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Impact of developmental disability on school absenteeism in U.S. children aged 6-17 years: National Survey of Children's Health, 2016-2017

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Behavioral, Social, and Health Education Sciences
2021

ABSTRACT

Impact of developmental disability on school absenteeism in U.S. children aged 6-17 years: National Survey of Children's Health, 2016-2017

By Mary Harbert Stromberg

Background: In the United States, approximately seven million students are chronically absent from school and students with disabilities are 1.5 times more likely to be chronically absent than students without a disability. Little research has been conducted to assess the relationship between developmental disability and school absenteeism and even fewer studies have considered the effect the condition's severity may have on a child's odds of school absenteeism.

Purpose: Using the bioecological systems theory, this study sought to examine the impact of individual developmental disabilities and disability severity on school absenteeism using data from the 2016-2017 National Survey of Children's Health.

Methods: This study conducted a secondary analysis using combined data from the 2016-2017, National Survey of Children's Health. School absenteeism was assessed using data indicating the child missed 11 or more school days in the past year. Developmental disabilities assessed in this study included attention deficit/hyperactivity disorder, learning disability, developmental delay, speech/language disorder, autism/ASD, intellectual disability, cerebral palsy, and Tourette syndrome. Bivariate relationships were examined using x^2 tests and multivariable logistic regressions were used to calculate odds ratios adjusting for individual, microsystem, and macrosystem factors.

Results: Almost 4% of the sample missed 11 or more school days in the past year and children with a developmental disability had a significantly higher percentage of school absenteeism compared to children without a selected developmental disability. The odds of school absenteeism differed by age range and between individual developmental disabilities. There also appears to be a dose-response relationship for certain developmental disabilities between school absenteeism and the severity of the condition, although there appears to be influence from individual, microsystem, and macrosystem level factors.

Conclusion: Children with one or more developmental disability have higher odds of school absenteeism compared to children with typical development. These odds are not consistent across different age ranges or across individual conditions. The odds of school absenteeism also appear to be impacted by the severity of the disability for certain conditions. This population could benefit from targeted school interventions to assist with regular school attendance and mitigate the impact of school absenteeism on education.

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ACKNOWLEDGEMENTS

I would like to sincerely thank all the people that have supported me during the completion of my master's thesis.

To my committee Chair, Dr. Robin McGee, thank you for your continually calm demeanor and your unparalleled support through this process. I have learned immeasurably from you this last year and I am so thankful for your mentorship.

To my committee member, Dr. Anna Rubstova, thank you for your willingness to dive deep into problems and challenge my thinking. Your guidance through this process has been invaluable.

To my committee member, Dr. Jessica Sales, thank you for your insight into complicated problems and your expertise.

To my friends and family, thank you for your support and continual encouragement during this time.

To my mom and grandmother, thank you for giving me the confidence to pursue higher education. Without your conviction, I would not have made it this far.

Lastly, to Townsend and Chloe, thank you for listening to me, thank you for lifting me up, and most importantly, thank you for being there when I needed you most.

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INTRODUCTION

In the United States, over seven million students missed 15 or more school days in the 2015-2016 school year (U.S. Depatrment of Education, 2019). This means that approximately one in six students in the U.S. are considered chronically absent from school (U.S. Depatrment of Education, 2019). School absenteeism can be defined as the instance of missing school for any reason whether excused by the school or unexcused. School absenteeism is associated with poor academic performance, lower educational attainment, heightened risk of school drop-out, and risky health behaviors among adolescents (Balfanz & Byrnes, 2012; Eaton et al., 2008; Ehrlich et al., 2013; Gottfried, 2009; Utah Education Policy Center, 2012). However, the consequences of school absenteeism extend far beyond academic achievement. Education is also a determinant of an individual's health later in life (Braveman et al., 2010; Hahn & Truman, 2015). The Healthy People initiative released by the U.S. Department of Health and Human Services specifies education to be one of the top five key social determinants of health (Healthy People 2030). Those with less years of education are more likely to die prematurely, engage in unhealthy behaviors such as smoking, and are more prone to diabetes and obesity (Robert Wood Johnson Foundation, 2016). Given the risks school absenteeism pose on the future health outcomes for students, extensive research has been conducted to identify risk factors that may lead to increased school absences. Common risk factors for school absenteeism include problems with mental health, difficulty sleeping, poor physical health or chronic disease, being the victim of bullying, instability in the home such as housing or food insecurity, perceived unsafe neighborhood and/or school environment, low socioeconomic status, lower levels of parent education, and being a racial/ethnic minority due to inequitable social factors surrounding race (Baams et al., 2017; Berman et al., 2018; Gee, 2018; Grinshteyn & Yang, 2017; Henderson et al., 2014; Hysing et al., 2015; Kearney, 2008; Lim et al., 2019; Miller & Johnson, 2016; Williams et al., 2018).

A multitude of studies examining school absenteeism have found that disability and chronic health conditions are also associated with a heightened risk of absence from school (Ansari & Gottfried, 2018; Crump et al., 2013; Fowler et al., 1985; Gottfried & Gee, 2017; Henderson et al., 2014; Moonie et al., 2008; Taras & Potts-Datema, 2005; U.S. Department of Education, 2016). For the 2015-2016 school year, the U.S. Department of Education found that students with disabilities are 1.5 times more likely to be chronically absent from school than students without a disability and only 67.6% of students with a disability graduated from high school in the 2016-2017 school year, compared to 84.6% for students in the U.S. overall (U.S. Department of Education, 2018). The Centers for Disease Control and Prevention (CDC) defines disability as “any condition of the body or mind that makes it more difficult for the person with the condition to do certain activities and interact with the world around them.” (Centers for Disease Control and Prevention [CDC], 2019) The current study, however, focused primarily on developmental disability, which is a particular subset of disability. Developmental disorders are a group of chronic conditions distinguished by developmental problems that result in impaired occupational, social, or academic functioning (Centers for Disease Control and Prevention, 2020). Between 2009-2017, approximately 17% of children between the ages of 3-17 years had at least one diagnosed developmental disability (Zablotsky et al., 2019). Common developmental disabilities include autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), intellectual disability (ID), communication disorders, sensory and motor disorders, and learning disorders (Centers for Disease Control and Prevention, 2020). While these disorders typically appear in childhood, some can affect individuals for the entirety of their lifetime (Patel et al., 2010; Thapar et al., 2017). Given that students with developmental disabilities may face unique risk factors for school absenteeism such as bully victimization, increased parental stress and mental health symptomology, co-morbid mental health conditions, poor physical health, and difficulty sleeping, it is reasonable to expect students with developmental disability may have a higher risk of school absenteeism (Blake et al., 2012; Eapen, 2014; Owens, 2008; Scherer et al., 2019; Schieve et al., 2012). This is particularly troublesome considering the importance of school for children with disabilities. Inadequate education for children with disabilities has the ability to negatively impact future academic achievement, social development, and employment opportunities (Aron & Loprest, 2012).

Although there is a great deal of literature on disability and school absenteeism, many of these studies focus primarily on physical health conditions (Crump et al., 2013; Moonie et al., 2008; Taras & Potts-Datema, 2005), or do not distinguish between different disability classifications (Cortiella & Boundy, 2018; U.S. Department of Education, 2016). The few studies that have focused specifically on developmental disability have found a positive association between developmental disability and school absenteeism (Black & Zablotsky, 2018; Hatton, 2018; Redmond & Hosp, 2008). However, with only one exception to the author's knowledge (Hatton, 2018), the severity of the developmental disability and its impact on school absenteeism has largely not been taken into account. Therefore, more information is needed on both the prevalence of school absenteeism for specific developmental disabilities as well as additional information regarding factors, such as condition severity, that may make students with developmental disabilities more likely to be absent from school.

Furthermore, much of the current research pertaining to the association between school absenteeism and developmental disability lacks the use of theory. While traditional education theories may focus too heavily on individual factors, the bioecological systems theory, as it was renamed by Bronfenbrenner in 2006 (Bronfenbrenner & Morris, 2006), provides a useful framework for understanding the multi-level factors that influence successful education and school absenteeism among children with developmental disability. The bioecological systems theory is a social ecological model that explains how different levels of influence, or systems, influence a child's development across the lifespan (Bronfenbrenner, 1992). These social systems include first the individual, then the microsystem, the mesosystem, the exosystem, and finally the macrosystem (Ettekal & Mahoney, 2017). The theory postulates that social systems in closer proximity to the child have a greater impact and influence on that child's development (Gubbels et al., 2019). Thus, this study focused primarily on factors in the microsystem such as parent mental and physical health and bully victimization, as well as individual level factors that include age, sex, adequate sleep, mental health treatment, and physical health status. While this study focused primarily on lower-level systems, other risk factors such as caregiver's level of education, family income level, and race/ethnicity from the macrosystem are included in this analysis as well.

Using the bioecological systems theory as a framework, this study sought to examine the relationship between individual developmental disabilities and school absenteeism using data from the 2016-2017 National Survey of Children's Health (Child and Adolescent Health Measurement Initiative). Given that severe disability is evidenced to correlate with increased severity for certain risk factors associated with school absenteeism (Kissel & Nelson, 2014; Liptak et al., 2001; Lycett et al., 2014; Tudor et al., 2012; Zinner et al., 2012), it is plausible that greater disability severity is positively associated with greater school days missed. Therefore, this study also sought to assess this hypothesized association by the severity of the condition, adjusting for individual, microsystem, and macrosystem factors which include the child's mental and physical health, sleep behavior, parents' mental and physical health, bully victimization, family income, and adult caregiver's level of education. The results from this research will provide a better understanding of the association between developmental disability and school absenteeism. It may also provide additional insight allowing for interventions to be directed to those most likely to be absent from school.

LITERATURE REVIEW

This study sought to investigate the association between individual developmental disabilities and school absenteeism. A secondary aim of this study was to examine this association based on the parent-rated severity of their child's developmental disability. In the following paragraphs, the link between education and health will be addressed along with the scope of school absenteeism in the U.S. Risk factors for both school absenteeism and developmental disability are also explored below. Finally, existing literature conducted in the field of disability and school absenteeism is reviewed.

Education and Health

There is a well-established link between education and health, making education an important social determinant of health. The Healthy People initiative released by the U.S. Department of Health and Human Services recognizes education as a top five key social determinant of health (Healthy People 2030). Social determinants of health are social, economic, or physical conditions in an individual's environment that affect quality-of-life and other physical and mental health outcomes (Healthy People 2030). Data from the 2010 National Health Interview Survey found a positive correlation between health status and level of education with 28% of adults with less than a high school diploma reporting fair or poor health compared to only 6% of adults with a bachelor's degree or higher (Schiller et al., 2012). Associations have also been identified between lower educational attainment and reduced life expectancy as well as higher rates of obesity, diabetes, and limitations in activity due to chronic disease (Braveman et al., 2010). Furthermore, academic achievement plays an important role in health behaviors and health outcomes. Results from the school-based Youth Risk Behavior Survey (YRBS) found that students with mostly A's, B's, or C's reported less risky health behaviors and more protective health behaviors than students with D's and F's. Another study, conducted by Hahn and Chattopadhyay (2019), found that that a one percentile increase in eighth grade standardized test scores resulted in a five day increase in life expectancy at age 40 (Hahn & Chattopadhyay, 2019). The effects of education on health can also extend beyond the individual. Lower maternal educational attainment is linked to increased risk of infant mortality (Braveman et al., 2010; Singh & Yu, 2019). Thus, education and educational attainment affects not only the health of the individual, but the health outcomes of future generations as well.

School Absenteeism

The U.S. Department of Education reported that approximately seven million, or one in six, children were considered chronically absent – missing 15 or more school days – during the 2015-2016 school year (U.S. Depatrment of Education, 2019). Problems with school absenteeism are found among students of all academic grade levels, but it is typically highest among high school students. Almost 22% of high school students were reported as chronically absent by the U.S. Department of Education in 2016, compared to 14.1% of middle school students and 13.6% of elementary school students (U.S. Depatrment of Education, 2019). Frequent absenteeism is particularly detrimental in that it can result in lower educational attainment, higher risk of school dropout, and is associated with risky health behaviors in adolescence and poor academic performance (Balfanz & Byrnes, 2012; Eaton et al., 2008; Ehrlich et al., 2013; Gottfried, 2009; Utah Education Policy Center, 2012).

Typically, school absences fall under two categories, excused and unexcused absences. Excused absences include illness or injury, religious holidays, or other family events with reasons for unexcused absences including truant behavior, school refusal, school withdrawal, or other disciplinary circumstances that exclude a child from school (Heyne et al., 2019). However, it is often difficult to reliably differentiate between excused and unexcused absences. A study assessing preschool through third grade students found that more than 40% of the students who were reported absent due to illness or injury where actually absent from school for other reasons (Kerr et al., 2012). Despite challenges in tracking reasons for absences, Gottfried et al. (2009) and Hancock et al. (2013) have found that school absences in any form may prove to be problematic and can result in negative student outcomes.

Risk Factors for School Absenteeism

School absenteeism is a complex problem with risk factors at multiple levels of influence. Given the importance education plays in later health outcomes and the link between frequent school absenteeism, school achievement, and education attainment, there has been extensive research to identify common risk factors for school absenteeism. These factors are commonly found at the macrosystem, microsystem, and individual levels.

Macrosystem risk factors: Neighborhood and school safety have been identified as risk factors that may lead to higher school absentee behavior (Berman et al., 2018). Low socioeconomic status (SES) has also been cited by multiple studies as a risk factor for school absenteeism. Specifically, low family income and lower levels of parental education are associated with higher school absenteeism, as well as housing and food insecurity (Henderson et al., 2014; Lim et al., 2019; Miller & Johnson, 2016). Racial/ethnic minority is another commonly cited risk factor for school absenteeism. In 2016, the U.S. Department of Education cited that students who identify as Hispanic, African American, Pacific Islander, American Indian, or multi-racial had higher rates of chronic school absenteeism than White students, especially in elementary school. However, the evidence for the association between racial/ethnic minority and school absenteeism has not been indisputable. Another study using aggregated data from the Medical Expenditure Survey 2008-2013 found no increased risk for school absenteeism for racial/ethnic minority students (Lim et al., 2019). The authors indicated that this may be due to the nature of the question that asks specifically about absences due to illness or injury, which may in turn miss other reasons for absenteeism such as bullying or truant behavior (Lim et al., 2019). While race/ethnicity can be seen as an individual characteristic, it is important to note the structural racism and unequal access to resources faced by minority communities. In this country, a higher proportion of people of racial/ethnic minority have a lower socioeconomic status which, as stated above, is also a risk factor for school absenteeism, making it possible that when race/ethnicity is examined independently it does not account for higher rates of school absenteeism. Thus, being a member of a racial/ethnic minority group alone does not raise the risk for school absenteeism, but rather is it due to the societal factors and inequities surrounding race.

Microsystem risk factors: Factors for school absenteeism within the microsystem include being the victim of bullying and other family factors, such as parents' mental and physical health.

<u>Bully Victimization</u>: Data from the 2013 Youth Risk Behavior Survey indicated that high school students who experienced electronic, or online, bullying had an increased relative risk for school absenteeism of 2.08 (Grinshteyn & Yang, 2017). A cross-sectional survey conducted in

California also found that that bias-based bullying, or bullying based on discrimination or other prejudice, significantly predicted school absenteeism among a large subsample (*n* = 41,132) of children aged 10-18 years (Baams et al., 2017).

Parental Mental and Physical Health: Parents' mental and physical health has also been identified as a risk factor for school absenteeism. Findings from the Early Childhood Longitudinal Study indicated that children with mothers who reported experiencing poor health had an increased likelihood of chronic school absenteeism in both kindergarten and third grade (Romero & Lee, 2008). Parental depression has also been correlated with increase school absences. Data taken from the 1997-2004 National Health Interview Survey found that children with parents who reported depressive symptoms all or most of the time had a 36% increased risk for school absenteeism (Guevara et al., 2013); though once these results were stratified by age (<6, 6-12, >12), only results for adolescents remained significant (Guevara et al., 2013). However, Claessens et al. (2015) found that persistent maternal depression measured in kindergarten predicted increase school absences in fifth graders (Claessens et al., 2015).

Individual risk factors: Differences in school absenteeism have been found between males and females as well as among different age groups (Gubbels et al., 2019; U.S. Department of Education, 2016). Problems sleeping, poor mental and physical health, and disability status have also been reported to be important risk factors for school absenteeism at the individual level (Gottfried & Gee, 2017; Hysing et al., 2015; Kearney, 2008).

Sex: Data gathered from the 2015-2016 Civil Rights Data Collection (CRDC) used by the U.S. Department of Education (2019) and from the National Assessment of Education Progress from 2015 conducted by García & Wiess (2018) suggest that female students have a higher prevalence of school absenteeism than male students. However, these are merely descriptive statistics. Gubbels et al. (2019) tested the effect of sex as a moderator in their meta-analysis on the risk factors associated with school absenteeism and dropout and found that a significant moderating effect for sex was only seen for one out of the 20 risk domains analyzed for moderation.

Age: Several studies have indicated that older students are more likely to be absent from school than their younger counterparts. A meta-analysis conducted by Gubbels et al. (2019) found older age to be a statistically significant risk factor for school absenteeism (Gubbels et al., 2019). The U.S. Department of Education also reports that as students progress into high school, the likelihood of school absenteeism also increases with over 20% of students in high school marked as chronically absent in the 2015-2016 school year compared with 14% for middle school students and 13.6% for elementary (U.S. Depatrment of Education, 2019).

Sleep: A large population-based study in Norway found that short sleep duration and sleep deficiency significantly increased the odds of substantial school absence, and insomnia more than doubled the odds of substantial school absence in adolescents (Hysing et al., 2015).

Mental Health: Regarding mental health, results from a British cross-sectional study found mental health difficulties in students 11-12 years of age to be positively associated with persistent school absenteeism (Lereya et al., 2019). Another study conducted by Wood et al. (2012) using secondary analysis of three longitudinal nationally or regionally representative datasets indicated that higher levels of reported depression and anxiety in their initial assessment was significantly associated with higher school absenteeism in their second assessment in both middle and high school students (Wood et al., 2012).

Physical Health: Multiple studies have assessed the role physical health status plays in school attendance with results indicating lower levels of reported physical health being associated with higher school absenteeism for children in all age ranges (Gottfried & Gee, 2017; Lim et al., 2019). There are a variety of studies that have found disability status to be a risk factor for school absenteeism with data the U.S. Department of Education indicating that students with disabilities were 50% more likely than students without disabilities to be chronically absent from school in the 2015-2016 school year (U.S. Depatrment of Education, 2019). The present study however focused on a particular subset of disability, called developmental disability, and its association with school absenteeism.

Developmental Disability

Developmental disability covers a broad scope of health conditions. Developmental disorders are distinguished by developmental problems that result in impaired occupational, social, or academic functioning (Centers for Disease Control and Prevention, 2020). According to data from the National Health Interview Survey, conducted by the CDC, approximately one in six children between the ages of 3-17 years were reported to have a diagnosed developmental disability and results indicated a 9.5% increase in the prevalence of any developmental disability from 2009-2017 (Zablotsky et al., 2019). Examples of common developmental disorders include autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), intellectual disability, communication disorders, sensory and motor disorders, and learning disorders (Centers for Disease Control and Prevention, 2020). The present study focused specifically on ADHD, learning disability, developmental delay, speech/language disorder, autism/ASD, intellectual disability ASD, cerebral palsy, and Tourette syndrome.

Although there is an abundance of literature that assesses the relationship between disability and school absenteeism, many of these studies do not distinguish between individual disabilities (Cortiella & Boundy; U.S. Department of Education, 2016), or they focus primarily on physical health conditions (Crump et al., 2013; Moonie et al., 2008; Taras & Potts-Datema, 2005), leaving little research specifically on developmental disability and its association with school absenteeism. This is especially troubling because not only is there a dramatic increase in the prevalence of developmental disability in recent years, but children with developmental disabilities may disproportionately experience certain risk factors for school absenteeism compared with children without developmental disabilities such as certain societal risk factors, being a victim of bullying, increased parent stress and mental health symptomology, comorbid mental health conditions, poor physical health, and difficulty sleeping. Thus, it is reasonable to expect children with developmental disability may experience higher rates of school absenteeism.

Macrosystem risk factors: Societal factors that may influence developmental disability include socioeconomic status (SES), such as family income and parent level of education, and race/ethnicity.

Socioeconomic Status (SES): Data taken from the National Health Interview Survey from 2009-2017 indicated that the prevalence of children with developmental disabilities was higher for certain socioeconomic measures (Zablotsky et al., 2019). The prevalence of any developmental disability diagnosis was significantly lower for children whose families were greater than or equal to 200% the federal poverty level and children whose mothers had a college degree or higher were significantly less likely to be diagnosed with any developmental disability (Zablotsky et al., 2019). However, for autism/ASD, another study found an opposing association. Using population-based surveillance, census, and survey data researchers found a positive association between autism/ASD and families' SES in that a higher prevalence of children with autism/ASD occurred among families with higher SES (Durkin et al., 2017). This study however does mention that this association may be influenced by the underdiagnosis of children with autism/ASD among families with lower SES (Durkin et al., 2017).

Race/Ethnicity: The association between developmental disability and race/ethnicity is complex and there exists a great deal of variability in this association between different developmental disabilities. In a study that used parent-report as the basis for developmental disability diagnosis, there was no significant difference in the prevalence of any developmental disability diagnosis between non-Hispanic White and non-Hispanic Black children, but non-Hispanic other and Hispanic children were significantly less likely to be diagnosed with any developmental disability compared to both non-Hispanic White and Black children (Zablotsky et al., 2019). Mandell et al. (2009) conducted a study using case finding methods used by the Autism and Developmental Disabilities Monitoring (ADDM) network at CDC to identify children with both a documented diagnosis as well as children that fit their case criteria for autism/ASD without a documented diagnosis. Result indicated that there exists significant racial and ethnic disparities in the identification of autism/ASD with non-Hispanic Black, Hispanic, and children in the non-Hispanic other race/ethnicity category being significantly less likely to have a documented autism/ASD diagnosis (Mandell et al., 2009). A study on early intervention services among children with developmental delay found that at 24 months of age Black children were five times less likely to receive early intervention services for a developmental delay compared to White children, which points to the disparities in access to services that exist between different racial/ethnic groups (Feinberg et al., 2011). Another study using data from the Early Childhood Longitudinal Study–Kindergarten Cohort 1998-1999 found minority students in elementary school to be less likely to receive special education services compared to similar White students (Morgan et al., 2015). This study limited case finding to students who were reported to receive special education services, so again the actual receipt of services may be more prevalent among White students. A study on the identification of learning disabilities by race/ethnicity found that Black, Hispanic, and students in the "other" race/ethnicity category were disproportionately identified with a learning disability (Shifrer et al., 2011). However, once the analyses adjusted for measures of SES, they found that the lower average SES among these families explained away this disproportion (Shifrer et al., 2011); thus, suggesting these discrepancies in prevalence of developmental disabilities between different racial/ethnic groups may be influenced by multiple societal factors such as access to health care and services.

Microsystem risk factors: Microsystem factors that may impact rates of school absenteeism among students with developmental disability include being the victim of bullying and parental levels of stress and mental health symptomology.

<u>Bully Victimization</u>: Studies have indicated that children with disabilities, and especially children with developmental disabilities, experience higher rates of bully victimization when compared to children without disabilities. In 2012, a study using two datasets from the U.S. Department of Education, the Special Education Elementary Longitudinal Study (SEELS) and the National Longitudinal Transition Study-2 (NLTS-2) found that the national prevalence of bullying among students with all disabilities to be 24.5% among elementary school students, 34.1% among middle school students, and 26.6% among high schoolers; this is one to one and a half times the national average for students without disabilities (Blake et al., 2012). Another study found that, children with intellectual disability reported higher rates of bully victimization, or being the victim of bullying, compared to children with typical development (Christensen et al., 2012). Interviews with 175 adolescents from a larger longitudinal study found that children with ASD reported higher rates of both bully victimization and chronic victimization when

compared to children with intellectual disability and children with typical development (Zeedyk et al., 2014). Increased prevalence of bully victimization has also been reported among students with ADHD, and learning disorders in comparison to students without a disability diagnosis (Lung et al., 2019). Children with CP have also been shown to be at increased risk of bully victimization possibly due to physical limitations and stigma (Whitney et al., 2019). Given that being the victim of bullying is a risk factor for school absenteeism, the disproportionate risk of bully victimization among children with developmental disabilities provides additional evidence for increased school absenteeism.

Parental Mental Health: Parenting stress and other mental health problems have been well documented among parents of children, aged 3-12 years, with developmental disabilities (Scherer et al., 2019). In Italy, parents of children with specific learning disorder, learning disorder, ASD, and ADHD as well as parents of children with typical development were assessed for parenting stress using the Parenting Stress Index (Craig et al., 2016). Results found significantly higher scores of perceived stress among mothers and fathers in all diagnostic groups compared to parents of children with typical development (Craig et al., 2016). A meta-analysis from 2019 that assessed 19 studies from 2004 to 2018 found that on average, 31% of parents of children with any intellectual or developmental disability (IDD) had elevated depression scores compared to 7% of parents with children without IDD (Scherer et al., 2019). Likewise, 31% of parents of children with IDD had elevated anxiety scores compared to 14% of parents of children without IDD (Scherer et al., 2019). Parental mental health conditions have been found to be a contributing factor for increased school absenteeism in children with typical development (Claessens et al., 2015; Guevara et al., 2013). Therefore, the increased stress, anxiety, and depression parents of children with developmental disabilities experience could further impact school absenteeism for children with developmental disabilities.

Individual level factors: At the individual level, factors that may influence school absenteeism among students with a developmental disability include comorbid mental health conditions, poor physical health, and difficulty sleeping.

Mental Health Conditions: Results using cross-sectional data from the National Comorbidity Adolescent Supplement found that children, ages 13 to 18, with intellectual disability had a higher prevalence of any mental disorder; however, once models were adjusted for confounders only specific phobias, agoraphobia, and bipolar disorder remained significantly higher among adolescents with intellectual disability (Platt et al., 2019). Although, other studies have found significant associations between intellectual disability and other mental health conditions (Reardon et al., 2015). In a large sample of British children, aged 5 to 16 years, researchers found that children with ID have significantly higher risk of any emotional disorder including depressive and anxiety disorders (Emerson & Hatton, 2007). Children with CP have also been found to have higher rates of anxiety compared to children without a CP diagnosis, even when controlling for potential confounding variables such as sociodemographic factors, bully victimization, and chronic pain (Whitney et al., 2019). There is also evidence to suggest children with learning disorders experience higher rates of anxiety and depression. A study conducted in Italy that compared children with reading and nonverbal learning disabilities with children who have typical development found that children in both groups of learning disability had higher scores for general anxiety compared to children with typical development (Mammarella et al., 2016). Although this study consists of a small sample size ($n=45$), their findings are in accordance with previous literature (Mammarella et al., 2016). Children with

ASD also have heightened rates of mental health disorder (Kirsch et al., 2020). A cohort study in Minnesota found that individuals with ASD had a higher incidence of mood and anxiety disorder when compared with controls and were also diagnosed at an earlier age than controls were, median age was 15.7 years vs. 18.1 years respectively (Kirsch et al., 2020). Children with ADHD experience comorbid psychiatric disorders, such as anxiety, depression, and conduct disorders, at a higher rates that children without an ADHD diagnosis (Cuffe et al., 2020). An epidemiological study assessing children in South Carolina and Oklahoma found children with ADHD were significantly more likely to have any anxiety/mood disorder than children without an ADHD diagnosis and had significantly higher rates of conduct disorders (Cuffe et al., 2020).

Physical Health: A retrospective analysis of data from the combined 1997-2005 National Health Interview Survey found that 6.1% of children with one or more developmental disability had fair or poor health, as reported by the parent, and 17.5% of children with three or more developmental disabilities had fair or poor health (Boulet et al., 2009). More recent data from the 2006-2010 National Health Interview Survey found that children with developmental disabilities also had more concurrent medical conditions, which included both short and long-term conditions, than children without developmental disabilities (Schieve et al., 2012). Children with developmental disabilities also had higher rates of health care usage, meaning children with developmental disabilities had higher rates of visiting a medical specialist or other health care professional, and were more likely to report having more than nine office visits in the past year (Schieve et al., 2012).

Sleep Difficulties: Certain developmental disabilities have an increased prevalence of sleep disturbances or sleep disorders. A study from the Netherlands using the Sleep Disturbance Scale for Children (SDSC) found that children, ages 6 to 12, with a diagnosis of ADHD and/or

ASD had significantly higher scores for sleep disturbance than children with typical development. They also found that children with ASD or ADHD spend less time asleep on both weekdays and weekend days with the children in the ASD group waking up significantly earlier compared to controls and children in the ADHD group going to sleep significantly later than children in the control group (van der Heijden et al., 2018). The same instrument was used in a Canadian study that assessed 150 children, aged 3-12 years, diagnosed with CP. One or more sleep disorders was reported in 44% of children with CP with school-age children experiencing higher prevalence of sleep problems (59.5%) compared to pre-school children (24.2%) (Horwood et al., 2018). There is also evidence to suggest children with intellectual disability also experience more problems with sleep duration and quality (Surtees et al., 2018).

Developmental Disability and School Absenteeism

The few studies that have assessed the association between developmental disability and school absenteeism have found higher rates of school absenteeism among students with developmental disabilities (Black & Zablotsky, 2018; Hatton, 2018; Redmond & Hosp, 2008). Student attendance records from 1997-2001 were examined in Missouri by Redmond & Hosp (2008) to assess the relationship between number of school days absent and communication and learning disorders and emotional disturbances. Results found that students with learning disability had consistently higher averages of school days missed compared to controls among all grades, five through nine, with highest rates of absenteeism seen in ninth grade. Students with emotional disturbances also had higher rates of school absenteeism across all grades when compared to controls (Redmond & Hosp, 2008). However, this association was not seen in children with communication disorders, with the average number of days missed among children with communication disorders being lower or the same as the controls' average across all grade levels (Redmond & Hosp, 2008). In England, 2016-2017 school year data from the country's Department for Education was used to assess school absences and school exclusions among children with moderate learning difficulty, severe learning difficulty, profound & multiple learning difficulty, and ASD (Hatton, 2018). Results found that children in all disability groups had higher rates of authorized, or excused, school absences when compared to children without special education needs (Hatton, 2018). Rates for unauthorized, or unexcused, absences were lower than authorized absences. Still, children with ASD and moderate learning difficulty had significantly higher rates of unauthorized absences compared to students without special education needs (Hatton, 2018). Unauthorized absentee rates of students with severe learning difficulties and profound & multiple learning difficulties did not differ from students without special education needs (Hatton, 2018). In this same study, persistent absenteeism was defined as missing 10% or more school days in a single school year, which included both authorized and unauthorized absences. Using this definition, 43.2% of students with profound and multiple learning difficulties, 22.3% of children with severe learning difficulties, 17.9% of children with moderate learning difficulties, and 17.3% of children with ASD were persistently absent in 2016-2017 (Hatton, 2018). The results of these studies indicate there is a significant relationship between developmental disability and school absenteeism and suggests the severity of the condition may impact number of school days missed. Black and Zablotsky (2018) assessed the relationship between selected developmental disabilities that included ASD, ADHD, intellectual disability (ID) or other developmental delay, and school absenteeism using combined 2014-2016 data from the National Health Interview Survey (Zablotsky et al., 2019). They also examined the association between multiple comorbid developmental disabilities and chronic school absenteeism. In their analyses, they controlled for co-occurring physical conditions as well as demographic variables such as age, sex, race/ethnicity, poverty status, family structure, and geographical region. Children with ID had the highest prevalence of school absenteeism, followed by children with ASD, other developmental delay, and ADHD(Black & Zablotsky, 2018). Findings from both unadjusted and adjusted models indicated that children with parent-reported ID, ASD, ADHD or other developmental delay were significantly more likely be chronically absent from school when compared to children without these disorders(Black & Zablotsky, 2018). Results also indicated that an increased number of comorbid developmental disabilities was also associated with an increased odds of school absenteeism (Black & Zablotsky, 2018). Taken together, these studies suggest that children with developmental disabilities experiences higher rates of school absenteeism.

Theoretical Framework: Bioecological Systems Theory

This study was informed by Bronfenbrenner's bioecological systems theory that explains how different levels of environmental influence, or systems as they are called, affect a child's development across the lifespan (Bronfenbrenner, 1992). While traditional education theories may focus too heavily on individual factors, the bioecological systems theory, as it was renamed in 2006 (Bronfenbrenner & Morris, 2006), provides a useful framework for understanding the multi-level factors that influence successful education and school absenteeism among children with developmental disability. This theory also recognizes that child development continues throughout the lifespan (Bronfenbrenner & Morris, 2006), making it appropriate for use in the current study as the study population consists of children aged 6-17 years. Given the multi-level factors that affect a child's risk for absenteeism, a theoretical framework informed by the social ecological model is warranted. In turn, this theory is growing in popularity with recent studies assessing school absenteeism using this theoretical lens as well (Gottfried & Gee, 2017; Melvin et al., 2019).

The theory contains four systems that surround the individual, or child in this case, with each higher-level system interacting with the child more distantly (Bronfenbrenner, 1992). The first is the microsystem. This system is the closest to the child and includes structures that interact directly with the child such as school, family, peers and social circles, neighborhood, other caretakers, and organized activities such as sports or extracurriculars (Paquette & Ryan, 2011). These interactions are bidirectional in that the child influences these structures and these structures influence the child (Paquette & Ryan, 2011). The second closest system in the model is the mesosystem, which includes the interactions between the different structures found in the microsystem (Ettekal & Mahoney, 2017). For example, how a child's parents interact with their school or teacher may influence a child's educational achievement (Paquette & Ryan, 2011). The next system is the exosystem. This system consists of the interactions between different structures in the microsystem with which the child does not interact with (Ettekal & Mahoney, 2017), an example being a parent's interaction with their workplace or a teachers interaction with school administrators. These interactions still influence the child's development even though the child does not have a direct link to them (Ettekal & Mahoney, 2017). Finally, the outermost system is the macrosystem. This systems is composed of beliefs, values, and social norms associated with culture and the broader socioeconomic structure of society (Ettekal & Mahoney, 2017). Although this is the most distal system to the child, it impacts all lower-level systems hence influencing a child's development (Ettekal & Mahoney, 2017). The theory postulates that social systems in closer proximity to the child have a greater impact and influence on that child's development (Gubbels et al., 2019). Therefore, this study focused primarily on factors in the microsystem such as peer relations, indicated by bully victimization, and family factors, such as parent's mental and physical health. While this study focused primarily on lower-level systems, it would be remised to ignore influences from the macrosystem. Therefore, race/ethnicity and family SES, indicated by family income and adult caregiver's education level, were accounted for in this study as well.

The bioecological systems theory conceptualizes individual-level factors, or person characteristics as they are called in the theory, into three different categories: demand, resource, and force characteristics (Bronfenbrenner & Morris, 2006). Demand characteristics are those that are directly observable and apparent to others around them such as age and gender. Resource characteristics are those that influence how a person or child interacts with the processes around them. These characteristics include a child's abilities and disabilities and experiences (Melvin et al., 2019). Finally, force characteristics refer to the nature of the child such as disposition, behavioral processes, and emotions. The present study focused primarily on resource characteristics – mental health, physical health, and adequate sleep – while also considering age and sex as demand characteristics.

Formal Statement of the Problem

There is an abundance of literature on the impact of disability on school absenteeism. However, only a few studies have assessed developmental disability specifically (Black & Zablotsky, 2018; Hatton, 2018; Redmond & Hosp, 2008), and only one study, to the author's knowledge, has taken into consideration the severity of the disability and its impact on school absenteeism (Hatton, 2018). This study, conducted by Hatton et al. (2018), found that children in the most severe learning disability group had the highest rates of school absenteeism (Hatton, 2018). This finding makes theoretical sense as the literature also designates that increased severity of developmental disability has been shown to increase the severity of certain risk factors for school absenteeism (Kissel & Nelson, 2014; Liptak et al., 2001; Lycett et al., 2014; Tudor et al., 2012; Zinner et al., 2012). However, this study by Hatton et al. (2018) focused solely on learning disability severity. Therefore, more information is needed on both the odds of school absenteeism for other individual developmental disabilities as well as information on how other individual factors, such as the disability severity, impacts a student's risk for school absenteeism.

Informed by the bioecological systems theory, this study aimed to assess the rate of school absenteeism among children with attention-deficit/hyperactivity disorder (ADHD), learning disability, developmental delay, speech/language disorder, autism/ autism spectrum disorder (ASD), intellectual disability (ID), cerebral palsy (CP), and Tourette syndrome using data from the 2016-2017 National Survey of Children's Health (Child and Adolescent Health Measurement Initiative). This study also sought to assess the odds of school absenteeism by parent-reported severity of the individual developmental disability. Given prior research and the school absenteeism risk factors associated with developmental disability, the primary hypothesis of this study was that the odds of school absenteeism are higher for children with developmental disability and that the odds of school absenteeism increase as disability severity increases.

METHODS

Study Design, Participants, Sampling

This study conducted a secondary analysis using combined data from the 2016-2017 National Survey of Children's Health (NSCH), a nationally representative, cross sectional survey conducted annually by the United States (U.S.) Census Bureau (Child and Adolescent Health Measurement Initiative). The purpose of the NSCH is to provide national and state-level data on children ages 0 to 17 years living the in the United States (U.S. Census Bureau, 2018a, 2018b). Data from this survey are publicly available and available for downloaded upon request.

Survey responses were collected via internet and mail from randomly selected, civilian, non-institutionalized households across the country (U.S. Census Bureau, 2018a, 2018b). In 2016 and 2017, 71,811 surveys were completed (Child and Adolescent Health Measurement Initiative, 2018); weighted response rates for 2016 and 2017 were 40.7% and 37.4% respectively (Child and Adolescent Health Measurement Initiative, 2018). The 2016 and 2017 NSCH used address-based sampling to select a random sample of households that cover all 50 states and the District of Columbia. One child from each selected household was then randomly selected as the subject of the survey. Children 0-5 years of age and children with special healthcare needs were over sampled in 2016 and 2017 (U.S. Census Bureau, 2018a, 2018b). Sampling frames were created by the U.S. Census Bureau (U.S. Census Bureau, 2018a, 2018b). In 2016, the sample consisted of an equal number of addresses from each state. While in 2017, the sample was distributed across the states to produce an equal response rate from each state (U.S. Census Bureau, 2018a, 2018b). To obtain a population-based estimate, survey weights were used.

Households were mailed instructions to complete the survey online; paper screeners and surveys were also mailed to some households along with the initial instructional letter or after remainder letters were sent (U.S. Census Bureau, 2018a, 2018b). Survey respondents were asked if there is one or more child aged 0-17 living in the household - only if the respondent answered "yes" did respondent continue to the screener (U.S. Census Bureau, 2018a, 2018b). The screener asked the age, race/ethnicity, and sex of all children in the household and additional information was collected on the four youngest children. Respondents using the paper version were to mail back the screener. Then, once one child was randomly selected to be the subject of the main survey questionnaire, an age-appropriate questionnaire – 0-5, 6-11, or 12-17 – was then mailed back to the respondent (U.S. Census Bureau, 2018a, 2018b). For online respondents, one child was randomly selected from the household after the initial screener was completed and respondents immediately continued to the appropriate questionnaire. Respondents for this survey are typically a parent or caregiver who have knowledge of the child's health and health care needs (U.S. Census Bureau, 2018a, 2018b).

Combined 2016-2017 data was used to increase sample size. Only survey items that remained the same across both study years are included in the combined dataset (U.S. Census Bureau, 2018a, 2018b). Analyses were restricted to children ages 6-17 and stratified by 6-11 and 12-17 years of age.

According to the Emory Institutional Review Board (IRB), this study qualified as Non-Human Subjects Research and therefore did not require IRB review.

Measures

Dependent variable: For children age 6-17, the NSCH asked caregivers, "During the past 12 months, about how many days did this child miss school because of illness or injury?" Responses were categorical and included "no missed school days", "1-3 days", "4-6 days", "7-10 days", "11 or more days", and "this child was not enrolled in school". Number of school days missed was recoded as a binary variable with 0 indicating the child missed less than 11 school days and 1 indicating the child missed 11 or more school days in the same academic year.

Independent variables: The 2016-2017 NSCH covered different types of developmental disability for children between the ages of 3 and 17 years. Caregivers were asked to report if a doctor or other healthcare provider has ever told them this child has autism or autism spectrum disorder (ASD) or attention deficit/hyperactivity disorder (ADD/ADHD). Caregivers were also asked if a doctor, health care provider, or educator ever told them their child has one of the following: learning disability, developmental delay, speech or other language disorder, intellectual disability, cerebral palsy, or Tourette syndrome. Response options were coded as binary by combining responses for “does not have the condition” and responses that indicated the child had at one time been diagnosed with the condition, but does not currently have the condition. If respondents indicated the child currently has a developmental disability, the respondent was asked to rate the severity of the child’s disability. Response options in the survey for condition severity were “mild”, “moderate”, and “severe”. In the data released by NSCH, moderate and severe responses were combined.

Covariates: Potential covariates were identified through careful literature review. At the individual level, problems with mental health were assessed. Caregivers were asked, “During the past 12 months, has this child received any treatment or counseling from a mental health professional, age 3-17 years?” Response options were binary (yes/no). The child’s physical health was controlled for as well. Respondents were asked, “In general, how would you describe this child's health?” Survey response options included “excellent or very good”, “good”, and “fair or poor”. The variable indicating child’s physical health was ultimately recoded as a binary variable by combining responses for “excellent or very good” and “good”. Sleep was also assessed in this survey. The survey asked respondents to rate how many hours the child slept on an average weeknight in the last week. Response options were again categorical starting with "less than 6 hours" and increased in one-hour increments until the greatest category – 11 hours. A binary indicator variable available in the dataset provided by the NSCH, which indicated if the child slept the recommended number of hours for their age, was used in the analysis. Given that comorbidity is common among developmental disabilities (Black & Zablotsky, 2018), all other selected disabilities were controlled for during regression analyses. In order to control for the presence of other developmental disabilities, eight new variables were created that combined all selected developmental disabilities subtracting one condition from each variable. Sex was indicated by a binary response option (male/female). Analyses were stratified by age, which were grouped into two categories 6-11 years of age and 12-17 years of age.

At the microsystem level, analyses controlled for bully victimization as well as parents' physical and mental health. The survey asked, " How true is the following statement: child is bullied, picked on, or excluded by other children?" Response options were binary (definitely or somewhat true/not true). Mental health status of the mother and father was assessed in this survey by asking, "In general, how is your mental or emotional health?" Response options were "excellent or very good", "good", and "fair or poor". Variables indicating mother's and father's mental health were grouped together to form a variable for parent's mental health and recoded as a binary variable by combining responses for "excellent or very good" and "good". Physical health of the mother and father was assessed in a similar fashion using the same response options. Respondents were asked, "In general, how is your physical health?" The same method using variables for mother's and father's physical health was used to create a new variable for parent's physical health. Again, responses for "excellent or very good" and "good" were combined for form a binary variable.

Macrosystem level factors were also assessed during analyses. Child's race/ethnicity was categorized as "White, non-Hispanic", "Black, non-Hispanic", "Hispanic", and "multi-racial/other, non-Hispanic". Family income based on federal poverty level (FPL) was grouped by "0-99% FPL", "100-199% FPL", "200-399% FPL", and "400% or more FPL". Using previous research as a precedent, "0-99% FPL" and "100-199% FPL" were combined and "200-399% FPL" and "400% or more FPL" were combined to form two categories for the variable used for family income. The NSCH also collected the primary adult caregiver's highest level of education. Response options included "less than high school education", "high school or GED", "some college or technical school", or "college degree or higher". Again, response options were combined to form a binary variable with two categories - "college degree or higher" or "less than a college degree".

Data Analysis

First, descriptive analyses were conducted to describe the sample. All variables used in this analysis were categorical; therefore, frequencies and percentages were calculated for all variables of interest. At the bivariate level, chi-square tests were conducted to assess between-group differences for children who missed 11 or more school days compared to those who missed 10 days or less and for children with a developmental disability and children without a developmental disability. Results from bivariate analyses were used to inform regression analyses. Next, simple logistic regressions were conducted to assess the relationship between developmental disability and school absenteeism as well as disability severity and school absenteeism. Multiple logistic regressions were then conducted to assess this relationship when controlling for potential covariates identified above. All analyses accounted for the study's complex sampling frame using the complex sampling function in SAS and sampling weights provided by the dataset. Statistical significance was determined at p-value $\leq .05$. All analyses were completed using SAS 9.4.

RESULTS

Univariate Analyses

There were 51,156 children aged 6-17 years in the 2016-2017 survey. Children were divided into two age ranges with 50.0% (*n*=21,539) of the population falling into the 6–11-year age range and 50.0% (*n*=29,617) in the 12–17-year age range. The sample was evenly split between males and females with 51.1% of the sample identified as male (*n*=26,124) and 48.8% as female (*n*=25,032). In terms of the dependent variable, school absenteeism, 3.7% (*n*=1,981) of children missed 11 or more school days in the last year leaving 48,157 children who missed 10 or fewer days of school in the last year. There were 1,018 missing observations for this variable, leaving 50,138 as the analytic sample size.

Individual: Most children were reported to have good, very good, or excellent physical health (98.2%; *n*=50,318) and most did not receive mental health care in the past 12 months (88.5%; *n*=43,879). Nearly 66% (*n*=34,717) of children were reported to sleep the recommended number of hours for their age, while 34.6% (*n*=15,445) of children did not sleep the recommended number of hours for their age.

Microsystem: The majority of parents reported good, very good, or excellent mental health (96.1%, *n*=39,105). Ninety-four percent of parents also reported good, very good, or excellent physical health (*n*=38,521). Almost 22% (*n*=22,545) of children were reported to have been bullied or excluded by other children.

Macrosystem: Children who identified as White, non-Hispanic made up a 70.0% (*n*=35,807) of the sample while 11.2% (*n*=5,718) identified as Hispanic and 12.7% (*n*=6,470) identified as multi-racial/other, non-Hispanic. Only 6.8% (*n*=3,161) of the children identified as Black, non-Hispanic. In terms of household income, 10.6% (*n*=5,424) children in the sample lived in household at 0-99% federal poverty level (FPL), 15.6% (*n*=7,791) in a household at 100-

199% FPL, 30.2% (*n*=15,452) in a household with 200-399% FPL, and 43.6% (*n*=22,309) children lived in a household with 400% or higher FPL. Approximately 46.8% (*n*=30,608) of adult respondents reported receiving a college degree or higher while 53.2% (*n*=19,664) reported receiving less than a college degree.

Developmental disability: In the sample, 17.2% (*n*=9,238) of children had one or more developmental disability. Among children in the sample with one or more developmental disability, 34.5% (*n*=5,932) of children had Attention-Deficit/Hyperactivity Disorder (ADHD); 23.6% (*n*=4,065) of children had a learning disability; 14.9% (*n*=2,557) of children currently had a developmental delay; 12.6% (*n*=2,171) of children had a speech or other language disorder; 8.7% (*n*=1,502) were reported to have autism or autism spectrum disorder (ASD) diagnosis, 3.7% (*n*=642) had an intellectual disability; 1.0% (*n*=173) of children had cerebral palsy, and 0.9% (*n*=153) of children were reported to have Tourette Syndrome. For children with ADD/ADHD, 40.8% (*n*=2,593) were reported to have mild ADD/ADHD while 59.2% (*n*=3,270) were reported to have moderate or severe ADD/ADHD. Among children with a current learning disability, 44.6% (*n*=1,970) were reported to have a mild learning disability and 55.4% (*n*=2,121) were reported to have a moderate or severe learning disability. Mild developmental delay made up 42.6% (*n*=1,067) of the sample of child with a current developmental delay leaving 57.4% (*n*=1,469) with a moderate or severe developmental delay. Nearly 58% (*n*=1,280) of children with a speech/language disorder were reported to have a mild speech/language disorder with 42.5% (*n*=884) with a reported moderate or severe speech/language disorder. Among child with reported autism/ASD, 42.8% (*n*=766) were reported to have mild autism/ASD and 57.2% (*n*=719) reported to have moderate or severe autism/ASD. The majority of children with an intellectual disability were reported to have a moderate or severe intellectual disability

(65.5%; *n*=423) and 34.5% (*n*=215) children were reported to have a mild intellectual disability. Reported cerebral palsy severity was more evenly split with 47.1% (*n*=74) reported to have mild cerebral palsy and 52.9% (*n*=99) reported to have moderate or severe cerebral palsy. Lastly, among child with Tourette syndrome, 55.6% (*n*=94) were reported to have mild Tourette syndrome and 44.4% (*n*=60) were reported to have moderate or severe Tourette syndrome.

Bivariate Analyses

Bivariate analyses were conducted to assess associations between the dependent and independent variables and selected covariates (Table 2). When assessing number of school days missed, statistically significant between group differences at the .05 level were found for all individual developmental disabilities examined and children with moderate or severe disability had a higher percentage of school absenteeism compared to those with mild disability for children with ADHD (mild: 4.97%; moderate/severe: 10.14%), learning disability (mild: 5.83%; moderate/severe: 12.69%), developmental delay (mild: 7.00%; moderate/severe: 11.16%), intellectual disability (mild: 4.17%; moderate/severe: 16.61%), cerebral palsy (mild: 19.88%; moderate/severe: 31.46%), and Tourette syndrome (mild: 10.90%; moderate/severe: 30.56%). However, statistically significant differences between mild disability and moderate or severe disability were only found for ADHD (p<.0001), learning disability (p=.0009), and developmental delay (p=.0476). Statistically significant between group differences for school absenteeism were also found among variables for age (p<.0001), child receiving mental health treatment (p<.0001), child's physical health status (p<.0001), parent's mental health status (p<.0001), parent's physical health status (p<.0001), having been bullied by others (p<.0001), family income status (p=.0041), and parent's level of education (p=.0024). When assessing developmental disability, statistically significant between group differences were found for variables for sex, child receiving mental health treatment, child's physical health status, adequate amount of sleep, parents' mental health status, parents' physical health status, having been bullied by others, race/ethnicity, family income, and adult caregiver's level of education (p<.0001).

Given the statistically significant difference between age ranges when assessing for school days missed, age-stratified bivariate analyses were also conducted, but resulted in no stark differences in significance.

Logistic Regression Analyses

Regression analyses, stratified by ages 6-11 and 12-17 years, were conducted to assess the odds of missing 11 or more school days for children with one or more developmental disability followed by assessing the odds of missing 11 or more school days among children with a specific developmental disability. Intellectual disability did not provide a large enough sample size to be included in regression analyses and was therefore excluded from the models.

Unadjusted logistic regression: For children aged 6-11 years (Table 3), results of unadjusted analyses found that the odds missing 11 or more school days in children with one or more of the selected developmental disability were 2.63 times (95% confidence interval [CI]: 1.88-3.68) higher compared to children with no developmental disability. When assessing individual disabilities, children with ADHD (OR: 2.26, 95% CI: 1.55–3.31), a learning disability (OR: 2.83, 95% CI: 1.87–4.29), developmental delay (OR: 2.88, 95% CI:1.99–4.19), a speech/language disorder (OR: 1.94, 95% CI:1.34–2.81), autism/ASD (OR: 2.99, 95% CI: 1.79–4.99), intellectual disability (OR: 5.39, 95% CI: 2.15–13.51), cerebral palsy (OR: 12.12, 95% CI: 5.44–27.00), and Tourette syndrome (OR: 6.21, 95% CI: 1.07–35.96) were more likely to miss 11 or more school days when compared to children who were not reported to have that particular condition. For children 12-17 years of age (Table 4), children with one or more of the selected developmental disabilities had 3.19 times (95% CI: 2.33–4.37) the odds of missing 11 or more days of school compared to children in the same age range without a developmental disability. After examining individual developmental disabilities, children with ADHD (OR: 2.79; 95% CI: 2.09–3.71), learning disability (OR: 3.50; 95% CI: 2.23–5.52), developmental delay (OR: 3.06; 95% CI: 2.16–4.33), speech/language disorder (OR: 4.52; 95% CI: 1.96–10.44), autism/ASD (OR: 4.91; 95% CI: 2.29–10.55), intellectual disability (OR: 4.36; 95% CI: 2.61–7.28), cerebral palsy (OR: 7.32; 95% CI: 3.14–17.04), and Tourette syndrome (OR: 5.66; 95% CI: 2.02–15.85) were more likely to be absent from school for 11 days or more when compared to children that do not have that individual disability.

Adjusted logistic regressions: Three models were fit to the data. Model 1 adjusts for other selected developmental disabilities and other individual level covariates, such as the child's physical health status and whether or not the child is receiving mental health treatment. Hours of sleep was not included as it was not significantly associated with missing 11 or more days of school at the bivariate level. Model 2 adds covariates from the microsystem to the model – being the victim of bullying, parents' mental health status, and parents' physical health status. Finally, model 3 adds macrosystem covariates, family income level and adult education level, to the model. Race/ethnicity was not significantly associated with school absenteeism at the bivariate level; therefore, it was not included in the fully adjusted model.

<u>Model 1</u>: For children aged 6-11 years (Table 3), the presence of one or more of the selected developmental disabilities increased the odds of missing 11 or more school days by 1.91 times (95% CI: 1.30–2.82) compared to children without a developmental disability. Only children with cerebral palsy remained significantly more likely to miss 11 or more school days

compared to children without cerebral palsy (aOR: 5.51; 95% CI: 2.28–13.30). Children aged 12-17 years (Table 4) with one or more selected developmental disability were 1.53 times (95% CI: 1.10–2.12) more likely to miss 11 or more days of school compared with children aged 12-17 years without one or more of these conditions. When assessing individual disabilities, children with speech/language disorder and cerebral palsy has significantly higher odd of school absenteeism. Children with speech/language disorder were 2.34 times (95% CI: 1.01–5.44) more likely to miss 11 or more school days and children with cerebral palsy were 2.8 times (95% CI: 1.10–7.27) more likely to miss 11 or more days of school compared to children without these conditions.

Model 2: In model 2, children aged 6-11 years (Table 3) with one or more reported developmental disability were 1.6 times (95% CI: 0.94–2.27) more likely to miss 11 or more school days compared to children who did not have a reported developmental disability. However, the results were not significant at the .05 level (p = .0841). When assessing individual developmental disabilities, only children with cerebral palsy (aOR: 12.06; 95% CI: 3.57–40.72) and children with Tourette syndrome (aOR: 6.54; 95% CI: 1.08 – 39.78) remained significantly more likely to miss 11 or more days of school when compared with children that did not have these conditions. Children aged 12-17 years (Table 4) with one or more of the selected developmental disabilities were almost twice as likely to miss 11 or more days of school when compared to children without a developmental disability (aOR: 1.94; 95% CI: 1.23–3.08). However, when assessing individual developmental disabilities only children with autism/ASD remained significantly more likely to miss 11 or more days of school when compared to their peers without autism/ASD (aOR: 2.92; 95% CI: 1.15–7.45).

Model 3: In the fully adjusted model, the odds of missing 11 or more days of school remained stable for children aged 6-11 years when assessing the presence of one or more developmental disability (aOR: 1.60; 95% CI: 0.94–2.75) (Table 3). Although again, this result was not significant at the .05 level ($p = .0858$). When assessing individual disabilities in children 6-11 years of age (Table 3), cerebral palsy and Tourette syndrome remained significant predictors of missing 11 or more school days. Children with cerebral palsy were 12.01 times (95% CI: 3.54–40.74) more likely to miss 11 or more school days compared with children without cerebral palsy, and children with Tourette syndrome were 6.49 times (95% CI: 1.10–38.39) more likely to miss 11 days of school or more compared to children without Tourette syndrome. In the fully adjusted model for children aged 12-17 years (Table 4), children with one or more of the selected developmental disabilities were 1.9 times (95% CI: 1.22–2.97) more likely to miss 11 or more school days compared to children without these conditions. Only children with autism/ASD remained significantly more likely to miss 11 or more school days compared to children without autism/ASD (aOR: 2.87; 95% CI: 1.22 – 6.75). Models assessing all individual developmental disabilities were significant ($p < .0001$).

Additional Analyses Assessing Disability Severity

Additional logistic regression analyses were conducted to assess the odds of missing 11 or more school days based on disability severity for children with ADHD, learning disability, developmental delay, speech/language disorder, and autism/ASD. There were too few children with cerebral palsy and Tourette syndrome for these samples to be spilt by disability severity; therefore, they were not included in these additional analyses.

Unadjusted logistic regression: In children 6-11 years of age (Table 5), unadjusted logistic regression analyses suggested children with both mild or moderate/severe ADHD, learning disability, developmental delay, speech/language disorder, and autism/ASD were significantly more likely to miss 11 or more school days compared to children without that particular condition. See table 5 for full description of odds ratios and confidence intervals. For children aged 12-17 years (Table 6), unadjusted logistic regression analyses indicated children with mild or moderate/severe ADHD, learning disability, developmental delay, speech/language disorder, and autism/ASD were more likely to miss 11 or more school days when compared with children that do not have that specific disability. In both age groups, 6-17 and 12-17 years, there was a general trend for a dose response relationship between developmental disability and school absenteeism in that children with a moderate/severe developmental disability had higher odds of missing 11 or more school days than did children whose disability was rated as mild.

Adjusted logistic regressions: Again, three models were fit to the data assessing the likelihood of missing 11 or more school days by individual disability severity. All models included the same individual, microsystem, and macrosystem covariates as in the previous analysis.

<u>Model 1</u>: Among children aged 6-11 years, when adjusting for individual level covariates, children with mild autism were 2.21 times (95% CI: 1.04–7.79) more likely to miss 11 or more days of school compared with their peers who did not have autism/ASD (Table 5). There were no significant results for any of the individual disabilities examined among children aged 12-17 years (Table 6).

<u>Model 2</u>: For children 6-11 years of age (Table 5), only children with mild autism/ASD were significantly more likely to miss school. Children with mild autism/ASD were 3.3 times (95% CI: 1.40–7.79) more likely to miss 11 or more school days compared to children without autism/ASD. Among children aged 12-17 years (Table 6), children with moderate/severe

ADD/ADHD were 1.29 times more likely to be absent from school for 11 or more school days compared to children without ADD/ADHD. Autism/ASD was also significant for children 12-17 years of age in model 2. Children with mild autism/ASD were almost two times (aOR: 1.94; 95% CI: 1.02 – 3.69) more likely to miss 11 or more days of school and children with moderate/severe autism/ASD were 4.03 times (95% CI: 1.04–15.70) more likely to be absent for 11 or more days compared with children without autism/ASD.

Model 3: In the fully adjusted model for children aged 6-11 years (Table 5), children with mild autism/ASD were 3.34 times (95% CI: 1.42–7.85) more likely to miss 11 or more school days compared to their peers without autism/ASD. Although not statistically significant, a dose response relationship existed for some selected disabilities such as ADD/ADHD, learning disability, and developmental delay for children in this age range. Interestingly though, autism/ASD and speech/language disorder had opposite effects as children with a mild disability were more likely to demonstrate school absenteeism compared to children with a moderate/severe form of the disability. See Table 5 for full description of adjusted odds ratios and confidence intervals.

In the fully adjusted model for children 12-17 years of age (Table 6), children with moderate/severe ADD/ADHD remained significantly more likely to miss 11 or more days of school compared with children who did not have ADD/ADHD (aOR: 1.27; 95% CI: 1.03–1.57). Children with mild autism/ASD were 2.03 times (95% CI: 1.06 – 3.88) and children with moderate/severe autism/ASD were 3.80 times (95% CI: 1.10–13.10) more likely to miss 11 or more school days compared with children without autism/ASD. Both ADD/ADHD and autism/ASD followed a dose response relationship for children in this age range with the likelihood of missing 11 or more school days increasing as the severity of the disability increased. Learning disability also followed this pattern although results were not statistically significant. Speech/language disorder and developmental delay were the only disabilities that did not have the same dose response relationship with school absenteeism. Models for all developmental disabilities were significant (p <.0001).

DISCUSSION

Conclusions

This study aimed to examine the relationship between individual developmental disabilities and school absenteeism using data from the 2016-2017 National Survey of Children's Health and Bronfenbrenner's bioecological systems theory to identify the multi-system influences that may affect school absenteeism in this population – focusing specifically on factors within the individual, microsystem, and macrosystem.

Consistent with previous research (Black & Zablotsky, 2018; Hatton, 2018; Redmond & Hosp, 2008; Zablotsky et al., 2019), having one or more developmental disability appeared to be associated with school absenteeism. However, when potential confounding variables were added, a significant association only held consistent for one of the two age groups. Results suggest children aged 12-17 years with one or more developmental disability are almost two times more likely to miss 11 or more school days compared with children who do not have a developmental disability, even when controlling for potentially confounding variables at the individual, microsystem, and macrosystem levels. For children aged 6-11 years however, the results are more attenuated by extraneous factors at the microsystem level such as being the victim of bullying and parents' mental and physical health status. This may be due to the fact that younger children are more reliant or parents or other adult caretakers to attend school (Cook et al., 2017), or the fact that school absenteeism in general is less likely for younger children compared to children in an older age range, even among children with a developmental disability (U.S. Depatrment of Education, 2019).

When assessing developmental disabilities independently from one another, there appears to be a stark difference in the likelihood of school absenteeism between the different developmental disabilities assessed in this study. Findings also suggest there is a difference between age groups – meaning children with a particular developmental disability may be more at risk for school absenteeism depending on their developmental or life stage.

In children aged 6-11 years, only cerebral palsy and Tourette syndrome remained significant predictors of missing 11 or more schools days in the fully adjusted model with children, aged 6-11 years, with cerebral palsy being 12.01 times more likely to miss 11 or more school days compared to children without cerebral palsy and children with Tourette syndrome almost 6.5 times more likely to miss 11 or more days of school compared with children who did not Tourette syndrome. These odds are considerably higher than other conditions examined, such as speech/language disorder or ADD/ADHD which appeared to serve as protective factors again school absenteeism in children 6-11 years of age – although, the results for speech/language disorder and ADD/ADHD were not statistically significant.

In children 12-17 years old, only autism/ASD remained statistically significant when adjusting for all potential confounding variables. In this age group, the odds of children with autism/ASD missing 11 more school days were 2.87 times higher compared to children in this age group that did not have autism/ASD. While results for the other developmental disabilities in this age group were not statistically significant at the .05 level, all developmental disabilities appeared to increase the odds of missing 11 or more school days except for ADD/ADHD which mimicked the findings in children aged 6-11 years.

In line with the bioecological systems theory, factors in lower-level systems, such as the individual and microsystem, appeared to have the greatest influence on the odds of school absenteeism for children in both age ranges. For most conditions, in the 6-11-year age range, that did not remain statistically significant in the fully adjusted models, results were attenuated by individual level factors – mental health treatment or physical health status. It is also important to note that once other developmental disabilities were controlled for in model 1, the results for many of the conditions were no longer significant – suggesting interaction between the different conditions, which is consistent with previous findings from Black & Zablotsky (2019). The same held true for children aged 12-17 years. However, factors in the microsystem level – particularly bullying – also attenuated the statistical significance of results associated with individual conditions for children in this age range.

This study also sought to assess this hypothesized association by the severity of the individual developmental disability, while adjusting for individual, microsystem, and macrosystem level factors. In unadjusted analyses, there was a statistically significant gradient effect in both age groups for all selected developmental disabilities with children who had a moderate/severe developmental disability being more likely to miss 11 or more days of school compared with children who have a mild form of the condition. When covariates were added to the models, the majority of developmental disabilities in both age groups continued to have this gradient effect. This is consistent with the study's hypothesis and with pervious literature on disability severity and school absenteeism (Hatton, 2018), although not all results were statistically significant. For some developmental disabilities, however, the direction of association was reversed. The odds of school absenteeism among children with a speech/language disorder decreased for children with moderate/severe disability severity for children in both age groups, making children with moderate/severe speech/language disorder less likely to miss 11 or more school days than children who had a mild speech/language disorder. In children aged 12-17 years with a developmental delay, the odds of missing 11 or more school days was also lower for children with a moderate/severe developmental delay than the odds for children with a mild developmental delay.

One of the more interesting findings of this study is the higher odds of school absenteeism among children 6-11 years of age with mild autism/ASD compared to children with moderate/severe autism. In the fully adjusted model, children aged 6-11 years with mild autism/ADD were 3.34 times more likely to be absent from school for 11 or more days compared to children without autism/ASD. This is compared to an odds ratio of only 0.52 for children with moderate/severe autism/ASD. Interestingly though, there was the opposite effect among children aged 12-17 years. In the fully adjusted model, children with moderate/severe autism were 3.80 times more likely to miss 11 or more school days when compared with children without autism/ASD and children with mild autism were 2.03 times more likely to miss 11 or more school days. Given that so few studies examine school absenteeism and developmental disability severity, it is difficult to theorize the reasons behind these differences in the direction of association seen between developmental disabilities. However, access to and availability of services for children whose condition is rated as more severe may be impacting the likelihood of school absenteeism between those with a mild form of the condition and those with a moderate/severe condition.

Strengths and Limitations

Despite limitations, the study does have several strengths worth noting. This study is one of the few studies on this topic that uses nationally representative data making it more generalizable to the U.S. population. Secondly, this study sought to provide an understanding of the association between school absenteeism and a large number of individual developmental disabilities. This study examined eight developmental disabilities, which is more than previous research examined by the author, and assessed this association in different age ranges which provides a more nuanced understanding of school absenteeism throughout life stages. Even though not every developmental disability was able to be completely examined through the analyses, developmental disabilities were examined independently of one another furthering the understanding of how a specific developmental disability may impact the potential for school absenteeism. A wide number of potentially confounding variables were also included in the models which helped isolate the associations. Finally, this study sought to provide insight into how disability severity may impact the likelihood for school absenteeism, a topic that has been thus far overlooked by much of the previous literature. This aspect combined with the greater number of developmental disability included in this study helps provide insight and direction for future research.

Limitations in this study include those that are common when using secondary data. First, missing data for the school absenteeism variable and for the parent-rated severity of the developmental disability could not be accounted for, which may bias results. Secondly, the wording of particular questions was outside the author's control. This study did not seek to make a distinction between school days missed due to illness or injury or due to another reason, such as school refusal. However, the survey asks specifically about school days missed due to illness or injury. Although it has been cited that school missed for any reason results in a detriment to child outcomes (Gottfried, 2009; Hancock et al., 2013). The survey also only collected number of school days missed up to 11 or more days, which is lower than the metric used by the U.S. Department of Education to define chronic school absenteeism, 15 or more days missed in a school year (U.S. Depatrment of Education, 2019). Using a continuous scale for number of days missed would have allowed for more in-depth analysis of the association between developmental disability and school absenteeism. Limitations due to data collection also exist. The NSCH relied on parent-reported, or other caregiver-reported, responses making it possible for number of school days missed and/or presence of developmental disability to be under or over reported and for developmental disability severity to be subjective to the respondent rather than based on medical definition creating the possibility of information bias in this study. Limitations within the data exist as well. First, sample sizes for certain developmental disabilities hindered analyses. For intellectual disability, there were not enough children with only an intellectual disability to include this condition in regression models and the number of children with cerebral palsy and Tourette syndrome were too small to be split by disability severity for the additional analyses assessing school absenteeism by the severity of the developmental disability. Therefore, the study was not able to report on intellectual disability independent from other developmental disabilities or whether the severity of cerebral palsy or Tourette syndrome has an impact on the odds of school absenteeism. Secondly, responses to moderate disability severity and severe disability were grouped in the data that was available for analysis. Therefore, a true dose response relationship cannot be observed. Finally, because this is a cross-sectional study design, any associations found cannot establish a causal relationship.

Implications and Future Research

In summary, the results from this study indicate there is an association between developmental disability and school absenteeism, especially among children aged 12-17 years, and this association is unique for different conditions. Matching the theoretical framework used by this study, the bioecological systems theory, factors in the lower-level systems such as physical health, mental health treatment, bullying, and parent's physical and mental health appeared to have the greatest impact on the odds of school absenteeism associated with an individual condition. Findings also indicated there is a difference in the odds for school absenteeism by the severity of the developmental disability. However, contrary to the study's hypothesis, there was not a ubiquitous pattern between the conditions. The study hypothesized that a child with a developmental disability that was considered moderate/severe would have a higher likelihood of being absent from school compared with child who had the same condition, but it was considered to be of mild severity. This was not the case for children aged 6-11 and 12-17 years with a speech/language disorder, children aged 6-11 years with autism/ASD, or children aged 12-17 years with a developmental delay where moderate/severe conditions had a lower odds of school absenteeism compared with mild conditions. While not all results from these models were statistically significant, this was still a surprising outcome from the study's analyses and should be assessed further. This may be due to differential access to services throughout the lifespan, attrition from school for children with more severe conditions, or due to other factors not assessed in this study. A qualitative study focused on parent's perspective on the challenges of school attendance for children with more severe developmental disability would be a valuable contribution to the literature and fundamental to better understanding this occurrence.

Findings from this study indicate that there are developmental disabilities that warrant special concern from special education teachers and other school officials. From these findings, it appears children aged 6-11 years with cerebral palsy and Tourette syndrome are significantly at risk for missing school. This association was not explained by the presence of other developmental disabilities, the child's physical or mental health, being the victim of bullying, parents' physical and mental health, family income, or the adult's education level. Unfortunately, there were not enough children with these conditions to study the impact of the severity of the condition on their likelihood for school absenteeism, which was a major limitation for this study.

Also, in children aged 12-17 years, children with moderate/severe ADD/ADHD were significantly more likely to miss school compared with children without ADD/ADHD. While the odds ratio was relatively small, just 1.27, this result is still largely significant and worthy of noting as it appears children with moderate/severe ADD/ADHD have a significantly higher odds of absenteeism from school even after adjusting for other conditions, the child's mental and physical health, bully victimization, parents physical and mental health, family income, and the caretaking adult's level of education.

Once again, results from unadjusted analyses indicate there is higher odds of school absenteeism for children with developmental disabilities; however, given that the statistical significance was attenuated by individual and microsystem factors for many conditions, educators and school health officials should examine these lower-level factors in children with developmental disability who have demonstrated school absenteeism in order to mitigate these factors or come up with potential solutions to the problems posed by one or more of these influences.

For future research, the high odds ratios seen for children with cerebral palsy and Tourette syndrome warrants additional research focusing specifically on these conditions and future studies should take into account the condition's severity to understand if the same gradient effect is evident. Even without understanding the effect of the conditions' severity, these results justify further academic resources for children aged 6-11 years with cerebral palsy and Tourette syndrome and their parents. Another condition that warrants future research is autism/ASD. In the 12-17-year age group, children with autism/ASD were significantly more likely to miss school compared the children in the same age range that did not have autism/ASD even after adjusting for potentially confounding variables. There was also a gradient effect for children in this age group that was not seen in the 6-11-year age group in that children with moderate/severe autism/ASD in the 12-17-year age range were more likely to miss 11 or more days of school than were children with mild autism/ASD. This may mean there is a decrease in academic and other services for children with moderate/severe autism/ASD as they continue to age. However, more research is needed to explore this hypothesis.

As previously mentioned, frequent school absenteeism can result in lower educational attainment, heightened risk of school drop-out, risky health behaviors among adolescents, and poor academic performance (Balfanz & Byrnes, 2012; Eaton et al., 2008; Ehrlich et al., 2013; Gottfried, 2009; Utah Education Policy Center, 2012). There is also a well-documented link between health and education (Healthy People 2030; Robert Wood Johnson Foundation, 2016). Therefore, there is a real need for additional academic programs and resources targeted for these children and their families to help reduce the odds of missing school, especially among children aged 12-17, as well as future research that assesses school absenteeism in the conditions mentioned above – cerebral palsy, Tourette syndrome, and autism/ASD. This study was unable to assess the reasons behind why a child with a developmental disability may be missing more school days than a child without a developmental disability. Thus, more research should be conducted to determine the reasons behind school absentee behavior among this population in order to better understand the association these conditions have with school absenteeism. In this way, targeted interventions can be constructed to help children with developmental disabilities and their families attend school regularly and mitigate the effects of school absenteeism on their education.

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TABLES

Table 1: Description and frequency of variables examined among children aged 6-17 years (n=51,156), National Survey of Children's Health, 2016-2017

Variable	Measures	Sample Size	Weighted %
Number of school days missed (DV)	0-10 school days missed	48,157	96.3
	11 or more school days missed	1,981	3.7
Developmental Disability	One or more developmental disability	9,238	17.2
	ADD/ADHD	5,932	10.4
	Mild	2,593	40.8
	Moderate or severe	3,270	59.2
	Learning disability	4,065	8.1
	Mild	1,907	44.6
	Moderate or severe	2,121	55.4
	Developmental delay	2,557	5.0
	Mild	1,067	42.6
	Moderate or severe	1,469	57.4
	Speech/language disorder	2,171	4.6
	Mild	1,280	57.5
	Moderate or severe	884	42.5
	Autism/ASD	1,502	3.1
	Mild	766	42.8
	Moderate or severe	719	57.2
	Intellectual disability	642	1.4
	Mild	215	34.5
	Moderate or severe	423	65.5
	Cerebral palsy	173	0.3
	Mild	74	47.1
	Moderate or severe	99	52.9
	Tourette syndrome	155	0.3
	Mild	94	55.6
	Moderate or severe	60	44.4
Individual			
Age	6-11 years of age	21,539	50.0
	12-17 years of age	29,617	50.0

Sex	Male	26,124	51.1
	Female	25,032	48.9
Receiving mental health treatment	Received mental health care	7,037	11.5
	Did not receive mental health care	43,879	88.5
Physical health	Good, very good, or excellent	50,318	98.2
	Fair or poor	691	1.8
Hours of sleep	Sleeps recommended age-appropriate amount of hours	34,717	65.4
	Does not sleep the recommended age-appropriate amount of hours	15,445	34.6
Microsystem			
Parents' mental health	Good, very good, or excellent	39,105	96.1
	Fair or poor	1,457	3.9
Parents' physical health	Good, very good, or excellent	38,521	94.0
	Fair or poor	2,080	6.0
Child is bullied, picked on or excluded by other children	Definitely or somewhat true	11,545	21.7
	Not true	38,608	78.3
Macrosystem			
Race/ethnicity	White, non-Hispanic	35,807	50.9
	Hispanic	5,718	25.3
	Black, non-Hispanic	3,161	13.8
	Multi-racial/other, non-Hispanic	6,470	10.0
Family income	0%–199% FPL	13,395	43.2
	200% and above FPL	37,761	56.8
Adult caregiver's level of education	College degree or higher	30,608	46.8
	Less than college degree	19,664	53.2

Abbreviations: ADHD (attention deficit hyperactivity disorder); ASD (autism spectrum disorders); FPL (federal poverty line)

Table 2: Characteristics of children aged 6-17, National Survey of Children's Health, 2016-2017, by school absenteeism and developmental disability

	n(Weighted %)			
Variable	**11 or more school days missed (n=1,981)[1]**	**10 or fewer school days missed (n=48,157)[1]**	**One or more developmental disability (n=9,238)[1]**	**No developmental disability (n=41,918)[1]**
Developmental disability	763(36.96)***	8,282(16.42)***	NA	NA
ADD/ADHD	490(22.79)***	5,328(9.93)***		
Mild	142(25.35)***	2,408(42.32)***	NA	NA
Moderate or severe	346(74.66)***	2,854(5.77)***		
Learning disability	409(21.11)***	3,557(7.50)***		
Mild	145(27.51)***	1,712(47.14)***	NA	NA
Moderate or severe	260(72.49)***	1,814(52.86)***		
Developmental delay	307(12.24)***	2,182(4.61)***		
Mild	96(32.75)*	943(44.80)*	NA	NA
Moderate or severe	210(67.25)*	1,219(55.20)*		
Speech/language disorder	185(10.88)***	1,938(4.28)***		
Mild	87(59.48)	1,172(58.94)	NA	NA
Moderate or severe	97(40.52)	761(41.06)		
Autism/ASD	171(10.59)***	1,299(2.76)***		
Mild	72(35.86)	682(44.65)	NA	NA
Moderate or severe	99(64.14)	600(55.35)		
Intellectual disability	99(5.41)***	520(1.18)***		
Mild	27(27.76)	178(35.92)***	NA	NA
Moderate or severe	72(72.24)	338(64.08)***		
Cerebral palsy	40(1.99)***	126(0.22)***		
Mild	13(38.16)	60(53.31)	NA	NA
Moderate or severe	27(61.84)	66(46.69)		

Tourette syndrome	19(1.47)***	134(0.23)***	NA	NA
Mild	9(30.87)	84(61.64)		
Moderate or severe	10(69.13)	49(38.36)		
No developmental disability	1,218(63.04)***	39,875(83.58)***	NA	NA
Individual				
Age				
6-11 years old	560(36.35)***	20,567(50.54)***	3,857(48.96)	17,682(50.23)
12-17 years old	1,412(63.65)***	27,590(49.46)***	5,381(51.04)	24,236(49.77)
Sex				
Male	977(53.37)	24,660(51.14)	6,081(66.18)***	20,043(47.92)***
Female	1,004(46.63)	23,497(48.87)	3,157(33.82)***	21,875(52.08)***
Receiving mental health treatment				
Received mental health care	847(36.30)***	6,060(10.61)***	3,612(36.06)***	3,425(6.41)***
Did not receive mental health care	1,131(63.70)***	41,888(89.39)***	5,582(63.94)***	38,297(93.59)***
Physical health				
Good, very good, or excellent	1,736(87.81)***	47,592(98.66)***	8,828(94.73)***	41,490(98.97)***
Fair or poor	240(12.19)***	425(1.34)***	384(5.27)***	307(1.03)***
Hours of sleep				
Sleeps recommended age-appropriate amount of hours	1,247(63.46)	33,290(65.52)	5,946(61.32)***	28,771(66.26)***
Does not sleep the recommended age-appropriate amount of hours	729(36.54)	14,591(34.48)	3,112(38.68)***	12,333(33.74)***

Microsystem				
Parents' mental health				
Good, very good, or excellent	1,237(90.95)***	37,251(96.36)***	6,294(93.38)***	32,811(96.63)***
Fair or poor	132(9.05)***	1,294(3.64)***	398(6.62)***	1,059(3.37)***
Parents' physical health				
Good, very good, or excellent	1,198(84.89)***	36,721(94.29)***	6,176(90.74)***	32,345(94.52)***
Fair or poor	177(15.11)***	1,857(5.71)***	518(9.26)***	1,562(5.48)***
Child is bullied, picked on or excluded by other children				
Definitely or somewhat true	904(41.78)***	10,519(20.78)***	4,094(42.83)***	7,451(17.28)***
Not true	1,062(58.22)***	37,217(79.22)***	4,961(57.17)***	33,647(82.72)***
Macrosystem				
Race/ethnicity				
White, non-Hispanic	1,455(55.03)	33,712(50.96)	6,630(53.89)***	29,177(50.26)***
Hispanic	222(24.32)	5,361(25.35)	1,002(22.14)***	4,716()25.93***
Black, non-Hispanic	92(11.42)	2,964(13.62)	658(16.26)***	2,503(13.32)***
Multi-racial/other, non-Hispanic	212(9.22)	6,120(10.08)	948(7.72)***	5,522(10.48)***
Family income				
0%–199% FPL	720(51.55)**	12,330(42.63)**	2,991(49.81)***	10,404(41.82)***
200% and above FPL	1,261(48.45)**	37,088(59.24)**	6,247(50.19)***	31,514(58.18)***
Adult caregiver's level of education				

College degree or higher	974(39.13)**	29,155(47.21)**	5,004(41.61)***	25,604(47.83)***
Less than college degree	975(60.87)**	18,275(52.79)**	4,064(58.39)***	15,600(52.17)***

Abbreviations: NA (not applicable); ADHD (attention deficit hyperactivity disorder); ASD (autism spectrum disorders); FPL (federal poverty line)

*** p <.001
** p < .01
* p < .05

[1] denominators may change based on missing data

Table 3: Odds of missing 11 or more school days among children with a developmental disability aged 6-11 years

	Unadjusted Odds Ratio (95% Confidence Interval)	Adjusted Odds Ratio (95% Confidence Interval)		
Variable		**Model 1[a]**	**Model 2[b]**	**Model 3[c]**
One or more developmental disability	2.63 (1.88–3.68)***	1.91 (1.30–2.82)**	1.60 (0.94–2.72)	1.60 (0.94 – 2.75)
ADD/ADHD	2.26 (1.55–3.31)***	1.19 (0.71–2.00)	0.83 (0.40–1.72)	0.83 (0.40 – 1.71)
Learning disability	2.83 (1.87–4.29)***	1.20 (0.70–2.04)	1.27 (0.60–2.70)	1.28 (0.59–2.76)
Developmental delay	2.88 (1.99–4.19)***	1.23 (0.74–2.02)	1.10 (0.53–2.32)	1.10 (0.52–2.32)
Speech/language disorder	1.94 (1.34–2.81)***	1.07 (0.68–1.71)	0.92 (0.50–1.69)	0.92 (0.50–1.69)
Autism/ASD	2.99 (1.79–4.99)***	1.28 (0.69–2.37)	1.16 (0.52–2.61)	1.17 (0.52–2.63)
Cerebral palsy	12.12 (5.44–27.00)***	5.51 (2.28–13.30)***	12.06 (3.57–40.72)***	12.01 (3.54–40.73)***
Tourette syndrome	6.21 (1.07–35.96)**	4.89 (0.76–31.59)	6.54 (1.08–39.78)*	6.49 (1.10–38.39)*

Abbreviations: NA (not applicable); ADHD (attention deficit hyperactivity disorder); ASD (autism spectrum disorders)

*** p <.001
** p < .01
* p < .05

[a]Controls for presence of co-occurring developmental disabilities of either ADHD, learning disability, developmental delay, speech/language disorder, autism/ASD, intellectual disability, cerebral palsy, and/or Tourette syndrome; child health status; and child receiving mental health treatment

[b]Controls for covariates in model 1 and adds variables for bully victimization; parents' mental health status; and parents' physical health status

[c]Controls for covariates in models 1 and 2 and adds variables for family income; and adult education level

Table 4: Odds of missing 11 or more school days among children with a developmental disability aged 12-17 years

Variable	Unadjusted Odds Ratio (95% Confidence Interval)	Adjusted Odds Ratio (95% Confidence Interval) Model 1[a]	Model 2[b]	Model 3[c]
One or more developmental disability	3.19 (2.33–4.37)***	1.53 (1.10–2.12)**	1.94 (1.23–3.08)**	1.90 (1.22–2.97)**
ADHD	2.79 (2.09–3.71) ***	0.90 (0.56–1.45)	0.92 (0.49–1.74)	0.94 (0.51–1.71)
Learning disability	3.50 (2.23–5.52)***	1.49 (0.92–2.42)	1.88 (0.94–3.75)	1.76 (0.94–3.31)
Developmental delay	3.06 (2.16–4.33)***	1.07 (0.64–1.79)	1.05 (0.55–2.03)	1.04 (0.53–2.03)
Speech/language disorder	4.52 (1.96–10.44)***	2.34 (1.01–5.44)*	2.65 (0.90–7.79)	2.50 (0.94–6.67)
Autism/ASD	4.91 (2.29–10.55)***	1.78 (0.78–4.05)	2.92 (1.15–7.45)*	2.87 (1.22 – 6.75)*
Cerebral palsy	7.32 (3.14–17.04)***	2.83 (1.10–7.27)*	2.44 (0.62–9.57)	2.48 (0.61–10.06)
Tourette syndrome	5.66 (2.02–15.85)**	2.41 (0.55–10.47)	3.13 (0.54–18.01)	3.22 (0.55–18.78)

Abbreviations: NA (not applicable); ADHD (attention deficit hyperactivity disorder); ASD (autism spectrum disorders)

*** p <.001
** p < .01
* p < .05

[a]Controls for presence of co-occurring developmental disabilities of either ADHD, learning disability, developmental delay, speech/language disorder, autism/ASD, intellectual disability, cerebral palsy, and/or Tourette syndrome; child health status; and child receiving mental health treatment

[b]Controls for covariates in model 1 and adds variables for bully victimization; parents' mental health status; and parents' physical health status

[c]Controls for covariates in models 1 and 2 and adds variables for family income; and adult education level

Table 5: Odds of missing 11 or more school days among children with a developmental disability aged 6-11 years based on disability severity

Variable	Unadjusted odds ratio (95% confidence interval)	Adjusted odds ratio (95% confidence interval)		
		Model 1[a]	Model 2[b]	Model 3[c]
ADD/ADHD				
Mild vs. no ADD/ADHD	1.63 (1.14–2.34)**	0.74 (0.41–1.33)	0.70 (0.32–1.54)	0.69 (0.32–1.54)
Moderate/severe vs. no ADD/ADHD	2.79 (2.19–3.55)***	1.45 (0.78–2.69)	0.91 (0.36–2.26)	0.90 (0.36–2.24)
Learning disability				
Mild learning disability vs. no learning disability	2.76 (1.97–3.87)***	1.02 (0.54–1.93)	1.09 (0.45–2.63)	1.09 (0.45–2.64)
Moderate/severe learning disability vs. no learning disability	5.30 (4.16–6.75)***	1.36 (0.70–2.66)	1.43 (0.53–3.85)	1.44 (0.53–3.94)
Developmental delay				
Mild dev. delay vs. no dev. delay	3.51 (2.47–4.99)***	1.11 (0.55–2.24)	0.92 (0.30–2.86)	0.92 (0.30–2.86)
Moderate/severe dev. delay vs. no dev. delay	6.89 (5.38–8.82)***	1.29 (0.73–2.29)	1.24 (0.58–2.67)	1.24 (0.58–2.67)
Speech/language disorder				
Mild speech/lang. disorder vs. no speech\/lang. disorder	2.75 (2.03–3.72)***	1.30 (0.76–2.21)	1.01 (0.50–2.02)	1.01 (0.50–2.02)
Moderate/severe speech/lang. disorder vs. no speech /lang. disorder	4.43 (3.21–6.10)***	0.79 (0.43–1.45)	0.76 (0.35–1.65)	0.76 (0.35–1.66)
Autism/ASD				
Mild autism/ASD vs. no autism/ASD	3.26 (2.09–5.07)***	2.21 (1.04–4.69)*	3.30 (1.40–7.79)**	3.34 (1.42–7.85)**

Moderate/severe autism/ASD vs. no autism/ASD	5.88 (4.14–8.37)***	1.09 (0.49–2.41)	0.52 (0.19–1.44)	0.52 (0.19–1.43)

Abbreviations: ADHD (attention deficit hyperactivity disorder); ASD (autism spectrum disorders); ID (intellectual disability); CP (cerebral palsy); Tourette (Tourette syndrome)

*** p <.001
** p < .01
* p < .05

[a]Controls for presence of co-occurring developmental disabilities of either ADHD, learning disability, developmental delay, speech/language disorder, autism/ASD, intellectual disability, cerebral palsy, and/or Tourette syndrome; child health status; and child receiving mental health treatment

[b]Controls for covariates in model 1 and adds variables for bully victimization; parents' mental health status; and parents' physical health status

[c]Controls for covariates in models 1 and 2 and adds variables for family income; and adult education level

Table 6: Odds of missing 11 or more school days among children with a developmental disability aged 12-17 years based on disability severity

	Unadjusted odds ratio (95% confidence interval)	**Adjusted odds ratio (95% confidence interval)**		
Variable		**Model 1[a]**	**Model 2[b]**	**Model 3[c]**
ADD/ADHD				
Mild vs. no ADD/ADHD	1.64 (1.34–2.01)***	0.81 (0.48–1.36)	0.95 (0.73–1.22)	0.78 (0.40–1.52)
Moderate/severe vs. no ADD/ADHD	3.85 (3.33–4.45)***	0.96 (0.55 – 1.70	1.29 (1.04–1.59)**	1.27 (1.03–1.57)**
Learning disability				
Mild learning disability vs. no learning disability	2.19 (1.78–2.69)***	1.06 (0.69–1.62)	1.23 (0.72–2.10)	1.20 (0.69–2.06)
Moderate/severe learning disability vs. no learning disability	3.57 (3.01–4.23)***	1.78 (0.89–3.53)	2.47 (0.92–6.63)	2.28 (0.93–5.58)
Developmental delay				
Mild dev. delay vs. no dev. delay	2.65 (2.02–3.48)***	1.11 (0.55–2.32)	1.17 (0.46–2.94)	1.15 (0.46–2.90)
Moderate/severe dev. delay vs. no dev. delay	4.00 (3.28–4.89)***	1.08 (0.63–1.88)	1.00 (0.49–2.04)	0.99 (0.48–2.06)
Speech/language disorder				

Mild speech/lang. disorder vs. no speech/lang. disorder	1.80 (1.29–2.52)***	2.76 (0.77–9.91)	3.40 (0.79–14.63)	3.12 (0.81–12.00)
Moderate/severe speech/lang. disorder vs. no speech/lang. disorder	3.12 (2.32–4.20)***	1.87 (1.05–3.32)	1.73 (0.83–3.65)	1.73 (0.82–3.66)
Autism/ASD				
Mild autism/ASD vs. no autism/ASD	2.48 (1.84–3.35)***	1.61 (0.92–2.82)	1.94 (1.02–3.69)*	2.03 (1.06–3.88)*
Moderate/severe autism/ASD vs. no autism/ASD	3.65 (2.77–4.82)***	2.00 (0.57–7.02)	4.03 (1.04–15.70)*	3.80 (1.10–13.10)*

Abbreviations: ADHD (attention deficit hyperactivity disorder); ASD (autism spectrum disorders); ID (intellectual disability); CP (cerebral palsy); Tourette (Tourette syndrome)

*** p <.001
** p < .01
* p < .05

[a]Controls for presence of co-occurring developmental disabilities of either ADHD, learning disability, developmental delay, speech/language disorder, autism/ASD, intellectual disability, cerebral palsy, and/or Tourette syndrome; child health status; and child receiving mental health treatment

[b]Controls for covariates in model 1 and adds variables for bully victimization; parents' mental health status; and parents' physical health status

[c]Controls for covariates in models 1 and 2 and adds variables for family income; and adult education level