014). Need and unmet need for care coordination among children with mental health conditions. *Pediatrics, 133*(3), e530-537. doi:10.1542/peds.2013-2590

Bruder-Costello, B., Warner, V., Talati, A., Nomura, Y., Bruder, G., & Weissman, M. (2007). Temperament among offspring at high and low risk for depression. *Psychiatry Research, 153*(2), 145-151. doi:10.1016/j.psychres.2007.02.013

Butwicka, A., Frisen, L., Almqvist, C., Zethelius, B., & Lichtenstein, P. (2015). Risks of psychiatric disorders and suicide attempts in children and adolescents with type 1 diabetes: a population-based cohort study. *Diabetes Care, 38*, 453–459. doi:10.2337/dc14-0262

Center for Behavioral Health Statistics and Quality. (2015). Behavioral health trends in the United States: Results from the 2014 National Survey on Drug Use and Health. Retrieved from http://www.samhsa.gov/data/

Centers for Disease Control and Prevention. (2013). *Mental Health Surveillance Among Children - United States, 2005 - 2011*. Retrieved from http://www.cdc.gov/media/dpk/2013/docs/Child_menatal_health/su6202.pdf

Centers for Disease Control and Prevention, National Center for Health Statistics (2013). *2011-2012 National Survey of Children's Health Frequently Asked Questions*. Retrieved from http://www.cdc.gov/nchs/slaits/nsch.htm

Chapman, D. P., Whitfield, C. L., Felitti, V. J., Dube, S. R., Edwards, V. J., & Anda, R. F. (2004). Adverse childhood experiences and the risk of depressive disorders in adulthood. *Journal of Affective Disorders, 82*(2), 217-225. doi:http://dx.doi.org/10.1016/j.jad.2003.12.013

Cheng, E. R., Cohen, A., & Goodman, E. (2015). The role of perceived discrimination during childhood and adolescence in understanding racial and socioeconomic influences on depression in young adulthood. *The Journal of Pediatrics, 166*(2), 370-377.e.371. doi:10.1016/j.jpeds.2014.10.010

Chrisman, S. P., & Richardson, L. P. (2014). Prevalence of diagnosed depression in adolescents with history of concussion. *Journal of Adolescent Health, 54*(5), 582-586. doi:10.1016/j.jadohealth.2013.10.006

Colman, I., Zeng, Y., McMartin, S. E., Naicker, K., Ataullahjan, A., Weeks, M., . . . Galambos, N. L. (2014). Protective factors against depression during the transition from adolescence to adulthood: findings from a national Canadian cohort. *Preventive Medicine, 65*, 28-32. doi:10.1016/j.ypmed.2014.04.008

Cook, N. R. (2007). Use and misuse of the receiver operating characteristic curve in risk prediction. *Circulation, 115*(7), 928-935.

Copeland, W. E., Wolke, D., Shanahan, L., & Costello, E. J. (2015). Adult Functional Outcomes of Common Childhood Psychiatric Problems: A Prospective, Longitudinal Study. *JAMA Psychiatry, 72*(9), 892-899. doi:10.1001/jamapsychiatry.2015.0730.

Correll, C. U., Kratochvil, C. J., & March, J. S. (2011). Developments in pediatric psychopharmacology: focus on stimulants, antidepressants, and antipsychotics. *Journal of Clinical Psychiatry, 72*(5), 655-670. doi:10.4088/JCP.11r07064

Correll, C. U., Manu, P., Olshanskiy, V., Napolitano, B., Kane, J. M., & Malhotra, A. K. (2009). Cardiometabolic risk of second-generation antipsychotic medications during first-time use in children and adolescents. *JAMA, 302*(16), 1765-1773. doi:10.1001/jama.2009.1549

Costello, E. J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry, 60*(8), 837-844.

Curtin, S. C., Warner, M., & Hedegaard, H. (2016). *Increase in suicide in the United States, 1999-2014* (NCHS data brief, no 241). Retrieved from Hyattsville, MD: http://www.cdc.gov/nchs/products/databriefs/db241.htm

Curtis, C. E., & Luby, J. L. (2008). Depression and social functioning in preschool children with chronic medical conditions. *The Journal of Pediatrics, 153*(3), 408-413. doi:10.1016/j.jpeds.2008.03.035

Dean, K., Stevens, H., Mortensen, P. B., Murray, R. M., Walsh, E., & Pedersen, C. B. (2010). Full spectrum of psychiatric outcomes among offspring with parental history of mental disorder. *Archives of General Psychiatry, 67*(8), 822-829. doi:10.1001/archgenpsychiatry.2010.86

Dube, S. R., Felitti, V. J., Dong, M., Giles, W. H., & Anda, R. F. (2003). The impact of adverse childhood experiences on health problems: evidence from four birth cohorts dating back to 1900. *Preventive Medicine, 37*(3), 268-277. doi:http://dx.doi.org/10.1016/S0091-7435(03)00123-3

Elliott, J. O., & Richardson, V. E. (2014). The biopsychosocial model and quality of life in persons with active epilepsy. *Epilepsy & Behavior, 41*, 55-65. doi:10.1016/j.yebeh.2014.09.035

Engel, G. L. (1977). The Need or a New Medical Model: A Challenge for Biomedicine. *Science, 196*(4286), 129-136.

English, D., Lambert, S. F., & Ialongo, N. S. (2014). Longitudinal associations between experienced racial discrimination and depressive symptoms in African American adolescents. *Developmental Psychology, 50*(4), 1190-1196. doi:10.1037/a0034703

Felitti, V. J., F., A. R., Nordenberg, D. W., D. F., Spitz, A. M., Edwards, V., Koss, M. P., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults. The Adverse Childhood Experiences (ACE) Study. *American Journal of Preventive Medicine, 14*(4), 245-258.

Flegal, K. M., Wei, R. & Ogden, C. (2002). Weight-for-stature compared with body mass index-for-age growth charts for the United States from the Centers for Disease Control and Prevention. *American Journal of Clinical Nutrition, 75*, 761-766.

Flier, J. S., & Maratos-Flier, E. (2012). Chapter 77. Biology of Obesity. In D. L. Longo, A. S. Fauci, D. L. Kasper, S. L. Hauser, J. L. Jameson, & J. Loscalzo (Eds.), *Harrison's Principles of Internal Medicine, 18e*. New York, NY: The McGraw-Hill Companies.

Goldman-Mellor, S., Gregory, A. M., Caspi, A., Harrington, H., Parsons, M., Poulton, R., & Moffitt, T. E. (2014). Mental health antecedents of early midlife insomnia: evidence from a four-decade longitudinal study. *Sleep, 37*(11), 1767-1775. doi:10.5665/sleep.4168

Grayson, J., Gardner, S., & Stephens, M. (2015). *Building Better Models with JMP Pro*. Cary, NC: SAS Institute Inc.

Grøntved, A., Singhammer, J., Froberg, K., Møller, N. C., Pan, A., Pfeiffer, K. A., & Kristensen, P. L. (2015). A prospective study of screen time in adolescence and depression symptoms in young adulthood. *Preventive Medicine, 81,* 108-13. doi: 10.1016/j.ypmed.2015.08.009

Hamm, M. P., Newton, A. S., Chisholm, A., Shulhan, J., Milne, A., Sundar, P.,… & Hartling, L. (2015). Prevalence and Effect of Cyberbullying on Children and Young People: A Scoping Review of Social Media Studies. *JAMA Pediatrics, 169*(8), 770-7. doi: 10.1001/jamapediatrics.2015.0944

Himes, J. H., & Dietz, W. H. (1994). Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services. *American Journal of Clinical Nutrition, 59*, 307-316.

Hintze, J. (2011). PASS 11. Retrieved from http://www.ncss.com

Jewett, R., Sabiston, C. M., Brunet, J., O'Loughlin, E. K., Scarapicchia, T., & O'Loughlin, J. (2014). School sport participation during adolescence and mental health in early adulthood. *The Journal of Adolescent Health, 55*(5), 640-644. doi:10.1016/j.jadohealth.2014.04.018

Kansagara, D., Englander, H., Salanitro, A., Kagen, D., Theobald, C., Freeman, M., & Kripalani, S. (2011). Risk prediction models for hospital readmission: a systematic review. *JAMA, 306*(15), 1688-1698. doi:10.1001/jama.2011.1515

Kushner, R. F. (2012). Chapter 78. Evaluation and Management of Obesity. In D. L. Longo, A. S. Fauci, D. L. Kasper, S. L. Hauser, J. L. Jameson, & J. Loscalzo (Eds.), *Harrison's Principles of Internal Medicine, 18e*. New York, NY: The McGraw-Hill Companies.

Leahy, L., & Kohler, C. G. (2013). *Manual of clinical psychopharmacology for nurses* (L. Leahy, Kohler, C. G. Ed.). Washington, DC: American Psychiatric Publishing.

Lipari, R.N., Hughes, A. and Williams, M. State estimates of major depressive episode among adolescents: 2013 and 2014. The CBHSQ Report: July 7, 2016. Center for Behavioral Health Statistics and Quality, Substance Abuse and Mental Health Services Administration, Rockville, MD.

Lu, E., Dayalu, R., Diop, H., Harvey, E. M., Manning, S. E., & Uzogara, S. G. (2012). Weight and mental health status in Massachusetts, National Survey of Children's Health, 2007. *Maternal Child Health Journal, 16*(Suppl 2), 278-286. doi:10.1007/s10995-012-1145-1

Mangerud, W. L., Bjerkeset, O., Holmen, T. L., Lydersen, S., & Indredavik, M. S. (2014). Smoking, alcohol consumption, and drug use among adolescents with psychiatric disorders compared with a population based sample. *Journal of Adolescence, 37*(7), 1189-1199. doi:10.1016/j.adolescence.2014.08.007

Marmorstein, N. R., Iacono, W. G., & Legrand, L. (2014). Obesity and depression in adolescence and beyond: reciprocal risks. *International Journal of Obesity, 38*(7), 906-911. doi:10.1038/ijo.2014.19

McIntyre, L., Williams, J. V., Lavorato, D. H., & Patten, S. (2013). Depression and suicide ideation in late adolescence and early adulthood are an outcome of child hunger. *Journal of Affective Disorders, 150*(1), 123-129. doi:10.1016/j.jad.2012.11.029

McLaughlin, K. A., & King, K. (2015). Developmental trajectories of anxiety and depression in early adolescence. *Journal of Abnormal Child Psychology, 43*(2), 311-323. doi:10.1007/s10802-014-9898-1

McPherson, K. E., Kerr, S., McGee, E., Morgan, A., Cheater, F. M., McLean, J., & Egan, J. (2014). The association between social capital and mental health and behavioural problems in children and adolescents: an integrative systematic review. *BMC Psychology, 2*(1), 7. doi:10.1186/2050-7283-2-7

Meinzer, M. C., Lewinsohn, P. M., Pettit, J. W., Seeley, J. R., Gau, J., M., Chronis-Tuscano, A., & Waxmonsky, J. G. (2013). Attention-deficit/hyperactivity disorder in adolescence predicts onset of major depressive disorder through early adulthood. *Depression and Anxiety, 30*(6), 546-553. doi:10.1002/da.22082

Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., . . . Swendsen, J. (2010). Lifetime prevalence of mental disorders in U.S. adolescents: results from the National Comorbidity Survey Replication--Adolescent Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(10), 980-989. doi:10.1016/j.jaac.2010.05.017

Nesi, J. & Prinstein, M. J. (2015). Using Social Media for Social Comparison and Feedback-Seeking: Gender and Popularity Moderate Associations with Depressive Symptoms. *Journal of Abnormal Child Psychology, 43*(8), 1427-38. doi: 10.1007/s10802-015-0020-0.

Ogden, C. L., Carroll, M. D., Kit, B. K., & Flegal, K. M. (2014). Prevalence of childhood and adult obesity in the united states, 2011-2012. *JAMA, 311*(8), 806-814. doi:10.1001/jama.2014.732

Olfson, M., Blanco, C., Liu, L., Moreno, C., & Laje, G. (2006). National trends in the outpatient treatment of children and adolescents with antipsychotic drugs. *Archives of General Psychiatry, 63*(6), 679-685. doi:10.1001/archpsyc.63.6.679

Olfson, M., Blanco, C., Liu, S., Wang, S., & Correll, C. U. (2012). National trends in the office-based treatment of children, adolescents, and adults with antipsychotics. *Archives of General Psychiatry, 69*(12), 1247-1256. doi:10.1001/archgenpsychiatry.2012.647

Ong, S. H., Wickramaratne, P., Tang, M., & Weissman, M. M. (2006). Early childhood sleep and eating problems as predictors of adolescent and adult mood and anxiety disorders. *Journal of Affective Disorders, 96*(1-2), 1-8.

Pilowsky, D. J., Wickramaratne, P., Poh, E., Hernandez, M., Batten, L. A., Flament, M. F., . . . Weissman, M. M. (2014). Psychopathology and functioning among children of treated depressed fathers and mothers. *Journal of Affective Disorders, 164*, 107-111. doi:10.1016/j.jad.2014.04.012

Pilowsky, D. J., Wickramaratne, P. J., Rush, A. J., Hughes, C. W., Garber, J., Malloy, E., . . . Weissman, M. M. (2006). Children of currently depressed mothers: a STAR*D ancillary study. *The Journal of Clinical Psychiatry, 67*(1), 126-136.

Rasic, D., Hajek, T., Alda, M., & Uher, R. (2014). Risk of mental illness in offspring of parents with schizophrenia, bipolar disorder, and major depressive disorder: a meta-analysis of family high-risk studies. *Schizophrenia Bulletin, 40*(1), 28-38. doi:10.1093/schbul/sbt114

Roomer, M. (2011). *Health care expeditures for the the five most common children's conditions, 2008: Estimates for U.S. civilian nonistitionalized children, ages 0 - 17*. Retrieved from Rockville, MD: http://www.meps.ahrq.gov/mepsweb/data_files/publications/st349/stat349.pdf

Sadock, B. J., Sadock, V. A., & Ruiz, P. (2014). *Kaplan & Sadock's Synposis of Psychiatry* (11 ed.).

SAS Institute. (2013). *SAS 9.4 language reference concepts*. Cary, NC: SAS Institute.

Scheifes, A., de Jong, D., Stolker, J. J., Nijman, H. L., Egberts, T. C., & Heerdink, E. R. (2013). Prevalence and characteristics of psychotropic drug use in institutionalized children and adolescents with mild intellectual disability. *Research in Developmental Disabilities, 34*(10), 3159-3167. doi:10.1016/j.ridd.2013.06.009

Shanahan, L., Copeland, W. E., Angold, A., Bondy, C. L., & Costello, E. J. (2014). Sleep problems predict and are predicted by generalized anxiety/depression and oppositional defiant disorder. *Journal of the American Academy of Child & Adolescent Psychiatry, 53*(5), 550-558.

Shen, H., Magnusson, C., Rai, D., Lundberg, M. Le-Scherban, F., Dalman, C. & Lee, B. K. (2016). Associations of parental depression with child schol performance at age 16 years in Sweden. JAMA Psychiatry, 73(3), 239-246. doi: 10.1001/jamapsychiatry.2015.2917.

Sherer, S., & Radzik, M. (2016). Chapter 3: Psychosocial Development in Normal Adolescents and Young Adults. In L. S. Neinstein, D. K. Katzman, S. T. Callahan, C. M. Gordon, A. Joffe, & V. I. Rickert (Eds.), *Neinstein's Adolescent and Young Adult Health Care: A Practical Guide* (6th ed., pp. 38-42). Philadelphia: Lippincott Williams & Wilkins.

Shomaker, L. B., Tanofsky-Kraff, M., Stern, E. A., Miller, R., Zocca, J. M., Field, S. E., . . . Yanovski, J. A. (2011). Longitudinal Study of Depressive Symptoms and Progression of Insulin Resistance in Youth at Risk for Adult Obesity. *Diabetes Care, 34*(11), 2458-2463. doi:10.2337/dc11-1131

Singh, G. K., Kenney, M. K., Ghandour, R. M., Kogan, M. D., & Lu, M. C. (2013). Mental Health Outcomes in US Children and Adolescents Born Prematurely or with Low Birthweight. *Depression Research and Treatment, 2013*, 570743. doi:10.1155/2013/570743

Skrove, M., Romundstad, P., & Indredavik, M. S. (2013). Resilience, lifestyle and symptoms of anxiety and depression in adolescence: the Young-HUNT study. *Social Psychiatry and Psychiatric Epidemiology, 48*(3), 407-416. doi:10.1007/s00127-012-0561-2

Steinhausen, H. C. (2015). Recent international trends in psychotropic medication prescriptions for children and adolescents. *European Child & Adolescent Psychiatry, 24*(6), 635-640.

Steyerberg, E. W., Vickers, A. J., Cook, N. R., Gerds, T., Gonen, M., Obuchowski, N., . . . Kattan, M. W. (2010). Assessing the performance of prediction models: a framework for traditional and novel measures. *Epidemiology, 21*(1), 128-138. doi:10.1097/EDE.0b013e3181c30fb2

Substance Abuse Mental Health Services Administration. (2015). *Behavioral Health Barometer: United States, 2014* (HHS Publication No. SMA–15–4895). Retrieved from Rockville, MD:

Sugaya, L., Hasin, D. S., Olfson, M., Lin, K. H., Grant, B. F., & Blanco, C. (2012). Child physical abuse and adult mental health: a national study. *Journal of Traumatic Stress, 25*(4), 384-392. doi:10.1002/jts.21719

Taylor, R. M., Gibson, F., & Franck, L. S. (2008). The experience of living with a chronic illness during adolescence: a critical review of the literature. *Journal of Clinical Nursing, 17*(23), 3083-3091.

Tevie, J., & Shaya, F. T. (2015). Association between mental health and comorbid obesity and hypertension among children and adolescents in the US. *European Child & Adolescent Psychiatry*(1435-165X (Electronic)).

Vasilenko, S. A., & Lanza, S. T. (2014). Predictors of multiple sexual partners from adolescence through young adulthood. *The Journal of Adolescent Health, 55*(4), 491-497. doi:10.1016/j.jadohealth.2013.12.025

Vidair, H. B., Reyes, J. A., Shen, S., Parrilla-Escobar, M. A., Heleniak, C. M., Hollin, I. L., . . . Rynn, M. A. (2011). Screening parents during child evaluations: exploring parent and child psychopathology in the same clinic. *Journal of the American Academy of Child & Adolescent Psychiatry, 50*(5), 441-450. doi:10.1016/j.jaac.2011.02.002

Visser, S. N., Danielson, M. L., Bitsko, R. H., Holbrook, J. R., Kogan, M. D., Ghandour, R. M., . . . Blumberg, S. J. (2014). Trends in the parent-report of health care provider-diagnosed and medicated attention-deficit/hyperactivity disorder: United States, 2003-2011. *Journal of the American Academy of Child & Adolescent Psychiatry, 53*(1), 34-46.e32. doi:10.1016/j.jaac.2013.09.001

Wade, T. J., Cairney, J., & Pevalin, D. J. (2002). Emergence of gender differences in depression during adolescence: national panel results from three countries. *Journal of the American Academy of Child & Adolescent Psychiatry, 41*(2), 190-198.

Westra, B. L., Savik, K., Oancea, C., Choromanski, L., Holmes, J. H., & Bliss, D. (2011). Predicting improvement in urinary and bowel incontinence for home health patients using electronic health record data. *Journal of Wound, Ostomy and Continence Nursing, 38*(1), 77-87. doi:10.1097/WON.0b013e318202e4a6

Wittchen, H. U., Kessler, R. C., Pfister, H., & Lieb, M. (2000). Why do people with anxiety disorders become depressed? A prospective-longitudinal community study. *Acta Psychiatrica Scandiavica Supplementum, 102*, 14-23.

Woods, H. C. & Scott, H. (2016). #Sleepyteens: Social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *Journal of Adolescence, 51,* 41-49. doi: 10.1016/j.adolescence.2016.05.008