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The Prevalence of Overweight and Obesity Among Adolescents With Chronic Health Conditions

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THE PREVALENCE OF OVERWEIGHT AND OBESITY AMONG ADOLESCENTS WITH CHRONIC HEALTH CONDITIONS

by

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WITH CHRONIC HEALTH CONDITIONS

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ABSTRACT

THE PREVALENCE OF OVERWEIGHT AND OBESITY AMONG ADOLESCENTS WITH CHRONIC HEALTH CONDITIONS

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Overweight and obesity during adolescence is a primary public health concern as these conditions are associated with several chronic health conditions (cardiovascular disease, Type II Diabetes, etc.) that can affect individuals into adulthood. The purpose of this study was two-fold: 1) to examine the prevalence of overweight and obesity among adolescents with chronic health conditions; and 2) To examine the odds of physical activity and sedentary behaviors in adolescents with chronic health conditions, viewing whether the presence of chronic health conditions impact PA and sedentary behaviors.

Analyses included 28,778 adolescents aged 10-17 from the 2011-12 National Survey of Children's Heath. Adolescents were grouped into one of nine different groups based on body mass index classification (normal weight, overweight, obese) and the presence of chronic health conditions (no chronic health conditions, one chronic health condition, or two or more chronic health conditions). Outcomes included the prevalence of overweight and obesity among chronic health conditions group, as well as regular physical activity, sports participation, club participation, television viewing time, and computer usage. Approximately 15% of adolescents with no secondary chronic health conditions were classified as overweight, and 13% were classified as obese. Of those with one secondary chronic health condition, 17% overweight, and 16.5% were classified as obese. For adolescents with two or more secondary chronic health conditions, 17.9%

were classified as overweight, and 22.6% were classified as obese. Adolescents classified as overweight with two or more chronic health conditions were 26% less likely to engage in regular physical activity ($p=0.015$), 47% less likely to have participated in a sport within the past 12 months ($p<0.001$), and 32% less likely to have participated in a club in the past 12 months ($p<0.001$) when compared to their peers without secondary chronic health conditions. Adolescents classified as obese with one chronic health condition were 31% more likely to have access to electronic devices in the bedroom ($p=0.004$). Additionally, obese adolescents with one secondary chronic health condition were 19% less likely to participate in regular physical activity ($p=0.035$) and 18% less likely to have participated in a sport within the past 12 months compared to their peers with no secondary chronic health conditions ($p=0.025$). Adolescents classified as obese with two or more chronic health conditions were 45% less likely to participate in regular physical activity, 49% less likely to have participated in a sport within the past 12 months ($p<0.001$), and 45% less likely to have participated in a club within the past 12 months ($p<0.001$) when compared to their peers without secondary chronic health conditions. These results support the need for intervention strategies to include adolescents in regular physical activities.

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DEDICATION

This dedication is to my thesis committee: Dr. McCoy, Dr. Credeur, Dr. Krebs, and Dr. Speed, who were mentioned in the acknowledgements. They have given me constructive criticism and helpful feedback to improve this thesis to the best of my ability. I would also like to dedicate this thesis to my family: my mother, Cathey Levy, my father, Jeffrey Levy, and my brother, Brooks Levy. My family is my entire rock, and without their love and support, I would not be near where I am today. The University of Southern Mississippi also receives a huge dedication, because it has shaped me in so many positive ways, and I am forever thankful for the students, faculty, and staff that the University has to offer. I am extremely grateful for my graduate assistant advisor, Ms. Laurie Benvenutti. I have been working as a Graduate Assistant in the Office of Undergraduate Admissions, and having her as an advisor and now close friend has taught me not only job responsibilities, but life lessons and advice.

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LIST OF ABBREVIATIONS

ACSM	American College of Sports Medicine
ASD	Autism Spectrum Disorder
BMI	Body Mass Index
CDC	Center for Disease Control and Prevention
CI	Confidence Interval
NSCH	National Survey of Children's Health
PA	Physical Activity
ADHD	Attention Deficit Hyperactivity Disorder

CHAPTER I - INTRODUCTION

The prevalence of overweight and obesity in adolescents is increasing from year to year, particularly in adolescents with chronic health conditions (Schalkwijk et al., 2015). Obesity may be the result of many factors, some of which include nutritional intake, lack of physical activity, parental lifestyle/behaviors, or genetic factors. The increase in overweight and obesity is concerning for future generations as there is a positive association between obesity and chronic health conditions such as Type II diabetes, hypertension, atherosclerosis, cardiovascular disease (CVD), joint pain, depression, etc. (Brown, Fujioka, Wilson, & Woodworth, 2009; Neilsen, 2010). Additionally, overweight and obese individuals can have chronic inflammatory response magnifying the effects of obesity, increasing the risk for the development of comorbid chronic health conditions (Neilsen, 2010). A study by Ogden et al. (2016) examining the prevalence of overweight and obesity in children and adolescents (2-19 years old) in the United States showed a 17% increase in the prevalence of obesity from 2011-2014. Most recent evidence suggests that 31.8% of children and adolescents aged 2-19 years are overweight or obese in the United States, with 16.9% of 2-19-year-olds classified as obese (Ogden, Carroll, Kit, & Flegal, 2014).

Excess body fat is associated with an increased risk for developing chronic health conditions such as cardiovascular disease (Ogden, Carroll, Kit, & Flegal, 2012). This is possibly due to the excess adipose tissue on the body effecting chemical responses in the body, possibly leading to insulin resistance (Type II Diabetes), which has the risk of developing into CVD (Sowers, 2003). A nationally representative sample showed that 70% of obese children and adolescents between the ages 5 and 17 years have one or more

positive risk factor for developing CVD, demonstrating the relationship between obesity and secondary chronic health conditions.

In addition to the physical consequences of excess body fat, overweight and obese adolescents and children often develop psychological issues such as low self-esteem, nervousness, and sadness (Ebbeling, Pawlak, & Ludwig, 2002). Studies have shown that society tends to "mold" overweight and obese individuals into certain categories such as lazy, unsuccessful, or having a lack of hygiene, etc. These "molds" that society places on overweight and obese individuals leads to the development of low self-esteem and other psychological issues mentioned above. The development of low self-esteem and psychological issues can lead to excess weight gain and decreased physical activity from adolescent age into adulthood (Goodman & Whitaker, 2012).

Regular physical activity in adolescents is important for healthy growth and development as well as the prevention of chronic health conditions (McCambridge et al., 2006). It is recommended that children and adolescents engage in 60 minutes or more of physical activity on all, if not most, days of the week (Pate et al., 1995 & McCoy, Jakicic, & Gibbs, 2016). Moderate intensity physical activity should make up most of the 60 minutes per day, with vigorous intensity activity as well as muscle and bone strengthening activities incorporated on 3 or more days per week (Thompson, Arena, Riebe, & Pescatello, 2013; McCoy et al., 2016; American College of Sports Medicine, 2014). A study completed in 2015-2016 examining physical activity levels found that only 48.6% of children and adolescents meet the recommendation of 60 minutes per day (Center for Disease Control and Prevention, 2016). Additionally, 24.7% watch television

for 3 or more hours per day. Among these children and adolescents, 16% were overweight and 13.9% of students were obese.

Given this background, participation in physical activity is beneficial for healthy growth and development (Gabel, Macdonald, Nettlefold, & McKay, 2017). Being physically active is extremely important for the growth and support of bones in the body, however many children and adolescents do not meet this recommendation.

Obesity in Children and Adolescents

A study examining trends in the prevalence of overweight and obesity in US children and adolescents showed a drastic increase in obesity from 6.5% in 1980 to 19.6% in 2008 in children 6 to 11 years old, and an increase from 5.0% to 18.1% in adolescents aged 12 to 19 years (Ogden et al., 2012). Physical, psychological, and social health are all affected by the presence of chronic health conditions, including obesity. Some of these include deconditioning, difficulty in completing physical and mental tasks, as well as exclusion from social groups, etc. (Lewis, Napolitano, Buman, Williams, & Nigg, 2017). When a child becomes overweight or obese, they are more likely to continue down that path as they transition into adulthood (Serdula et al., 1993). A review article by Serdula et al. (1993) found that approximately one-third of obese preschool children were also obese into adulthood, and approximately half of obese school-aged children are obese as adults. A meta-analysis examining overweight and obese children and adolescents found that approximately 55% of obese children will still be obese as adolescents, and approximately 80% of those adolescents will be obese as adults (Simmonds, Llewellyn, Owen, & Woolacott, 2016). The increasing prevalence of excess weight in children has caused an increase in public health concern due to the increased

risk of developing obesity-related morbidities in adulthood as well as early mortality (Ebbeling et al., 2002).

Chronic Health Conditions

Long term health conditions are defined as any condition that effects an individual mentally or physically, with these conditions potentially effecting activities of daily living and/or leisure activities (Healthcare Cost and Utilization Project, 2015). Secondary conditions are defined as a medical, social, emotional, family, or community issues that an individual with a primary disabling chronic condition is likely to experience (Ham & Ainsworth, 2010). A secondary condition often develops in response to another condition, such as a positive correlation between obesity and joint pain, or obesity and depression (Turk, 2006). Secondary chronic health conditions become increasingly more prevalent when an individual is either overweight or obese, thus, it is crucial to examine their prevalence of these conditions in relation to indices such as BMI (Healthcare Cost and Utilization Project, 2015).

Association Between Obesity and Chronic Health Conditions

There is a positive association between excess body weight and comorbid chronic health conditions (McCoy et al., 2016 & Rimmer, Rowland, & Yamaki, 2007). McCoy et al., (2016), examined the prevalence of overweight and obesity in children with Autism Spectrum Disorder and found that adolescents with autism are 27% more likely to be overweight, and 70% more likely to be obese compared to their typically developing peers (McCoy et al., 2016.) Additionally, adolescents with physical and mental disabilities are more likely to be overweight or obese compared to adolescents without physical and mental disabilities (Rimmer et al., 2007; McCoy et al., 2016). A secondary

analysis examining associations between obesity and intellectual and developmental disabilities demonstrated that obese adolescents with intellectual or developmental disabilities have a greater prevalence of secondary chronic health conditions related to obesity, such as hypertension and Type II Diabetes, compared to their peers without an intellectual or developmental disability (Rimmer, Yamaki, Lowry, Wang, & Vogel, 2010). Excess body fat is also associated with other secondary chronic health conditions such as Type II Diabetes due to the increase in insulin resistance associated with obesity (Goran, Ball, & Cruz, 2003). Sowers (2003), looked at chemical responses to excess adipose tissue, and found that decreasing the adipose tissue on the body can result in improvements in insulin sensitivity, especially in adipose tissue around the abdomen. A study examining associations between obesity, mobility limitations and physical disability in adolescents found that obese adolescents had an increased prevalence of both mobility limitations and physical disabilities compared to their normal weight peers (Rimmer et al., 2007). These associations demonstrate the need for combating overweight and obesity within these populations.

Consequences of Overweight/Obesity and Chronic Health Conditions

As stated previously, overweight and obesity are positively associated with other chronic health conditions (Rimmer et al., 2007). Adolescents with chronic health conditions are prone to pain, fatigue, deconditioning, social isolation, and difficulty performing physical movements, when compared to peers without chronic health conditions (Pinquart & Shen, 2011). The presence of chronic health conditions can lead to difficulties in keeping up with peers, leading to reduced inclusion in specific activities. Due to the association between physical activity and weight management, public health

professionals are constantly examining how to include adolescents with chronic health conditions in regular physical activities with their peers to decrease their likelihood of overweight and obesity (Rimmer et al., 2007; McCoy et al., 2016).

Physical Activity in Adolescents

The recommendation for physical activity in children and adolescents is 60 minutes or more of physical activity on all, if not most, days of the week (Pate et al., 1995; McCoy et al., 2016). Moderate intensity physical activity should make up the majority of the 60 minutes per day of total PA, with vigorous intensity activities and muscle and bone strengthening activities incorporated on 3 or more days per week (Thompson et al., 2013; American College of Sports Medicine, 2014; McCoy et al., 2016). Regular physical activity in adolescents is important for healthy growth and development as well as the prevention of chronic health conditions (McCambridge et al., 2006). The benefits of regular physical activity include: improved cognitive function, improved physical performance and fitness, improved endurance, and improved psychological outcomes (O'Dea, 2003). While regular physical activity is related to improved health outcomes, children and adolescents do not meet physical activity guidelines. In fact, more children and adolescents engage in sedentary behaviors, which have a negative effect on these areas (O'Dea, 2003). Only 42% of children ages 6 to 11 meet the recommendation while only 8% of 12- to 19-year-olds meet the recommendation of physical activity levels, while the majority engage in sedentary behaviors (Schulz, Anner, & Hills, 2009).

Sedentary Behavior in Adolescents

According to the American Academy of Pediatrics (2016) and Ghose (2013), children should spend less than 2 hours per day engaging in leisure-time sedentary behaviors such as screen viewing, computer usage, playing video games, etc. Sedentary behaviors are associated with both overweight and obesity in children and adolescents (Crespo et al., 2001; Epstein, Paluch, Gordy, & Dorn, 2000; McCoy et al., 2016). A study examining associations between objectively measured sedentary behaviors and excess body fat shows that sedentary behavior was positively associated with overweight and obesity in children and adolescents (Mitchell et al., 2009 & McCoy et al., 2016). Guardian-reported data examining adolescents aged 2-18 years showed that adolescents spend approximately 25% of their hours awake throughout the day watching television, which may be a contributing factor in weight gain (Robinson et al., 2001). Additionally, access to electronics in the bedroom increases the likelihood of overweight or obesity, potentially due to increased sedentary hours, eating while watching television without supervision, as well as commercials promoting the consumption of unhealthy foods (Boseley, 2017 & McCoy et al., 2016). Determining the reasons behind why adolescents choose either sedentary or physical activities can assist public health institutes in developing a plan to decrease physical inactivity in adolescents, potentially decreasing the prevalence of overweight and obesity (Epstein & Roemmich 2001 & McCoy et al., 2016)).

Association between Overweight and Obesity and Activity Levels

Much evidence exists supporting the positive relationship between body fat percentages and physical activity levels (Alliance, 2006; Janz, Burns, & Levy, 2005;

McCambridge et al., 2006; McCoy et al., 2016). Janz et al. (2005) examined the association between sedentary behaviors and adiposity and found that sedentary behaviors such as screen viewing time were linked to excess body fat, while adolescents that participated in vigorous activities had less body fat. A study by McCambridge et al., (2006) examining the addition of regular physical activity in children with hypertension, showed that after 8 months of regular physical activity, blood pressure decreased. In another study examining associations between obesity and extracurricular activities showed that extracurricular club and sport participation was significantly associated with decreased obesity (Alliance, A., 2006). Regular physical activity and sports participation have been shown to be protective factors preventing overweight and obesity in adolescents (McCambridge et al., 2016; Alliance, 2006; McCoy et al., 2016).

Gaps in the Literature

Few studies exist with nationally representative samples on overweight and obesity in adolescents with secondary chronic health conditions. Several studies, including McCoy et al., 2016 & Rimmer et al., 2007, support the association between obesity and secondary chronic health conditions are related to one another, however, there is a lack of recent evidence on the prevalence of overweight and obesity in this population. This thesis examined the prevalence of overweight and obesity in adolescents with secondary chronic health conditions. Additionally, this thesis adds to the literature in that it examined the odds of physical activity and sedentary behaviors within adolescents with secondary chronic health conditions.

Purpose

The purpose of this study was two-fold: 1) to examine the prevalence of overweight and obesity in adolescents with secondary chronic health conditions; and 2) to determine the relationships between overweight and obesity with the presence of secondary chronic health conditions and physical activity and sedentary behaviors.

Specific Aims

1. To describe the prevalence of overweight and obesity (BMI classification) in adolescents aged 10-17 with secondary chronic health conditions.
2. To examine the odds of physical activity behaviors in adolescents aged 10-17 with overweight and/or obesity and the presence of secondary chronic health conditions.
    a. To examine regular physical activity (≥3 days per week) in those with no secondary chronic health conditions, one secondary chronic health condition, and two or more secondary chronic health conditions.
    b. To examine sports participation in those with no secondary chronic health conditions, one secondary chronic health condition, and two or more secondary chronic health conditions.
    c. To examine organized club participation in those with no secondary chronic health conditions, one secondary chronic health condition, and two or more secondary chronic health conditions.
3. To examine the odds of sedentary behaviors in adolescents aged 10-17 years with overweight/obesity and the presence of secondary chronic health conditions.

a. To examine screen time in those with no secondary chronic health conditions, one secondary chronic health condition, and two or more secondary chronic health conditions.
b. To examine computer use in those with no secondary chronic health conditions, one secondary chronic health condition, and two or more secondary chronic health conditions.
c. To examine access to electronics in the bedroom in those with no secondary chronic health conditions, one secondary chronic health condition, and two or more secondary chronic health conditions.

Hypotheses

1. Descriptive analyses will report the unadjusted prevalence of overweight and obesity in adolescents aged 10-17 with secondary chronic health conditions.
2. Overweight and obese adolescents aged 10-17 with one or more secondary chronic health conditions are less likely to participate in physical activity behaviors compared to their peers without secondary chronic health conditions.
    a. Overweight and obese adolescents with one or more secondary chronic condition are less likely to participate in regular physical activity (≥3 days per week) compared to their peers without secondary chronic health conditions.
    b. Overweight and obese adolescents with one or more secondary chronic health condition are less likely to participate in organized sports compared to their peers without secondary chronic health conditions.

c. Overweight and obese adolescents with one or more secondary chronic health condition are less likely to participate in a club or organization compared to their peers without secondary chronic health conditions.

3. Overweight and obese adolescents aged 10-17 with one or more secondary chronic health condition are more likely to engage in sedentary behaviors compared to their peers without secondary chronic health conditions.
    a. Overweight and obese adolescents with one or more secondary chronic health condition are more likely to have screen time ≥2 hours per day compared to their peers without secondary chronic health conditions.
    b. Overweight and obese adolescents with one or more secondary chronic health condition are more likely to have screen viewing/computer usage time ≥ 2 hours per day compared to their peers without secondary chronic health conditions.
    c. Overweight and obese adolescents with one or more secondary chronic health condition are more likely to have electronic access in their bedrooms compared to their peers without secondary chronic health conditions.

CHAPTER II - METHODS

Participants

Data used in this study is de-identified data from the 2011-2012 National Survey of Children's Health (NSCH). The NSCH is a nationally-representative questionnaire based on adolescents' physical, dental, emotional and mental health, health insurance coverage, health care access and quality, community and school activities, and neighborhood safety and support. Questionnaires administered by the NSCH are volunteer-based and conducted using random digit dialing. The random digit dialing is conducted by the NSCH's partners and sponsors: The National Center for Health Statistics (2011), Centers for Disease Control, and the Maternal and Child Health Bureau. Completed surveys are available for public use through their website. Questions are asked to the guardian of the adolescent with the most knowledge of the adolescent's health status, with most of responses coming from the mother. Parents/guardians were asked if they had an adolescent(s) under 17 years of age living with them and if they would voluntarily participate in the survey. Questionnaires were completed in approximately thirty-minutes and all answers were reported based on the guardian's current knowledge on the adolescent's health status and behaviors (National Survey of Children's Health, 2012).

The sample was limited to adolescents between the ages of 10-17 years (n=21,581) as body mass index (BMI) classification was only available for adolescents in this age group. Additionally, adolescents were excluded if they had missing data for outcome variables including: Current chronic health conditions (n=909), BMI

classification (n=1,380), screen time (n=140), computer use (n=283), access to electronic devices in bedroom (n=18), physical activity (n=278), sports participation (n=13), and club participation (n=19).

Table 1 describes the grouping for this study. Adolescents were grouped by BMI classification and presence of secondary chronic health conditions: normal weight with no secondary chronic health conditions, normal weight with one secondary chronic health condition, and normal weight with two or more secondary chronic health conditions, overweight with no secondary chronic health conditions, overweight with one secondary chronic health condition, and overweight with two or more secondary chronic health conditions, obese with no secondary chronic health conditions, obese with one secondary chronic health condition, and obese with two or more secondary chronic health conditions. Though temporality cannot be determined from the data available, for the purposes of this study overweight and obesity will serve as the primary chronic health condition, and any other diagnosed chronic health condition will be considered secondary conditions.

Table 1

Grouping

Normal Weight	**Overweight**	**Obese**
No secondary chronic health conditions	No secondary chronic health conditions	No secondary chronic health conditions
One secondary chronic health condition	One secondary chronic health condition	One secondary chronic health condition
Two or more secondary chronic health conditions	Two or more secondary chronic health conditions	Two or more secondary chronic health conditions

Measures

Secondary chronic health conditions were determined based on classification as a chronic disease by the Agency for Healthcare Research and Quality and availability in the NSCH database. The Chronic Condition Indicator groups ICD-9-CM diagnosis into either chronic or not chronic (Hwang, Weller, Ireys, & Anderson, 2001). This specific indicator was chosen because it uses a physician panel to group conditions as chronic or acute (Hwang et al., 2001).

Secondary Chronic Health Condition Classification

Secondary chronic health conditions were classified as either 'yes,' 'no,' or 'has been told their adolescent has the secondary chronic health condition but does not currently have' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has the condition, even if he/she does not have the condition now.' 'Yes' responses were then classified as having the secondary chronic health condition, 'no' responses were classified as not having the condition, and 'has been their child has the secondary condition but does not currently have' responses were excluded from data analysis to prevent any misclassification.

Autism Spectrum Disorder Autism spectrum disorder (ASD) was classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has Autism, Asperger's Disorder, pervasive developmental disorder, or other autism spectrum disorder, even if he/she does not have the condition now.'

Asthma Asthma was classified by ‘yes’ or ‘no’ response to the question ‘please tell me if a doctor or other health care provider has ever told you that your child has asthma, even if he/she does not have the condition now.’

Depression Depression was classified by ‘yes’ or ‘no’ response to the question ‘please tell me if a doctor or other health care provider has ever told you that your child has depression, even if he/she does not have the condition now.’

Anxiety Anxiety was classified by ‘yes’ or ‘no’ response to the question ‘please tell me if a doctor or other health care provider has ever told you that your child has anxiety problems, even if he/she does not have the condition now.’

Disruptive Conduct Disorder: Attention Deficit Hyperactive Disorder (ADHD) ADHD was classified by ‘yes’ or ‘no’ response to the question ‘please tell me if a doctor or other health care provider has ever told you that your child has Attention Deficit Disorder or Attention Deficit Hyperactive Disorder, even if he/she does not have the condition now.’

Learning Disability Learning disability was classified by ‘yes’ or ‘no’ response to the question ‘please tell me if a doctor or other health care provider has ever told you that your child has a learning disability, even if he/she does not have the condition now.’

Developmental Delay Developmental delay was classified by ‘yes’ or ‘no’ response to the question ‘please tell me if a doctor or other health care provider has ever told you that your child has any developmental delay, even if he/she does not have the condition now.’

Intellectual Disability/Mental Retardation Intellectual disability was classified by ‘yes’ or ‘no’ response by to the question ‘please tell me if a doctor or other health care

provider has ever told you that your child has an intellectual disability or mental retardation, even if he/she does not have the condition now.'

Cerebral Palsy Cerebral Palsy was classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has cerebral palsy, even if he/she does not have the condition now.'

Speech Disorders Speech Disorders were classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has speech or other language problems, even if he/she does not have the condition now.'

Tourette's syndrome Tourette's syndrome was classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has Tourette's syndrome, even if he/she does not have the condition now.'

Diabetes Diabetes was classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has diabetes, even if he/she does not have the condition now.'

Epilepsy/Seizures Epilepsy or Seizures were classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has epilepsy or seizure disorder, even if he/she does not have the condition now.'

Hearing Disabilities Hearing disabilities were classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has hearing problems, even if he/she does not have the condition now.'

Vision Disabilities Vision disabilities were classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has vision problems that cannot be corrected with standard glasses or contact lenses, even if he/she does not have the condition now.'

Bone, Joint, or Muscle Disabilities Bone, joint, or muscle disabilities were classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has a bone, joint, or muscle disability even if he/she does not have the condition now.'

Brain Injury or Concussion Brain injury or concussion were classified by 'yes' or 'no' response to the question 'please tell me if a doctor or other health care provider has ever told you that your child has a brain injury or concussion even if he/she does not have the condition now.'

BMI Classification

BMI was determined by the adolescents' parent-reported height and weight, then dividing their weight (kilograms) by their height in meters (squared), kg/m^2, and grouped into normative values. (National Survey of Children's Health, 2012). Normal weight was classified as falling between the 5^{th} percentile and $<85^{th}$ percentile, overweight was classified as $\geqq 85^{th}$ and $<95^{th}$ percentile, and obesity was classified as $\geq 95^{th}$ percentile for the specific age and sex chart, guidelines in reference to the NSCH through the Center of Disease Control (Center of Disease Control and Prevention, 2016).

Physical Activity

The guardian was asked 'how many days during the past week did your child exercise, play a sport, or participate in a physical activity for at least twenty-minutes that

made them sweat and breathe hard' and 'how many days during the past week did the child engage in a vigorous physical activity.' Answers ranged from 0 to 7 days and were then grouped as 'not regularly physically active' if < 3 days and 'regularly physically active' if ≥3 days (Walter, Gordon, & Pescatello, 2010). Throughout this study, adolescents will be grouped as 'sedentary' if they fall <3 days per week of physical activity and 'active' if they fall ≥3 days per week of physical activity.

Organized Sports Participation

Guardians were asked 'during the past 12 months, was your child on a sports team, or did he/she take sports lessons after school or on the weekends.' 'Yes' or 'no' responses were reported.

Club Participation

Guardians were asked 'during the past 12 months, did your child participate in any clubs or organizations after school or on the weekends.' They also were asked if their child participated in any other organized activities such as music, dance, language, or other arts. Guardians reported either 'yes' or 'no' responses.

Sedentary Behavior

Screen time Guardians were asked 'On an average weekday, about how much time does your child usually spend in front of a TV watching TV programs, videos, or playing video games.' Reponses were then dichotomized into ≥ 2 hours/day and < 2 hours per day (Hinkley, Salmon, Okely, Crawford, & Hesketh, 2012).

Computer Usage Guardians were asked 'On an average weekday, about how much time does your child usually spend with computers, cell-phones, handheld videogames, and other electronic devices, doing other things than school work' and 'does

your child have computer access in their bedroom.' Reponses were then dichotomized into ≥ 2 hours per day and < 2 hours per day (Hinkley et al., 2012).

Covariates

Age, gender, sex, race, household income, highest education in the household, and educational setting were adjusted for in all analyses. Covariates were chosen based on potential for confounding and previous literature on obesity in chronic conditions (Chen, Kim, Houtrow, & Newacheck, 2010).

Statistical Analysis

Analyses were completed using SPSS, version 23 (SPSS Inc.) Chi square analyses were used to determine differences between groups. Correlational ratio was determined by the logistic regression to observe the relationship between BMI classification and presence of secondary conditions and all outcome variables. This was used to compare the relationship between independent groups, and also to view the relationships and differences between the groups as a whole. This determined the type of relationship between secondary chronic health conditions and BMI, while considering physical activity behaviors, sports participation, club participation, screen time, and computer usage. Logistic regression models were utilized for examining the odds of sedentary and physical activity behaviors and BMI/secondary condition classifications. For this study, dependent variables were BMI classification and presence of secondary chronic health conditions; physical activity, sports participation, club participation, screen time, and computer time served as independent variables. Significance was set at $p<0.05$.

CHAPTER III – RESULTS

Specific Aim I

Analyses included 28,778 adolescents aged 10-17; 21,581 reported no chronic health conditions, 4,514 reported one chronic health condition, and 2,683 reported two or more chronic health conditions. The average age of participants was 13.6 ± 2.3 years ($p>0.05$, not significant). Compared to their normal weight peers, adolescents with chronic health conditions were more likely to be male (52.4% and 58% vs. 46.7% respectively, ($p<0.001$), more likely to live in a household <133% of the federal level (20.1% and 28.1% vs. 17% respectively, $p<0.001$), and less likely to have a guardian with >12 years of education (78.9% and 72.8% vs. 80% respectively, $p<0.001$). Demographic characteristics broken down by chronic health condition status are shown in Table 2.

Table 2

Demographic Characteristics

	No Chronic Health Conditions (n=21,581)	One Chronic Health Condition (n=4,514)	Two or more Chronic Health Conditions (n=2,683)	*p* value
Age, years: M (SD)	13.6 (2.3)	13.5 (2.3)	13.5 (2.3)	0.331
Sex, male (%)	46.7	52.4	58.0	**<0.001**
Race, White non-Hispanic (%)	67.6	67.0	69.3	**<0.001**
Household income[a] (%)				**<0.001**
Poor	17.0	20.1	28.1	
Near Poor	6.9	7.4	9.9	
Not Poor	76.2	72.5	62.0	
Highest education[b] (%)				**<0.001**
<12 years	4.8	4.8	6.5	
12 years	15.2	16.3	20.8	
>12 years	80.0	78.9	72.8	
Education setting (%)				**<0.001**
Public school	86.0	85.8	86.6	
Private school	11.2	11.7	9.5	
Home school	2.5	2.2	3.0	

[a] Income is grouped into three categories based on household federal poverty level: "poor," <133% poverty; "near poor," ≥133% poverty but <185% poverty; "not poor," ≥185% poverty.
[b] Highest level of education in family
Bold values are statistically significant (p <0.05)

The unweighted prevalence of secondary chronic health conditions in shown in Table 3. A total of 21,581 were classified as having no secondary chronic health conditions, 4,514 reported one secondary chronic health condition, and 2,683 reported having two or more secondary chronic health conditions. Secondary chronic health conditions were separated into physical, developmental, and behavioral/emotional categories.

Table 3

Unweighted Prevalence of Secondary Chronic Health Conditions

Condition	Prevalence (N)	Prevalence (%)

Physical		
Cerebral Palsy	62	0.22
Asthma	2,911	10.12
Diabetes	192	0.67
Hearing Problems	306	1.06
Vision Problems	356	1.24
Bone/Joint/Muscle Problems	697	2.42
Brain Injury/Concussion	82	0.28
Developmental		
Learning Disability	1,918	6.66
Autism/Asperger's	340	1.18
Developmental Delay	626	2.18
Intellectual disability/mental retardation	278	0.97
Stuttering/Speech problems	610	2.12
Tourette's Syndrome	44	0.15
Epilepsy or Seizure Disorder	169	0.59
Behavioral/emotional		
ADD/ADHD	2,277	7.91
Depression	757	2.63
Anxiety	1,041	3.62
Behavioral Conduct	610	2.12

A total of 4,606 physical secondary chronic health condition cases were reported, with asthma reported most frequently (n=2,911), followed by bone/joint/muscle conditions (n=697), vision problems (n=356), and hearing problems (n=306). A total of 3,985 developmental secondary chronic health condition cases were reported, with learning disabilities being the most prevalent (n=1,918), followed by developmental delays (n=626), and speech problems (n=610). A total of 4,685 behavioral/emotional secondary chronic health condition cases were reported, with ADD/ADHD being the most prevalent (n=2,277), followed by anxiety (n=1,041), and depression (n=757).

Descriptive characteristics of outcome variables by secondary chronic health condition status are shown in Table 4. Approximately 72% of adolescents with no secondary chronic health conditions were classified as normal weight, 15% overweight, and 13% were classified as obese. Of those with one secondary chronic health condition, 66% of adolescents were classified as normal weight, 17% overweight, and 16.5% were

classified as obese. For adolescents with two or more secondary chronic health conditions, 59.5% were classified as normal weight, 17.9% were classified as overweight, and 22.6% were classified as obese. Chi square analyses showed adolescents with two or more secondary chronic health conditions had a higher total percent of overweight and obese classifications combined (40.5%), and adolescents with one secondary chronic health condition (34%) when compared to their peers with no secondary chronic health conditions ($p<0.001$).

A higher percentage of adolescents with secondary chronic health conditions engaged in ≥2 hours per day of screen time and computer usage (57.9% and 44.4%, respectively for two or more chronic health conditions, *p's* <0.001; 51.4% and 42.7% respectively for one chronic health condition, *p's* <0.001) compared to their peers with no chronic health conditions (47.9% and 39.2% respectively, *p's* <0.001). A lower percentage of adolescents with secondary chronic health conditions participated in regular physical activity, sports participation, and club participation (70.4%, 47.6%, and 52.6% respectively for two or more chronic health conditions, *p*'s <0.001; 78.3%, 64.7%, and 67.5% respectively for one chronic health condition, *p*'s <0.001) compared to their peers with no chronic health conditions (80.0%, 68.2%, and 69.5% respectively, *p*'s <0.001).

Table 4

Descriptive Characteristics for Outcome Variables

	No Chronic Health Conditions (n=21,581)	One Chronic Health Condition (n=4,514)	Two or more Chronic Health Conditions (n=2,683)	*p* value
Weight status (%)				**<0.001**

Normal Weight	71.3	66.0	59.5	
Overweight	15.0	17.0	17.9	
Obese	12.8	17.0	22.6	
Screen viewing time, mean (SE), hours/week(SE), hours/week	1.9 (1.7)	2.0 (1.8)	2.3 (2.0)	**<0.001**
≥ 2 hours/day (%)	47.9	51.4	57.9	
Computer Use, mean (SE), hours/week hours/week	1.8 (2.0)	2.0 (2.2)	2.1 (2.3)	**<0.001**
≥ 2 hours/day (%)	39.2	42.7	44.4	
Television access in bedroom 'yes' (%)	59.7	64.4	61.1	**<0.001**
Physical activity, mean (SE), days/weekdays/week	4.3 (2.1)	4.2 (2.2)	3.9 (2.4)	**<0.001**
Regular physical activity[a] (%)	80.0	78.3	70.4	
Sports participation (%)	68.2	64.7	47.6	**<0.001**
Club participation (%)	69.5	67.5	52.6	**<0.001**

[a]≥ 3 days/week
Bolded values significant (p <0.05)

Specific Aim II

Adjusted odds of sedentary and physical activity variables by secondary chronic health condition status in normal weight adolescents are shown in Table 5. Adjusted odds of sedentary and physical activity variables by secondary chronic health condition status in overweight weight adolescents are shown in Table 6. Adjusted odds of sedentary and physical activity variables by secondary chronic health condition status in obese adolescents are shown in Table 7.

Adolescents Classified as Normal Weight with One Secondary Chronic Health Condition

As shown in Table 5, adolescents classified as normal weight with one chronic health condition were 19% more likely to engage in 2 or more hours per day of computer usage, and 16% more likely to have access to electronics in their bedroom compared to their peers without secondary chronic health conditions (p's >0.001). Additionally, normal weight adolescents with one secondary chronic health condition were 9% less likely to have participated in a sport within the past 12 months compared to their peers

with no secondary chronic health conditions (p=0.050). Screen time, regular physical activity, and club participation were not statistically significant.

Adolescents Classified as Normal Weight with Two or More Secondary Chronic Health Conditions

Adolescents classified as normal weight with two or more chronic health conditions were 43% more likely to engage in 2 or more hours per day of daily screen time, 32% more likely to engage in 2 or more hours of computer usage compared to their peers classified as normal weight without secondary chronic health conditions. Additionally, normal weight adolescents with two or more secondary chronic health conditions were 46% less to be regularly physically active, 58% less likely to have participated in sports in the past 12 months, and 46% less likely to have participated in a club in the past 12 months compared to their peers without secondary chronic health conditions (p*'s* >0.001). Access to electronics in the bedroom was not statistically significant.

Table 5
Adjusted[a] Odds Ratios (95% confidence interval) of Sedentary Behaviors and Physical Activity in Normal Weight Adolescents with Chronic Health Conditions versus No Chronic Health Conditions

	No Chronic Health Conditions (n=21,581)	One Chronic Health Condition (n=4,514)	Two or more Chronic Health Conditions (n=2,683)
Access to electronic devices in the bedroom			
Has access	Reference	**1.16 (1.07, 1.27)**	1.01 (0.90, 1.13)
Sports participation			
Participated in a sport	Reference	**0.91 (0.83, 0.99)**	**0.42 (0.38, 0.48)**
Club participation			
Participated in a club	Reference	0.99 (0.90, 1.08)	**0.54 (0.48, 0.60)**

[a]Models adjusted for age, sex, race, household education, household income, and educational setting
Bolded values significant (p <0.05)

Figure 1. Regular Physical Activity Levels Among Normal Weight, Overweight, and Obese Adolescents

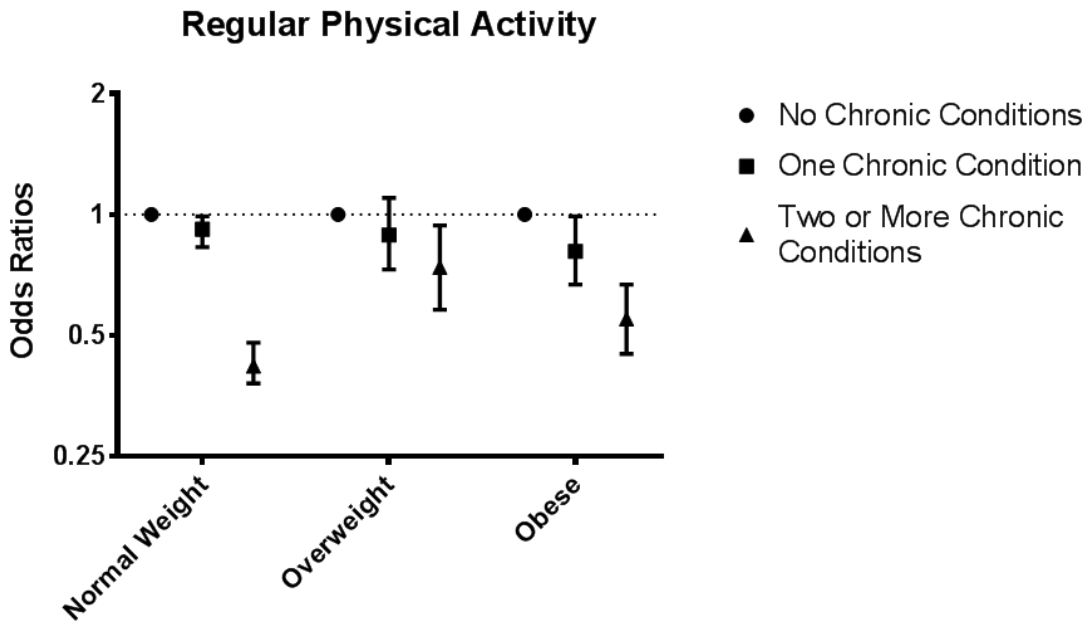


Figure 2. Computer Use Among Normal Weight, Overweight, and Obese Adolescents

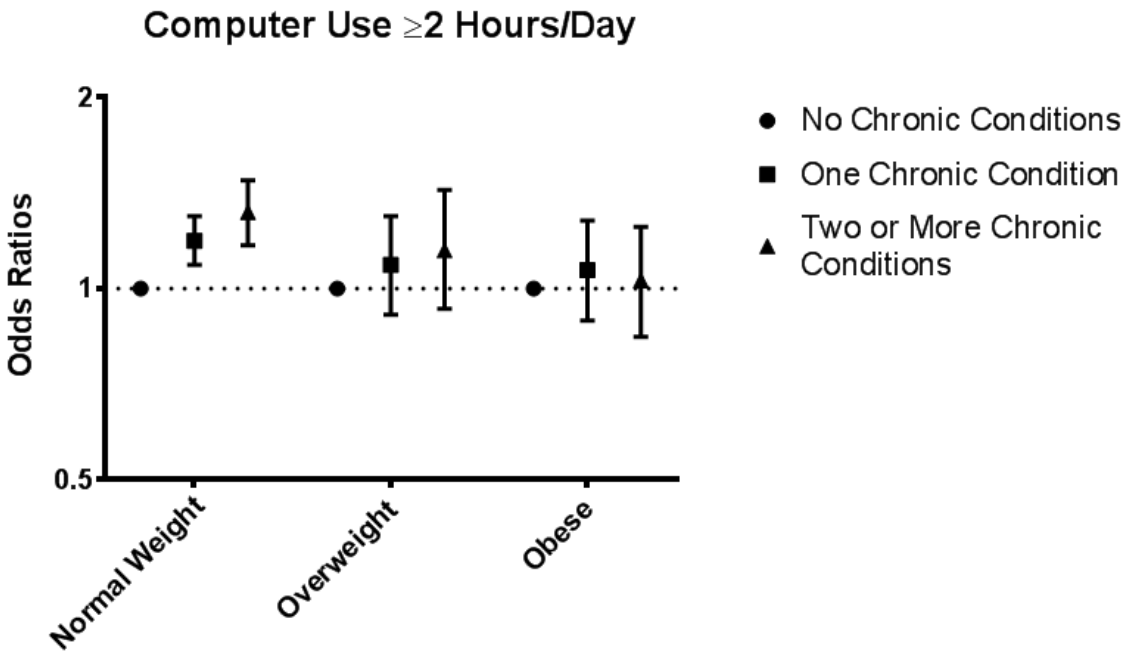
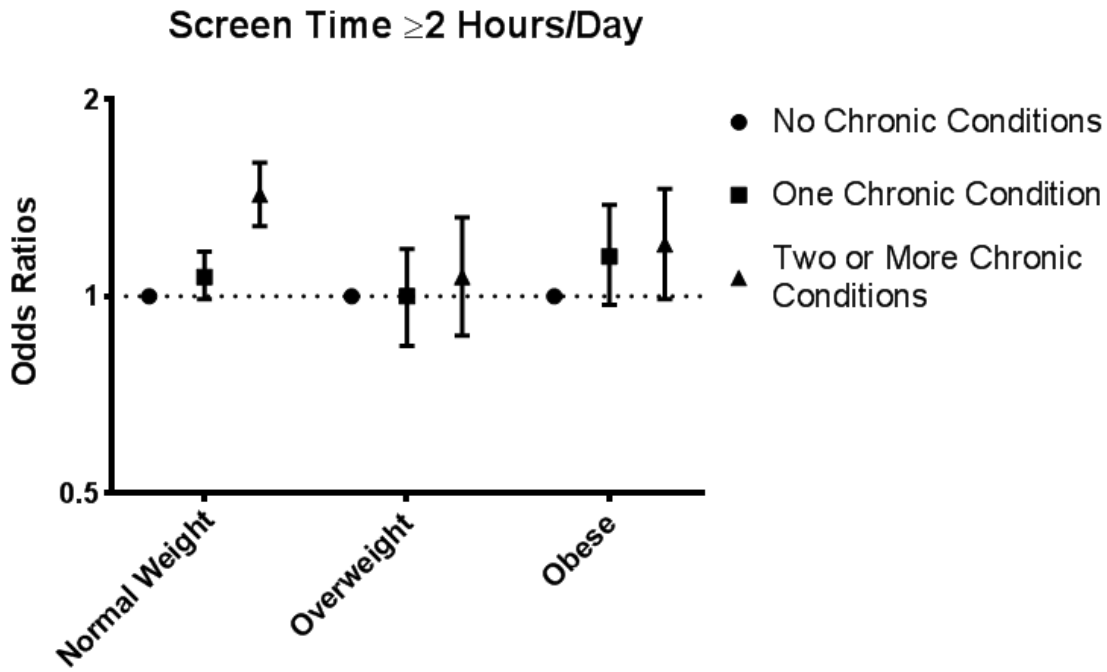


Figure 3. Screen Time Among Normal Weight, Overweight, and Obese Adolescents



Adolescents Classified as Overweight with One Secondary Chronic Health Condition

As shown in Table 6 and Figures 1, 2, and 3, daily screen time, computer usage, access to electronic devices in the bedroom, regular physical activity, sports participation and club participation were not statistically significant among adolescents classified as overweight with one chronic health condition ($p>0.05$).

Adolescents Classified as Overweight with Two or More Chronic Health Conditions

Adolescents classified as overweight with two or more chronic health conditions were 26% less likely to engage in regular physical activity ($p=0.015$), 47% less likely to have participated in a sport within the past 12 months ($p<0.001$), and 32% less likely to have participated in a club in the past 12 months ($p<0.001$) when compared to their peers without secondary chronic health conditions. Screen time, computer use, and access to electronic devices in the bedroom were not statistically significant.

Table 6

Adjusted[a] Odds Ratios (95% confidence interval) of Sedentary Behaviors and Physical Activity in Overweight Adolescents with Chronic Health Conditions versus No Chronic Health Conditions

	No Chronic Health Conditions (n=21,581)	One Chronic Health Condition (n=4,514)	Two or more Chronic Health Conditions (n=2,683)
Access to electronic devices in the bedroom			
Has access	Reference	1.14 (0.96, 1.37)	0.93 (0.75, 1.15)
Sports participation			
Participated in a sport	Reference	0.88 (0.73, 1.04)	**0.53 (0.43, 0.65)**
Club participation			
Participated in a club	Reference	0.93 (0.78, 1.12)	**0.68 (0.55, 0.84)**

[a]Models adjusted for age, sex, race, household education, household income, and educational setting
Bolded values significant ($p<0.05$)

Adolescents Classified as Obese with One Secondary Chronic Health Condition

As shown in Table 7, adolescents classified as obese with one chronic health condition were 31% more likely to have access to electronic devices in the bedroom (p=0.004). Additionally, obese adolescents with one secondary chronic health condition were 19% less likely to participate in regular physical activity (p=0.035) and 18% less likely to have participated in a sport within the past 12 months compared to their peers with no secondary chronic health conditions (p=0.025). Screen time, computer use, and club participation were not statistically significant.

Adolescents Classified as Obese with Two or More Chronic Health Conditions

Adolescents classified as obese with two or more chronic health conditions were 45% less likely to participate in regular physical activity, 49% less likely to have participated in a sport within the past 12 months, and 45% less likely to have participated in a club within the past 12 months (p*'s* <0.001) when compared to their peers without secondary chronic health conditions. Screen time, computer use, and access to electronic devices in the bedroom were not statistically significant (Table 7; Figures 1, 2, and 3).

Table 7
Adjusted[a] Odds Ratios (95% confidence interval) of Sedentary Behaviors and Physical Activity in Obese Adolescents with Chronic Health Conditions versus No Chronic Health Conditions

	No Chronic Health Conditions (n=21,581)	One Chronic Health Condition (n=4,514)	Two or more Chronic Health Conditions (n=2,683)
Access to electronic devices in the bedroom			
Has access	Reference	**1.31 (1.09, 1.58)**	1.12 (0.92, 1.37)
Sports participation			
Participated in a sport	Reference	**0.82 (0.68, 0.98)**	**0.51 (0.42, 0.62)**
Club participation			
Participated in a club	Reference	0.94 (0.78, 1.12)	**0.55 (0.45, 0.67)**

[a]Models adjusted for age, sex, race, household education, household income, and educational setting
Bolded values significant (p <0.05)

CHAPTER IV – DISCUSSION

Summary of Main Findings

This study attempted to determine the prevalence of overweight and obesity among adolescents 10-17 years of age with chronic health conditions in a nationally representative sample, and to distinguish relationships between the presence of secondary chronic health condition(s) and BMI classification, focusing on physical activity levels and behaviors, as well as sedentary behaviors. Specifically, the aims of this thesis were: (1) to describe the prevalence of overweight and obesity (BMI classification) in adolescents aged 10-17 with secondary chronic health conditions; and (2) to examine the odds of physical activity behaviors in adolescents aged 10-17 with overweight and/or obesity and the presence of secondary chronic health conditions. Hypotheses were that adolescents with secondary chronic health condition(s) are more likely to be classified as 'overweight' or 'obese' as well as more likely to engage in sedentary activities (≥ 2 hours per day of television, computer, or any other screen time), less likely to be regularly physically active (≥ 3 days per week), and less likely to participate in organized sports and clubs when compared to peers without secondary chronic health conditions.

Hypotheses were supported that the prevalence of overweight and obesity were significantly higher in adolescents with secondary chronic health conditions (Table 4). Additionally, adolescents classified as overweight and obese were significantly more likely to participate in sedentary behaviors, and significantly less likely to participate in regular physical activity, as well as participate in sports and clubs (Tables 5, 6, and 7; Figures 1, 2, 3).

Association Between Chronic Health Conditions and BMI Classification

According to the American Academy of Orthopedic Surgeons (2014), 32% of adolescents between 2 and 19 are classified as either 'overweight' or 'obese,' which supports the literature on the increasing prevalence of overweight and obesity (Schalkwijk et al., 2015; Ogden et al., 2016; Ogden et al., 2012; Serudla et al., 1993; Simmonds et al., 2016; McCoy et al., 2016). It is undetermined whether some secondary chronic health conditions are caused by the effects of being overweight or obese, or whether the chronic health condition aids in leading to the excess body fat. For this study, overweight and obesity were used as the primary chronic health condition and any other condition as the secondary chronic health condition, because it is unknown which one was present first, though overweight and obesity is associated with chronic health conditions (Brown et al., 2009; Neilsen, 2010; Goran et al., 2003; McCoy et al., 2016).

Overweight and obesity are associated with secondary chronic health conditions such as cardiovascular disease, Type II diabetes, as well as muscle and joint problems (Brown et al., 2009; Neilsen, 2010; Goran et al., 2003; Hu, Colditz, Willett, & Manson, 2003). Excess body fat throughout childhood and adolescence leading into adulthood leads to the increased risk for the development of cardiovascular disease and Type II diabetes (Goran et al., 2003).

Goran et al., (2003) examined glucose tolerance in obese children and adolescents, and found that out of 55 obese children, 25% of them had current impaired glucose tolerance and out of 112 obese adolescents, 21% had current impaired glucose tolerance, which is associated with the onset of cardiovascular disease. Also reported, approximately 4% had an undiagnosed impaired glucose tolerance, suggesting

underreporting of glucose intolerance. Due to the increase in overweight and obesity prevalence among adolescents, and the association between excess body fat and glucose intolerance, this may explain the increased prevalence in this population. Additionally, the prevalence of Type II diabetes is also increasing among those who engage in sedentary behaviors (Hu et al., 2003). Sedentary behaviors lead to increased BMI levels (Hu et al., 2003). Specifically, Hu et al., examined television viewing time and the prevalence of Type II diabetes among females (n= 50,277) prospectively for 6 years. Results showed that among females who had a BMI in the normal weight category (<30 kg/m^2) and no reported type II diabetes, 7.5% (n=3,757) had increased their BMI to >30 kg/m^2, and 1,515 cases of type II diabetes were reported. Additionally, results showed that each additional 2 hours per day of watching television was associated with a 23% (95% CI, 17%-30%) increase in obesity and a 14% (95% CI, 5%-23%) increase in risk of diabetes; each additional 2 hours per day of sitting at work was associated with a 5% (95% CI, 0%-10%) increase in obesity and a 7% (95% CI, 0%-16%) increase in diabetes.

Excess weight is likely to cause muscle and joint pain due to increased mass resting on bones and joints, which are not built to support excess weight, as well as increases in inflammation of joints and pain in the bone (Wearing, Hennig, Byrne, Steele, & Hills, 2006; Smith, Sumar, & Dixon, 2014; Zdziarski, Wasser, & Vincent, 2015; Rimmer et al., 2007). When looking at the mechanisms of the development of bone and joint problems, it is thought that excess body fat can lead to the development of further bone and joint disorders (Wearing et al., 2006). Excess body fat can lead to lack of vitamin utilization, and hormonal changes, which, along with excess weight, can cause extra stress on the bone and joints, potentially leading to bone and joint problems

(Wearing et al., 2006). A meta-analysis of 10 studies examining associations between musculoskeletal pain and obesity in children and adolescents between the ages of 2 to 18 years found that with every 10kg increase in body weight there was a 10% increase in the presence of musculoskeletal pain (Smith et al., 2014). Additionally, mobility limitations from musculoskeletal pain or other muscle and joint conditions is positively correlated to obesity; overall, 29.7% of adolescents who have a mobility limitation are obese versus 15.7% of their peers without a mobility limitation. Both Goran et al., (2003) and Hu et al., (2003) results support the results found in the current study, positive correlations between obesity, secondary chronic conditions, and sedentary behaviors.

Additionally, overweight and obesity has been linked to emotional, behavioral, and developmental disabilities such as autism spectrum disorder, down syndrome, and cerebral palsy (Rimmer et al., 2010; McCoy et al., 2016). For example, Rimmer et al., (2010) conducted a parent-reported online survey examining associations between overweight and obesity and chronic health conditions in adolescents (n=461, 14.9 ±1.9 years of age). Within this study, adolescents with autism were more likely to be classified as overweight and obese compared to adolescents without intellectual disabilities (obese – 24.6% vs. 13.0%, OR = 2.19, 95% CI = 1.44–3.31; overweight – 42.5% vs. 28.8%, OR = 1.84, 95% CI = 1.28–2.64). Additionally, adolescents with Down syndrome were also more likely to be overweight and obese compared to adolescents without disability (obese – OR = 3.00, 95% CI = 1.86–4.81; overweight – OR = 3.01, 95% CI = 1.86–4.66). Furthermore, overweight and obese adolescents have an even higher prevalence of comorbid secondary chronic health conditions including: high blood cholesterol (7.7% vs. 0.7%, $p = 0.005$), and diabetes (6.5% vs. 1.4%, $p = 0.041$) for overweight adolescents,

and high blood pressure (19.0% vs. 1.5%, $p = 0.012$) for obese adolescents (Rimmer et al., 2010). This association is also seen in children and adolescents with physical disabilities, with 16.7% of adolescents with physical disabilities classified as obese, while only 12.8% of their peers without physical disabilities are classified as obese (Rimmer et al., 2007), supporting the results found in the current study.

Specific secondary chronic health conditions, such as cerebral palsy, make it difficult for the adolescent to participate on sports teams with typically developing adolescents. It has been shown that 86% of adolescents with cerebral palsy also have the presence of an oral motor dysfunction which makes communicating and breathing difficult (Stern, 2017). For example, Rogozinski et al., (2007) did a retrospective analysis of gross motor function, cerebral palsy, and obesity and found that the prevalence of obesity increased from 7.7% in 1994-1997, to 14% in 1998 to 2002, to 16.5% in 2003 to 2004. Additionally, obesity was independently associated with cerebral palsy.

There are several potential mechanisms that may explain the increased prevalence of overweight and obesity in adolescents with chronic health conditions including increased levels of sedentary behavior, and decreased levels of physical activity (McCoy et al., 2016).

Association Between BMI Classification and Physical Activity

Regular physical activity aids in the prevention of overweight and obesity (Laurson, Lee, & Eisenmann, 2011; Deghan et al., 2005; Stone et al., 1998; McCoy et al., 2016). Laurson et al., (2011) viewed physical activity levels (paired with recommended television viewing and sleep time) and obesity in the *2011 Youth Risk Behavior Survey* among high school students (n=9,589, females: 4,874), and found that male students who

did not meet any of the PA, television, or sleep requirements were 4 times more likely to be obese, and females were 3.8 times more likely to be obese, when compared to their peers who met the recommended PA, sleep, and television time (Laurson et al., 2011), demonstrating the relationship between physical activity behaviors and overweight and obesity. Additionally, overweight and obese male adolescents were looked at in a single group study, with no control group (n= 68), participating in a 16-week weight loss program, following up at both eight and sixteen weeks (Lee, H. & Kim, Y., 2015). This study found that while BMI significantly decreased ($F=3.51$, $p=0.03$) physical activity significantly increased ($F=4.01$, $p=0.02$), supporting the findings in the current thesis (Lee, H. & Kim, Y., 2015). These results support the findings in this thesis that an increased BMI has a positive relationship with lack of regular physical activity levels. Overall, physical activity levels have decreased throughout the years, and this is likely to be correlated with the increased BMI levels. The *Journal of Intellectual Disability Research* published a study by Izquierdo-Gomez et al., (2017) examining children and adolescents with Down syndrome and physical activity levels (n=99, 38 females) ranging from 11-20 years of age, wearing a accelerometer. Following up at one and two years throughout, results show the participant's physical activity levels decrease from the baseline measurements to follow-up meetings (all, $p>0.05$), also, the children and adolescents who met the recommended daily physical activity levels at baseline, decreased their physical activity levels at the one and two year follow-up as well ($p<0.05$), but were still more likely to meet the minimum guidelines when compared to their peers who did not meet the minimum requirements at baseline (Izquierdo-Gomez et. al., 2017).

Associations Between BMI Classification and Sedentary Behavior

Overweight and obesity are associated with increased sedentary behavior in children and adolescents (ACSM, 2012; Johnson, Cohen, Kasen, & Brook, 2007; Boseley, 2017; Epstein et al., 2000; McCoy et al., 2016). Additionally, television viewing time in excess is associated with the presence and/or development of both attention and learning disorders, as well as educational achievement in school. A study by Johnson et al., (2007), examining television viewing time in 678 families (mothers and children) over a period of 20 years showed that the more hours per day the adolescent engaged in screen time, the more likely they were to have a learning or attention disorder (Johnson et al., 2007). Specifically, seven-year-old females with television access in their rooms were 30% more likely to be overweight at 11 years of age, while males were 20% more likely to become overweight by the same age (Boseley, 2017). Sedentary behaviors, such as television viewing, are associated with weight gain, and there are several studies implementing exercise programs in order to reverse this obesity prevalence. For example, Epstein et al., (2000) examined physical activity and sedentary behaviors in obese children and adolescents between 8 and 12 years old from 90 total families. The participants were grouped into one of four groups reducing sedentary behaviors and increasing PA levels at different intensities (increasing activity groups (n=45) split between low dose (n=22) and high dose (n=23), and decreasing sedentary groups (n=45) split between low dose (n=23, 10 miles per week) and high dose (n=22; 20 miles per week), following up with meetings at different times for a total of two years (Epstein et al., 2000). There was no significant difference across the 4 treatment groups (p =0.73), but an average of 6.0 kg weight loss was seen among participants after participation

(Epstein et al., 2000). This supports the positive correlation between television viewing time and other sedentary activities and higher BMI levels found in this study.

Strengths & Limitations

The strength of this study is the quantity of adolescents included (n=28,778) in a nationwide database with responses from various races, poverty levels, and secondary chronic health condition(s). Also, several chronic health conditions were looked at to determine results.

Though this study is not without limitations. Limitations include: guardian-reported responses, grouping of sedentary and physical activity behaviors, and design of the study. The guardian-reported responses were a limitation as guardians may have incorrectly reported height, weight, physical activity behaviors, or sedentary behaviors. The parent-reported method could have resulted in under- or overestimation of BMI, sedentary behaviors, or physical activity behaviors compared to objective measurements of height, weight, and behaviors. Another possibility for the statistical insignificant results may be related to the secondary chronic health conditions being grouped into one condition and two or more, it is undetermined what specific conditions were present with the positive correlation to sedentary behaviors, increased BMI, and lack of PA. Another limitation was the inability to determine temporality. As this study used survey data and was of cross-sectional design, it is unknown whether the adolescent developed the excess body weight first, or the "secondary" chronic condition first. Therefore, results should be interpreted cautiously.

Conclusions & Future Directions

In summary, this study suggests that adolescents with a secondary chronic health condition(s) had a higher prevalence of overweight and obesity when compared to adolescents without secondary chronic health conditions. Adolescents with secondary chronic health conditions were less likely to participate in physical activity behaviors and more likely to engage in sedentary behaviors. Future studies on the associations between BMI, chronic health conditions and physical activity and sedentary behavior should include objective measurements of height, weight, sedentary and physical activity behaviors. Some objective measurements for physical activity/inactivity include pedometers or accelerometers, or wearing a heart rate monitor. With the increased prevalence of overweight and obesity in adolescents, more research is needed to determine if interventions are effective for decreasing excess weight in those with chronic health conditions.

APPENDIX A – IRB Approval Letter

THE UNIVERSITY OF
SOUTHERN MISSISSIPPI

INSTITUTIONAL REVIEW BOARD
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Phone: 601.266.5997 | Fax: 601.266.4377 | www.usm.edu/research/institutional.review.board

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months.
  Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: 12345678
PROJECT TITLE: How to Achieve IRB Approval at USM
PROJECT TYPE: New Project
RESEARCHER(S): Jonas Doe
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Psychology
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 01/02/2015 to 01/01/2016
Lawrence A. Hosman, Ph.D.
Institutional Review Board

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