Distribution Agreement

In presenting this Thesis as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant Emory University and its agents the non-exclusive license to archive, make accessible, and display my Thesis in whole or in part in all forms of media, now or hereafter known, including display on the World Wide Web. I understand that I may select some access restrictions as part of the online submission of this Thesis. I retain all ownership rights to the copyright of the Thesis. I also retain the right to use in future works (such as articles or books) all or part of this Thesis.

_____

John C. Morris Date

MEDICATION USE IN CHILDREN AGED 6-17 YEARS FOR SELECTED BEHAVIORAL AND EMOTIONAL CONDITIONS AND ITS ASSOCIATION WITH PRETERM BIRTH: 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

BY

John C. Morris
Degree to be awarded: MPH
Executive MPH Program

Vijaya Kancherla, PhD, Committee Chair Date

Andrea Winquist, MD, PhD, Committee Member Date

Melissa Alperin, MPH, MCHES Date
Chair, Executive MPH Program

MEDICATION USE IN CHILDREN AGED 6-17 YEARS FOR SELECTED BEHAVIORAL AND EMOTIONAL CONDITIONS AND ITS ASSOCIATION WITH PRETERM BIRTH: 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

BY

John C. Morris
Pharm.D, University of Maryland, Baltimore, 2002
B.S., University of Georgia, 1998

Thesis Committee Chair: Vijaya Kancherla, PhD

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 of the degree of Master of Public Health in the Executive MPH program
2015

Abstract

MEDICATION USE IN CHILDREN AGED 6-17 YEARS FOR SELECTED BEHAVIORAL AND EMOTIONAL CONDITIONS AND ITS ASSOCIATION WITH PRETERM BIRTH: 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

BY

John C. Morris, Pharm.D

Background

Prematurity is associated with an increased risk of mental health disorders such as Attention-Deficit Disorder/Hyperactivity Disorder (ADD/ADHD), anxiety, and depression in children. Consequently, preterm birth may be associated with increased psychotropic medication use among school-aged children. We hypothesize that prematurity is associated with an increased risk of medication use for 1) ADD/ADHD and 2) emotions, concentration, or behavior (ECB) in children.

Methods

Using a nationally-representative sample of non-institutionalized school-aged children aged 6-17 years from the 2011-2012 National Survey of Children's Health (NSCH) (n=42,178), we examined the prevalence, among these children, of maternal-reported medication use for 1) ADD/ADHD at the time of the interview, and 2) ECB within the 12 months prior to the interview. We also examined the association between prematurity and medication use for these conditions. We calculated adjusted odds ratios (aOR) and 95% Confidence Intervals (CI) using multivariate logistic regression analysis accounting for the complex survey design. We examined interaction and stratified our findings by sex.

Results

Overall, an estimated 6.9% (2.2 million) and 9.9% (3.2 million) of children in the U.S. used medication for ADD/ADHD and ECB, respectively, during the study period. Among these children, about 15% were born prematurely. After adjusting for potential confounders, children born preterm were at a significantly higher risk of current use of medications for ADD/ADHD (aOR=1.38; 95% CI=1.10-1.72) and use of medications for ECB during the year prior to the interview (aOR=1.37; 95% CI=1.13-1.66) compared to term-born children. Additionally, sex modified the association between prematurity and use of ADD/ADHD medications. Preterm boys had a significantly higher risk of current ADD/ADHD medication use compared to term-born boys (aOR=1.68; 95% CI 1.28-2.19); while the same association was non-significant among girls (OR=0.85, 95% CI 0.59-1.22).

Conclusion

Our findings provide nationally-representative prevalence estimates of medication use for ADD/ADHD and ECB among school-age children. We present novel insights into the association between preterm birth and medication use for these conditions. Our study findings highlight the role of prematurity on childhood mental health, and point to the need for further understanding of differences in prescription patterns and long-term effects of these medications in U.S. school-aged children.

MEDICATION USE IN CHILDREN AGED 6-17 YEARS FOR SELECTED BEHAVIORAL AND EMOTIONAL CONDITIONS AND ITS ASSOCIATION WITH PRETERM BIRTH: 2011-2012 NATIONAL SURVEY OF CHILDREN'S HEALTH

BY

John C. Morris
M.P.H., Emory University, 2015
Pharm.D, University of Maryland, Baltimore, 2002
B.S., University of Georgia, 1998

Thesis Committee Chair: Vijaya Kancherla, PhD

A Thesis submitted to the Faculty of the Rollins School of Public Health of Emory University in partial fulfillment of the requirements of the degree of Master of Public Health in the Executive MPH program
2015

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my thesis committee chair, Dr. Vijaya Kancherla, for stimulating my interest in the field of maternal and child health epidemiology; for gently, kindly, and patiently guiding me through the steps required to complete this thesis project; and for sharing her knowledge and experience with me. I would not have efficiently completed this thesis without you.

I would also like to sincerely thank Dr. Andrea Winquist for participating on my thesis committee and for being an excellent role model by reading every word and number, double checking my references, and assessing the meaning of each sentence of the many drafts of this document. Your contributions are invaluable.

I thank the Data Resource Center for providing answers to my questions and guidance regarding specific manipulations of the NSCH data.

I thank my fellow classmates, with whom I have made lasting friendships, for providing transportation laughs, fellowship, and smiling face among the crowd during presentations, and an overall rich learning environment.

Last, but not the least, I want to thank my family: my wife and children, my parents, my sister, and in-laws for supporting me spiritually and mentally during my enrollment in the Executive MPH program.

To my wife, specifically, thank you for providing me space and time to complete my assignments and other requirements of the program and for being a wonderful spouse and friend, resilient mother, and amazing woman.

Table of Contents

Extended Introduction

Epidemiology of Preterm Birth

Preterm birth (delivery prior to 37 weeks of gestation) is a preventable cause of infant disability, morbidity, and mortality. Preterm birth costs the U.S. health care system more than 26 billion dollars each year, of which approximately nine billion dollars are paid by taxpayers (1, 2). According to the March of Dimes "Our Campaign to End Premature Birth: Annual Report 2014", the prevalence of preterm birth is 11.4% (3). This ranks the United States 54th out of 184 countries for the highest rate of preterm births, similar to countries such as Angola, Dominican Republic, Honduras, Malaysia, Myanmar, Nigeria, Somalia, Thailand, and Turkey (4). The lowest rates (7-9%) of preterm birth exist in Eastern Asia, Latin American, Northern Africa, and Oceania, while the highest rates (12-14%) exist in Southern Asia, Southeastern Asia, and Sub-Saharan Africa (5). Although some (30-35%) preterm births are medically necessary, such as in mothers with pre-eclampsia, eclampsia or intrauterine growth restrictions, preterm birth is an important detriment to infant survival and quality of life. It also leads to psychosocial effects on the family and increased healthcare costs (1, 6).

The causes of preterm birth are largely unknown but likely include a combination of biological (the presence of fetal fibronectin), genetic (tumor necrosis factor alpha, TNFα allele and interleukin six, IL6 polymorphism), pathological (periodontal disease, malnutrition, infection, or inflammation), behavioral (tobacco, alcohol and illicit drug use, or a short inter-pregnancy interval), social (maternal stress or low economic status or education level), and environmental factors (long working hours) (1, 7-9). Maternal race, ethnicity, and age are associated with a higher risk of preterm birth, and groups at increased risk for preterm birth

include non-Hispanic black women and either younger (less than 20 years) or older (40 years or more) mothers. For example, in 2013, the prevalence of preterm birth among non-Hispanic black women was 16.3%, compared to 10.2% among non-Hispanic white women, and 13.1% in women less than 20 years compared to 15.9% for women 40-44 years of age (10). Additionally, the prevalence of preterm birth by demographic characteristics has changed over time. For example, the rate of preterm birth in non-Hispanic white women increased from 1990 to 2013 (change from 10.6% to 11.4%) but decreased for non-Hispanic blacks (change from 18.9% to 16.3%) during the same time frame (10). Additionally, the prevalence in women less than 20 years of age decreased (change from 14.6% to 13.1%), while it increased among women 40-44 years of age (change from 12.3% to 15.9%) from 1990 to 2013 (10).

Children born preterm are at a significantly greater risk for having negative short term health outcomes such as death, seizures, respiratory distress, anemia, and hospital readmission (11-13). Chronic diseases such as diabetes and cardiovascular disease are also linked to preterm birth (14-16). Long-term effects of preterm birth that begin in childhood include cerebral palsy, mental retardation, negative parent and family outcomes, poorer health-related quality of life (HRQoL), and mental disorders such as anxiety, conduct disorders, and Attention Deficit Disorder or Attention Deficit/Hyperactivity Disorder (ADD/ADHD, will be referred to as ADHD) (17-19). Consequently, preterm birth may be associated with increased psychotropic medication use among school-aged children who were born prematurely. In one study, the risk to have used a psychotropic medication during young adulthood was 1.1 to 1.7 times greater for a child who was born preterm compared to children born full term (20).

A psychotropic medication is defined as "a drug that affects psychic function, behavior, or experience" (21). The objective for the use of psychotropic medications is to decrease symptoms and improve functionality in the patient (22). The term psychotropic medications represents a wide variety of drugs, including the following therapeutic categories: ADHD agents (see Table A for a complete list), antidepressants (monoamine oxidase inhibitors, selective norepinephrine reuptake inhibitors, selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors, and tricyclic agents), anti-manic agents (including anti-epileptics and lithium), antipsychotics (atypical agents, phenothiazine drugs), anxiolytics (benzodiazepines), and sedatives (barbiturates).

Long-term effects of preterm birth on children, adolescents, and families

Preterm birth negatively influences a child's reported HRQoL, parental mental health, and family outcomes. The HRQoL of children who were born preterm was shown to be reduced by the time a child who was born preterm reaches school-age. The health utility index (HUI) is a system to measure functioning based on the following considerations: 1) the experience of patients undergoing therapy; 2) long-term outcomes associated with disease or therapy; 3) the efficacy, effectiveness and efficiency of healthcare interventions; and 4) the health status of general populations (23). A systematic review was performed to examine studies that address differences in HRQoL between children who were born preterm and those who were born at term (mean age range, 8-16 years old). The data collection methods of the analyzed studies included parent and adolescent self-reports on HUI questionnaires and parent and adolescent interviews. Results from the HUI assessment were used to calculate a utility score, which

represents the child- or family-reported health status of the child; a lower score indicates a lower reported health status for the child. The review documented multiple studies that provided consistent results: a reduction of HRQoL in children who had been born preterm, which differed significantly from children who had been born full term. For example, one study of school-aged children reported health utility scores of 0.82 for preterm children and 0.95 for control subjects (p-value < 0.001) (24). The negative health effects for children born preterm, including lower parent- and child-reported utility scores, have been shown to exist among adolescents, too. For example, in two studies the authors presented utility scores of 0.87 vs. 0.93 (p-value < 0.05) and 0.91 vs. 0.97 (p-value < 0.01) for children born preterm versus control subjects (25, 26). Also, results from studies utilizing the Child Health Questionnaire (CHQ), a validated instrument to measure general quality of life in children from 5-18 years of age, demonstrated reduced scores among children born preterm for the following categories: parent-reported global health, family functioning, and emotional well-being; and child-reported general health perception, self-esteem, behavior, and physical functioning (27).

Negative effects on families of a child born who was born preterm have been reported in multiple international studies that have investigated parental mental health and family outcomes. However, small samples sizes, low study completion rates, and missing data threaten their internal validity. Parents of children born preterm have been reported to experience higher levels of depression and parental stress, are more likely to report moderate to severe anxiety, and poorer family functioning (problem solving, communication, and establishing roles) compared to families of children born at term. These negative outcomes have been shown to begin by age two and persist up to the age of seven (17). In one study,

parents who reported impaired mental health when their prematurely born child was two years of age were at greater risk [odds ratio (OR), 95% confidence interval (CI] (OR=11.33, 95% CI 1.34-95.82) of also reporting mental health problems when the prematurely born child was at age seven, compared to parents of term born children (28).

Epidemiology of ADHD and emotions, concentration, and behavior (ECB) problems in U.S. children

Mental health conditions among U.S. children are common. Approximately 17% of children 2-17 years of age are reported to have been diagnosed with one or more of the following conditions: depression, anxiety, ADHD, and conduct disorders (13). It was reported in 2014, that the 12-month prevalence of any mental disorder among United States (U.S.) children (8-15 years old) was approximately 13% (29). Among school-aged children 6-17 years old represented in the 2003 National Survey of Children's Health (NSCH), 5.4% had ever been diagnosed with depression or anxiety and 6.3% with behavioral or conduct disorders (30). Results of a study using 2007 National Survey of Children's Health (NSCH) data estimated that 8% of children aged 6-17 years had ever been diagnosed with depression or anxiety and 5.4% with behavioral or conduct disorders (31). Overall, the 12-month prevalence estimate for an ECB disorder diagnosis among U.S. school-aged children was approximately 5% in 2007 (31).

Among adult participants in the 2001-2003 National Comorbidity Survey Replication (NCS-R) the most commonly self-reported ECB problems were anxiety disorders, mood disorders, impulse-control disorders, and substance use disorders. One study estimated the lifetime risk for these disorders to be 28.8%, 20.8%, 24.8%, and 14.6%, respectively (32).

Anxiety and impulse-control disorders were documented to have a young age of onset (median 11 years) compared to other mental health conditions such as mood disorders (median age 30 years) (32). Significant socio-demographic predictors of the lifetime risk for anxiety disorders include sex and race/ethnicity, but no association has been found with age-related student education levels. The lifetime risk for anxiety disorders was 1.6 times greater (95% CI 1.5-1.8) for females than for males, while the risk was lower for non-Hispanic blacks (OR=0.8, 95% CI 0.6-0.9) and Hispanics (OR=0.7, 95% CI 0.6-0.9) compared to non-Hispanic whites (32). The only factor significantly associated with the lifetime risk for being diagnosed with an impulse control disorder (including ADHD) was sex; the risk was lower for females (OR=0.7, 95% CI 0.6-0.8) than for males.

ADHD is a mental health condition defined as "a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, has symptoms presenting in two or more settings (e.g. at home, school, or work; with friends or relatives; in other activities), and negatively impacts directly on social, academic or occupational functioning" (33). Poorer HRQoL is a common outcome in children and adolescents diagnosed with ADHD and HRQoL has been shown to worsen as ADHD severity increases. For example, a study assessing school-aged children, using the CHQ demonstrated that, compared to U.S. population norms, self-esteem, family activities, and the psychosocial summary score were significantly lower in children with ADHD (measure of change: -0.90, -0.97, and -0.98, respectively; $p<0.0001$). The magnitude of effect was associated with two significant predictors, the number of comorbid conditions (oppositional defiant disorder and learning disability) and the parent-reported ADHD subtype (hyperactive, inattentive, or combined) (22).

There is considerable variability among ADHD prevalence estimates in the literature; however, the evidence suggests that ADHD prevalence is increasing. One study estimated the world-wide, pooled prevalence of ADHD among school-aged children to be 5.29% (95% CI 5.01-5.56) in 2007. The prevalence of ADHD in North America, Europe, and Asia were statistically similar (approximately 4-6%) and comparable to the worldwide average; however, the estimates for Africa and the Middle East were significantly lower than for those for North America (test of heterogeneity p-value 0.03 and 0.01, respectively) (34). Further, among children aged 8-15 years represented in the 2001-2004 National Health and Nutrition Examination Study (NHANES), the 12-month prevalence of ADHD which met the Diagnostic and Statistical Manual of Mental Disorders, Fourth edition (DSM-IV) criteria was approximately 8.7% (95% CI 7.3-10.1), or 2.4 million children (35). Additional data from large, representative samples of U.S. children enrolled in the NSCH suggests that the prevalence of ever having a diagnosis of ADHD among children aged 4-17 years has increased from 7.8% in 2003 to 9.5% in 2007, an increase of 21.8% (36).

Disparities in prevalence estimates and the odds of a child having a mental health diagnosis are known to exist between male and female children, between children of different racial/ethnic groups and socio-demographic classes, and between children with different levels of health status and living conditions. Overall, female children and minorities have lower odds of having a mental health diagnosis than male and non-minority children. For example, in one study, female children had 0.83 times the unadjusted odds (95% CI 0.71-0.96) of being diagnosed with depression or anxiety and 0.43 times the adjusted odds (95% CI 0.35-0.53) for behavioral or conduct problems compared to males (31). The adjusted odds for a child to be

diagnosed with a behavioral or conduct disorder have been found to be increased significantly for non-Hispanic black children compared to non-Hispanic white children (OR 1.42, 95% CI 1.09-1.85) and for those with public insurance (OR 2.40, 95% CI 1.86-3.10) compared to those with private insurance (31).

Prevalence estimates in the literature demonstrate a consistent male to female ratio for a diagnosis of ADHD greater than 2:1. A cross-sectional study using parental responses to a questionnaire in Missouri demonstrated that, among the overall sample, children (7-12 years), and adolescents (13-17 years), the male to female ratios for a child to have had a current or lifetime DSM-IV-like ADHD diagnosis were 2.28, 2.09, and 2.56, respectively (p-values < 0.0001) (37). These estimates are similar to the nationally representative sample from the 2007 NSCH, in which the male to female ratios were 2.33 and 2.57 for ever or currently being diagnosed with ADHD, respectively (36). Also, significant differences in the prevalence of ADHD have been found between age categories 6-11 and 12-18 years old (6% vs. 3%) (34). Another study reported the prevalence of having a current ADHD-like diagnosis among children aged 7-12 years and adolescents aged 13-17 years to be 11.7% and 9.7%, respectively (37).

A child's exposure to second hand smoke (SHS) in the home has been shown in multiple studies to independently increase the prevalence and odds of having ADHD or other behavioral disorders. One study that used data from the 1999-2004 U.S. National Health and Nutrition Examination Survey (NHANES) indicated that the prevalence of current ADHD among children reportedly exposed to household SHS was 11.5% (95% CI 8.7-14.3), compared to 6.9% (95% CI 6.1-7.7) for unexposed children (38). After controlling for potential confounders, such as

maternal smoking, gender, child's age, race/ethnicity, and health insurance status, the odds of having ADHD was 1.5 times greater (95% CI 1.1-2.0) among children exposed to SHS compared to unexposed children (38). Similarly, a study using 2007 NSCH data provides evidence that supports these findings. The estimated prevalence of ADHD among children exposed to SHS was 13% (95% CI 11.9-14.2) compared to 5.5% (95% CI 5.3-5.6) among children reported to be unexposed to SHS (39). Additionally, it was reported that the adjusted odds for SHS-exposed children to have ADHD or a conduct disorder were 1.44 and 1.78 times greater (95% CI 1.21-1.72 and 1.44-2.21, respectively) compared to unexposed children (39).

Epidemiology of ADHD and ECB problems in U.S. children who were born prematurely

Numerous international, national, and community studies and meta-analyses have provided evidence that school-aged children who were born prematurely had poorer ratings on behavioral assessment tools and an increased risk for having ADHD or problems with ECB. Based on the results being born preterm is a risk factor for ADHD and other behavior problems in school-aged children. A Swedish study conducted from 1990-1992 assessed a cohort of 11 year old children who were born preterm. Their results were based on parental and teacher responses to one of two assessment tools designed for school-aged children (defined as ages 6-18 years). Parents completed the Child Behavior Checklist (CBCL) and teachers used the Teacher Report Form (TRF). The CBCL and TRF are comparable scales based on the DSM-IV criteria for behavioral syndromes. Parents reported significantly poorer ratings for attention (p-value < 0.001) and ECB problems including anxiety/depression (p-value < 0.001) in 11 year old children who were born preterm compared to full term, age-, sex-, and birth location-matched

controls (40). Results from teacher reports were similar to those from the parents. A total problem score was calculated from the responses and the evidence suggested that 11 year old children who were born preterm were more likely to be rated in the abnormal range for attention, anxiety, and depression. In adjusted analyses, among 11-year old children, the associations between being rated as abnormal for an attention (OR=3.46, 95% CI 1.40-8.54) or having behavioral problems (OR=2.56, 95% CI 1.06-6.18) were significantly greater for children who were born preterm than for children who were born full term (40). A study of two U.S. communities (Pittsburgh, Pennsylvania and Palo Alto, California) also utilized the CBCL to assess behavioral problems among 9-16 year old children who had been born preterm. Higher scores indicate poorer functioning. The authors found that children who were born preterm scored higher for the total score (p-value < 0.001) and internalizing symptoms (i.e. anxiety/depression and attention) (p-value = 0.001) compared to full term children (19).

A meta-analysis of case-control studies was performed using publications dated from 1980 through 2001 to assess the cognitive and behavioral outcomes of school-aged children who were born preterm. A majority of studies that were included in the meta-analysis showed an increase in incidence of internalizing behavioral problems (75% of the studies) and ADHD (67% of the studies) among school-aged children who were born preterm (mean age range 5-14 years) (41). Further, six of these studies were assessed to determine the association between preterm birth and ADHD. Children who were born preterm had a risk of having been diagnosed with ADHD (based on DSM criteria relating to the time of the study) of more than two times greater (RR=2.64, 95% CI 1.85-3.78) compared to children born full term (41).

A study that utilized 2011 NSCH data provided nationally-representative prevalence estimates for selected parent-reported mental health conditions among children aged 2-17 years. Additionally, they examined the association between prematurity and a child having ever been diagnosed with ADHD or ECB problem (including anxiety, depression, and conduct disorders). They reported increased prevalence of several selected mental health conditions including emotional/behavioral problems, anxiety, conduct disorders, and ADHD among children who were born preterm compared to those born at term. The prevalence of these conditions was approximately 1.5-3 percentage points higher for children who were born preterm (all p-values < 0.001); the largest difference in prevalence occurred among children with ADHD (preterm, 10.51% vs. full term, 7.44%) (42). After adjusting for potential child- (birth weight, age group, gender, and race/ethnicity) and household-level (place of residence, household composition, highest parent education level, and poverty status) confounders, statistically significant associations persisted between preterm birth and those mental health conditions. They reported increased risk for ever being reported to have an ECB disorder or ADHD among children who were born preterm compared to those born full term for the following disorders: emotional/behavioral (OR=1.47, 95% CI 1.25-1.73), anxiety (OR=1.58, 95% CI 1.31-1.91), conduct disorder (OR=1.50, 95% CI 1.21-1.86), and ADHD (OR=1.49, 95% CI 1.29-1.73) (42).

Disparities of several socio-demographic characteristics were identified to exist among children who were born preterm and who had a parent-reported mental health diagnosis (ADHD, anxiety or depression, or behavior or conduct disorder). These characteristics included sex, race/ethnicity, and the child's age group. The risk for children who were born preterm to

have been diagnosed with ADHD or ECB problems was greater than the risk for all, nationally-representative, similarly aged children. For example, in 2011, the risk that male children who were born preterm had a parent-reported behavioral or conduct disorder diagnosis was 50% (OR=1.50, 95% CI 1.31-1.73) greater than female children who were born preterm (42). Also, among children who were born preterm, the risk that those children had a parent-reported diagnosis of ADHD was highest in the oldest age group (12-17 years) (OR=7.49, 95% CI 5.92-9.48) compared to the youngest (2-5 years) (42). Children of Hispanic (OR=0.42, 95% CI 0.33-0.54) and non-Hispanic black race/ethnicity (OR=0.64, 95% CI 0.53-0.77) were at a lower risk to have ever been reported to have ADHD compared to non-Hispanic white children (42).

Pharmacotherapy for ADHD and ECB problems using psychotropic medications

In 2009, mental health care spending totaled $147 billion in the U.S. and expenditures were expected to reach $203 billion in 2014 (43, 44). The U.S. health care system spent $8.9 billion directly on treatment for mental health in 2006 (31). Further, approximately three out of every ten dollars (28%) spent to treat mental health conditions were paid for retail purchases of prescription medications, an absolute increase of 21% since 1986 (43, 44). The prevalence of behavioral or conduct disorders (excluding ADHD) decreased from the years 2004-2007 (change from 6.3% to 5.4%); however, the share of prescription spending on ADHD and antipsychotic medications increased from the years 2002-2009 (change from 7% and 24% to 14% and 34%, respectively) (43). Additionally, the prevalence of depression or anxiety increased in children from 2004-2007 (change from 5.4% to 7.8%); however, the share of prescription spending decreased for antidepressants (change from 49% to 34%) from 2002 to 2009 (31, 43).

A reason for the decreased use of antidepressants may include suicidality warnings included with the product labeling (See Appendix Figure A), while increases in prescription spending for ADHD may be partly attributed to changes in treatment guidelines, which widen the recommended age range for medication use (from 6-12 years to 4-18 years). These clinical guidelines recommend that medications be reserved for school-aged children experiencing moderate to severe dysfunction, and specify that a child should meet the following criteria: 1) symptoms have persisted for at least 9 months, 2) dysfunction is manifested at both home and school, and 3) dysfunction has not adequately responded to behavioral therapy (45). Mental health counseling and treatment for ADHD, emotions, concentration, or behavior (ECB) have expanded beyond traditional specialty care, such as mental health providers and hospitals into the pediatric, family practice, and / or school environments (31).

It was previously uncommon for pediatricians or family practitioners to treat ADHD in children less than 6 years old during the late 1980's (0%-12.7% of pediatricians and 7.3%-8% of family practitioners) (46). However, the development of newer agents with improved safety profiles and lengthy experience of use for traditional ADHD and psychotropic medications have heightened non-specialty physicians' comfort towards prescribing these medications for children. Although most medications labeled to treat ADHD are indicated for children no less than 6 years old, increasing off-label use of ADHD medications in younger children has caused the Food and Drug Administration (FDA) to request that pharmaceutical manufacturers of these medications study the safety and efficacy of psychotropic medication use in children as young as 4 years old (47). A full list of medications currently labeled to treat ADHD is presented in Appendix Table A, including the minimum recommended age for use.

Due to age-related differences in pharmacodynamics and pharmacokinetics in children, initiation of therapy should be done cautiously, starting at low doses and titrating slowly to obtain the intended therapeutic effect with the absence of adverse drug events (ADE). ADE concerns related to medications used for ADHD or ECB include sudden death, diminished growth, diabetes, cardiovascular effects, and suicide.

Trends and prevalence estimates of medication use for ADHD or ECB

The pharmacoepidemiology of medication use for ADHD or ECB is changing, and as the prevalence of mental health diagnoses increases so does the prevalence of medication use. A series of non-NSCH based studies have provided prevalence estimates of medication use for ADHD or ECB using nationally-representative U.S. survey data. One study reported the estimated prevalence of stimulant medication use for ADHD from 1996-2008 for ADHD among subjects ages 18 years or younger using the Medical Expenditure Panel Survey (MEPS) data. The prevalence in 2008 was estimated to be 3.5% (95% CI 3.0-4.1), which represented an absolute increase of 2.4% (95% CI 1.8-2.9) since 1996 (48). Data from the 2011/2012 National Health Interview Survey (NHIS) indicated that among children aged 6-17 years 7.5% were prescribed medication for emotional or behavioral difficulties (49).

Studies using NSCH data have also reported prevalence estimates for medicated ADHD (50). A study using data from the 2003 NSCH indicated that 4.3% (95% CI 4.1-4.6) of non-institutionalized children 4-17 years of age were medicated for ADHD (51). According to a study using 2007 NSCH data the prevalence of medicated ADHD increased to 4.8% (95% CI 4.4-5.1), or approximately 2.7 million children; however, the 2003 and 2007 estimates cannot be directly

compared due to differences in the wording of the survey question which may have caused misclassification bias (36, 52). The wording of the questions was the same for the 2007 and 2011 NSCH, so the prevalence estimates can be directly compared. According to a study using 2011 NSCH data, 6.1% (95% CI 5.7-6.5), or approximately 3.5 million of all, non-institutionalized, children aged 4-17 years living in the U.S. were medicated for ADHD (53). This corresponds to a 28% increase compared to the 2007 NSCH estimates and a 35.5% increase compared to the first NSCH survey in 2003.

Child and family-level characteristics associated with medication use for ADHD or ECB

The literature provides evidence that many characteristics are associated with medication treatment for childhood ADHD, among those with ADHD. Such characteristics include sex, race/ethnicity, child's age, family education level, socio-economic and insurance status, and the household's geographic location. Overall, among all children aged 4-17 years who were subjects of the 2007 NSCH, male children were more likely to be medicated for ADHD compared to females (prevalence ratio 2.76) (36). Studies from 2011 NSCH data have provided information regarding the demographic groups with the highest prevalence of medication use for ADHD, which include males, whites, non-Hispanics, those children living in primarily English speaking households, children with public insurance type, and those living in the Midwest and South. This study also documented that the proportion of children with ADHD who were using medication increased with parent-rated ADHD severity (53).

Additionally, there are differences between males and females in which socio-demographic characteristics are associated with medication use for ADHD among those with

ADHD. A study that utilized sex-specific, predictive, multivariate logistic regression modeling identified the following child and family-level characteristics to be important predictors of medicated ADHD. For male children aged 4-17 years with ADHD, the factors associated with medication use include: younger age, non-Hispanic ethnicity, family income > 100% of poverty level, existing health coverage, health contact within the last twelve months, and the presence of psychological difficulties. For female children with ADHD, younger age, non-Hispanic ethnicity, the health burden of psychological difficulties, and fair-to-poor paternal mental health were the variables which were found to be associated with medication use (51).

Among the 2003 NSCH sample, the age group with the highest rate of medication use for ADHD was 9-12 years (6.2%, 95% CI 5.7-6.7) (50). However, among male participants of the 2007 NSCH, the prevalence of medicated ADHD was highest for the 11-14 year age group, while the rate for females increased with age (36). Children with the highest medication rates for ADHD were reported to be among the white race (5.2%) in 2007 compared to the other race category (4.4%) (53). In 2011, the rates of medicated ADHD among children with ADHD increased in white children (change from 5.2% to 7.1%) and black children (change from 5.1% to 5.7%) but decreased for the "other" race group (change from 4.4% to 3.5%) compared to the rates in 2007 (53). In the 2007 and 2011 NSCH, Non-Hispanic children had higher medication rates than Hispanic children and those with public insurance had higher rates compared to those with private insurance (53).

The study using MEPS data found that differences in the prevalence of stimulant use for ADHD existed between sexes, race/ethnicity groups, age groups, and groups by insurance type.

Although the rates increased from the years 1996-2008, the demographic characteristics of children with the highest prevalence were consistent throughout the study period. In 2008 the highest prevalence (%, 95% CI) occurred in males (5.3, 4.4-6.2), non-Hispanic whites (4.4, 3.5-5.2), those among the middle age group (6-12 years) (5.1, 4.1-6.1), and those with public health insurance (4.3, 3.4-5.2) (48). A study on medication use for ADHD among subjects aged 20 years or less using Medicaid data found similar results. The authors of the publication reported that the prevalence (%, 95% CI) was highest for males (6.92, 6.84-6.99), those with non-Hispanic white race/ethnicity (6.87, 6.77-6.96), and among children in the 10-14 year age group (9.25, 9.11-9.39) during the period from 2003-2004 (54).

Statistically significant associations also existed between these demographic characteristics and stimulant medication use. The associations between stimulant medication use and gender and health insurance type were greater for males (OR=2.62, 95% CI 2.05-3.35) compared to females and those with public insurance (OR=1.88, 95% CI 1.00-3.54) compared to those with no insurance (48). Compared to non-Hispanic white children, African Americans (OR=0.64, 95% CI 0.49-0.85) and Hispanics (OR=0.70, 95% CI 0.49-1.00) had a lower risk for stimulant use (48). Although the association was not significant by age group, the direction of the association was that children aged 5-12 had a lower risk of stimulant medication use compared to those aged 13-17 (OR=0.89, 95% CI 0.71-1.12) (48).

Association between prematurity and medication use for ADHD or ECB problems

Currently there are no population based studies that assess the association between preterm birth and the use of medication for ADHD or ECB.

Manuscript Introduction

Epidemiology of Preterm Birth

Preterm birth (delivery prior to 37 weeks of gestation) is a preventable cause of infant disability, morbidity, and mortality. Preterm birth costs the U.S. health care system more than 26 billion dollars each year, of which approximately nine billion dollars are paid by taxpayers (1, 2). According to the March of Dimes, the prevalence of preterm birth is 11.4% (3). Although some (30-35) preterm births are medically necessary, such as in mothers with pre-eclampsia, eclampsia, or intrauterine growth restrictions, preterm birth is an important detriment to infant survival and quality of life. It also leads to psychosocial effects on the family and increased healthcare costs (1, 6). The causes of preterm birth are largely unknown but likely include a combination of biological, genetic, pathological, behavioral, social, and environmental factors (1, 7-9). Maternal race, ethnicity, and age are associated with the risk of preterm birth, and groups at increased risk for preterm birth include non-Hispanic black women and either younger (less than 20 years) or older (40 years or more) mothers (10).

Children born preterm are at a significantly greater risk for having negative short term health outcomes such as death, seizures, respiratory distress, anemia, and hospital readmission (11-13). Chronic diseases such as diabetes and cardiovascular disease are also linked to preterm birth (14-16). Long-term effects of preterm birth that begin in childhood include cerebral palsy, mental retardation, negative parent and family outcomes, poorer health-related quality of life (HRQoL), and mental disorders such as anxiety, conduct disorders, and Attention-Deficit Disorder or Attention-Deficit/Hyperactivity Disorder (ADD/ADHD, will be referred to as

ADHD) (17-19). Consequently, preterm birth may be associated with increased psychotropic medication use among school-aged children who were born prematurely.

A psychotropic medication is defined as "a drug that affects psychic function, behavior, or experience" (21). The objective for the use of psychotropic medications is to decrease symptoms and improve functionality in the patient (22). The term psychotropic medications represents a wide variety of drugs, including the following therapeutic categories: ADHD agents (see Appendix Table A for a complete list), antidepressants (monoamine oxidase inhibitors, selective norepinephrine reuptake inhibitors, selective serotonin reuptake inhibitors, serotonin-norepinephrine reuptake inhibitors, and tricyclic agents), anti-manic agents (including anti-epileptics and lithium), antipsychotics (atypical agents, phenothiazine drugs), anxiolytics (benzodiazepines), and sedatives (barbiturates).

Long-term effects of preterm birth on children, adolescents, and families

Preterm birth negatively influences a child's reported HRQoL, parental mental health, and family outcomes. The HRQoL of children who were born preterm was shown to be reduced by the time a child who was born preterm reaches school-age. A systematic review was performed to examine studies that address differences in HRQoL between children who were born preterm and those who were born at term (mean age range, 8-16 years old). The review documented multiple studies that provided consistent results: a reduction of HRQoL in children who had been born preterm, which differed significantly from children who had been born full term. Also, results from studies utilizing the Child Health Questionnaire (CHQ), a validated instrument to measure general quality of life in children from 5-18 years of age, demonstrated

reduced scores among children born preterm for the following categories: parent-reported global health, family functioning, and emotional well-being, and child-reported general health perception, self-esteem, behavior, and physical functioning (27).

Negative effects on families of a child born who was born preterm have been reported in multiple international studies that have investigated parental mental health and family outcomes. Parents of children born preterm have been reported to experience higher levels of depression and parental stress, are more likely to report moderate to severe anxiety, and poorer family functioning (problem solving, communication, and establishing roles) compared to families of children born at term. These negative outcomes have been shown to begin by age two and persist up to the age of seven (17, 28).

Epidemiology of ADHD and emotions, concentration, and behavior (ECB) problems in U.S. children

Mental health conditions among U.S. children are common. Approximately 17% of children 2-17 years of age are reported to have been diagnosed with one or more of the following conditions: depression, anxiety, ADHD, and conduct disorders (13). It was reported in 2014, that the 12-month prevalence of any mental disorder among United States (U.S.) children (8-15 years old) was approximately 13% (29). Among school-aged children 6-17 years old represented in the 2003 National Survey of Children's Health (NSCH), 5.4% had ever been diagnosed with depression or anxiety and 6.3% with behavioral or conduct disorders (30). Results of a study using 2007 NSCH data estimated that 8% of children aged 6-17 years had ever been diagnosed with depression or anxiety and 5.4% with behavioral or conduct disorders (31).

Overall, the 12-month prevalence estimate for an ECB disorder diagnosis among U.S. school-aged children was approximately 5% in 2007 (31).

Anxiety and impulse-control disorders were documented to occur at a younger age of onset (median 11 years) compared to other mental health conditions such as mood disorders (median age 30 years) (32). Significant socio-demographic predictors of the lifetime risk for anxiety disorders include sex and race/ethnicity, but no association has been found between anxiety disorders and age-related student education levels. The lifetime risk for anxiety disorders was 1.6 times greater [95% confidence interval (CI) 1.5-1.8] for females than for males, while the risk was lower for non-Hispanic blacks (odds ratio (OR)=0.8, 95% CI 0.6-0.9) and Hispanics (OR=0.7, 95% CI 0.6-0.9) compared to non-Hispanic whites (32). The only factor significantly associated with the lifetime risk for being diagnosed with an impulse control disorder (including ADHD) was sex; the risk was lower for females (OR=0.7, 95% CI 0.6-0.8) than for males.

ADHD is a mental health condition defined as "a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, has symptoms presenting in two or more settings (e.g. at home, school, or work; with friends or relatives; in other activities), and negatively impacts directly on social, academic or occupational functioning" (33). Poorer HRQoL is a common outcome in children and adolescents diagnosed with ADHD and HRQoL has been shown to worsen as ADHD severity increases.

There is considerable variability among ADHD prevalence estimates in the literature; however, the evidence suggests that ADHD prevalence is increasing. One study estimated the

world-wide, pooled prevalence of ADHD among school-aged children to be 5.29% (95% CI 5.01-5.56) in 2007. Further, among children aged 8-15 years represented in the 2001-2004 National Health and Nutrition Examination Study (NHANES), the 12-month prevalence of ADHD which met the Diagnostic and Statistical Manual of Mental Disorders, Fourth edition (DSM-IV) criteria was approximately 8.7% (95% CI 7.3-10.1), or 2.4 million children (35). Additional data from large, representative samples of U.S. children enrolled in the NSCH suggests that the prevalence of ever having a diagnosis of ADHD among children aged 4-17 years has increased from 7.8% in 2003 to 9.5% in 2007, an increase of 21.8% (36).

Disparities in prevalence estimates and the odds of a child having a mental health diagnosis are known to exist between male and female children, between children of different racial/ethnic groups and socio-demographic classes, and between children with different levels of health status and living conditions. Overall, female children and minorities have lower odds of having a mental health diagnosis than male and non-minority children (31). Prevalence estimates in the literature demonstrate a consistent male to female ratio for a diagnosis of ADHD greater than 2:1. A study using data from the 2007 NSCH documented male to female ratios of 2.33 and 2.57 for ever or currently being diagnosed with ADHD, respectively (36). Also, significant differences in the prevalence of ADHD have been found between age categories 6-11 and 12-18 years old (6% vs. 3%) (34). Another study reported the prevalence of having a current ADHD-like diagnosis among children aged 7-12 years and adolescents aged 13-17 years to be 11.7% and 9.7%, respectively (37). A child's exposure to second hand smoke (SHS) in the home has been shown in multiple studies to independently increase the prevalence and odds of having ADHD or other behavioral disorders (38, 39).

Epidemiology of ADHD and ECB problems in U.S. children who were born prematurely

Numerous international, national, and community studies and meta-analyses have provided evidence that school-aged children who were born prematurely had poorer ratings on behavioral assessment tools and an increased risk for having ADHD or problems with ECB. Based on the results being born preterm is a risk factor for ADHD and other behavior problems in school-aged children (19, 40). A meta-analysis of case-control studies was performed using publications dated from 1980 through 2001 to assess the cognitive and behavioral outcomes of school-aged children who were born preterm. A majority of studies that were included in the meta-analysis showed a higher incidence of internalizing behavioral problems (75% of the studies) and ADHD (67% of the studies) among school-aged children who were born preterm (mean age range 5-14 years) (41). Further, six of these studies were assessed to determine the association between preterm birth and ADHD. Children who were born preterm had a risk of having been diagnosed with ADHD (based on DSM criteria relating to the time of the study) of more than two times greater (RR=2.64, 95% CI 1.85-3.78) compared to children born full term (41).

A study that utilized 2011 NSCH data provided nationally-representative prevalence estimates for selected parent-reported mental health conditions among children aged 2-17 years. Additionally, they examined the association between prematurity and a child having ever been diagnosed with ADHD or ECB problem (including anxiety, depression, and conduct disorders). They reported increased prevalence of several selected mental health conditions including emotional/behavioral problems, anxiety, conduct disorders, and ADHD among

children who were born preterm compared to those born at term. The prevalence of these conditions was approximately 1.5-3 percentage points higher for children who were born preterm (all p-values < 0.001); the largest difference in prevalence occurred among children with ADHD (preterm, 10.51% vs. full term, 7.44%) (42). After adjusting for potential child- (birth weight, age group, gender, and race/ethnicity) and household-level (place of residence, household composition, highest parent education level, and poverty status) confounders, statistically significant associations persisted between preterm birth and those mental health conditions. They reported increased risk for ever being reported to have an ECB disorder or ADHD among children who were born preterm compared to those born full term for the following disorders: emotional/behavioral (OR=1.47, 95% CI 1.25-1.73), anxiety (OR=1.58, 95% CI 1.31-1.91), conduct disorder (OR=1.50, 95% CI 1.21-1.86), and ADHD (OR=1.49, 95% CI 1.29-1.73) (42).

Disparities of several socio-demographic characteristics were identified to exist among children who were born preterm and who had a parent-reported mental health diagnosis (ADHD, anxiety or depression, or behavior or conduct disorder). These characteristics included sex, race/ethnicity, and the child's age group. The risk for children who were born preterm to have been diagnosed with ADHD or ECB problems was greater than the risk for all, nationally-representative, similarly aged children. For example, in 2011, the risk that male children who were born preterm had a parent-reported behavioral or conduct disorder diagnosis was 50% (OR=1.50, 95% CI 1.31-1.73) greater than female children who were born preterm (42). Also, among children who were born preterm, the risk that those children had a parent-reported diagnosis of ADHD was highest in the oldest age group (12-17 years) (OR=7.49, 95% CI 5.92-

9.48) compared to the youngest (2-5 years) (42). Children of Hispanic (OR=0.42, 95% CI 0.33-0.54) and non-Hispanic black race/ethnicity (OR=0.64, 95% CI 0.53-0.77) were at a lower risk to have ever been reported to have ADHD compared to non-Hispanic white children (42).

Pharmacotherapy for ADHD and ECB problems using psychotropic medications

In 2009, mental health care spending totaled $147 billion in the U.S. and expenditures were expected to reach $203 billion in 2014 (43, 44). The U.S. health care system spent $8.9 billion directly on treatment for mental health in 2006 (31). Further, approximately three out of every ten dollars (28%) spent to treat mental health conditions were paid for retail purchases of prescription medications, an absolute increase of 21% since 1986 (43, 44). The prevalence of behavioral or conduct disorders (excluding ADHD) decreased from the years 2004-2007 (change from 6.3% to 5.4%); however, the share of prescription spending on ADHD and antipsychotic medications increased from the years 2002-2009 (change from 7% and 24% to 14% and 34%, respectively) (43). Additionally, the prevalence of depression or anxiety increased in children from 2004-2007 (change from 5.4% to 7.8%); however, the share of prescription spending decreased for antidepressants from the years 2002-2009 (change from 49% to 34%) from 2002 to 2009 (31, 43).

A reason for the decreased use of antidepressants may include suicidality warnings included with the product labeling (See Appendix Figure A), while increases in prescription spending for ADHD may be partly attributed to changes in treatment guidelines, which widen the recommended age range for medication use (from 6-12 years to 4-18 years). These clinical guidelines recommend that medications be reserved for school-aged children experiencing

moderate to severe dysfunction, and specify that a child should meet the following criteria: 1) symptoms have persisted for at least 9 months, 2) dysfunction is manifested at both home and school, and 3) dysfunction has not adequately responded to behavioral therapy (45). Mental health counseling and treatment for ADHD, emotions, concentration, or behavior (ECB) have expanded beyond traditional specialty care, such as mental health providers and hospitals into the pediatric, family practice, and / or school environments (31).

It was previously uncommon for pediatricians or family practitioners to treat ADHD in children less than 6 years old during the late 1980's (0%-12.7% of pediatricians and 7.3%-8% of family practitioners) (46). However, the development of newer agents with improved safety profiles and lengthy experience of use for traditional ADHD and psychotropic medications have heightened non-specialty physicians' comfort towards prescribing these medications for children. Although most medications labeled to treat ADHD are indicated for children no less than 6 years old, increasing off-label use of ADHD medications in younger children has caused the Food and Drug Administration (FDA) to request that pharmaceutical manufacturers of these medications study the safety and efficacy of psychotropic medication use in children as young as 4 years old (47). A full list of medications currently labeled to treat ADHD is presented in Appendix Table A, including the minimum recommended age for use. Due to age-related differences in pharmacodynamics and pharmacokinetics in children, initiation of therapy should be done cautiously, starting at low doses and titrating slowly to obtain the intended therapeutic effect with the absence of adverse drug events (ADE). ADE concerns related to medications used for ADHD or ECB include sudden death, diminished growth, diabetes, cardiovascular effects, and suicide.

Trends and prevalence estimates of medication use for ADHD or ECB

The pharmacoepidemiology of medication use for ADHD or ECB is changing, and as the prevalence of mental health diagnoses increases so does the prevalence of medication use. A series of non-NSCH based studies have provided prevalence estimates of medication use for ADHD or ECB using nationally-representative U.S. survey data. One study reported the estimated prevalence of stimulant medication use for ADHD from 1996-2008 for ADHD among subjects ages 18 years or younger using the Medical Expenditure Panel Survey (MEPS) data. The prevalence in 2008 was estimated to be 3.5% (95% CI 3.0-4.1), which represented an absolute increase of 2.4% (95% CI 1.8-2.9) since 1996 (48). Data from the 2011/2012 National Health Interview Survey (NHIS) indicated that among children aged 6-17 years 7.5% were prescribed medication for emotional or behavioral difficulties (49).

Studies using NSCH data have also reported prevalence estimates for medicated ADHD (50). A study using data from the 2003 NSCH indicated that 4.3% (95% CI 4.1-4.6) of non-institutionalized children 4-17 years of age were medicated for ADHD (51). According to a study using 2007 NSCH data the prevalence of medicated ADHD increased to 4.8% (95% CI 4.4-5.1), or approximately 2.7 million children; however, the 2003 and 2007 estimates cannot be directly compared due to differences in the wording of the survey question which may have caused misclassification bias (36, 52). The wording of the questions was the same for the 2007 and 2011 NSCH, so the prevalence estimates can be directly compared. According to a study using 2011 NSCH data, 6.1% (95% CI 5.7-6.5), or approximately 3.5 million of all, non-institutionalized, children aged 4-17 years living in the U.S. were medicated for ADHD (53). This corresponds to a

28% increase compared to the 2007 NSCH estimates and a 35.5% increase compared to the first NSCH survey in 2003.

Child and family-level characteristics associated with medication use for ADHD or ECB

The literature provides evidence that many characteristics are associated with medication treatment for childhood ADHD, among those with ADHD. Such characteristics include sex, race/ethnicity, child's age, family education level, socio-economic and insurance status, and the household's geographic location. Overall, among all children aged 4-17 years who were subjects of the 2007 NSCH, male children were more likely to be medicated for ADHD compared to females (prevalence ratio 2.76) (36). Studies from 2011 NSCH data have provided information regarding the demographic groups with the highest prevalence of medication use for ADHD, which include males, whites, non-Hispanics, those children living in primarily English speaking households, children with public insurance type, and those living in the Midwest and South. This study also documented that the proportion of children with ADHD who were using medication increased with parent-rated ADHD severity (53).

Additionally, there are differences between males and females in which socio-demographic characteristics are associated with medication use for ADHD among those with ADHD. A study that utilized sex-specific, predictive, multivariate logistic regression modeling identified the following child and family-level characteristics to be important predictors of medicated ADHD. For male children aged 4-17 years with ADHD, the factors associated with medication use include: younger age, non-Hispanic ethnicity, family income > 100% of poverty level, existing health coverage, health contact within the last twelve months, and the presence

of psychological difficulties. For female children with ADHD, younger age, non-Hispanic ethnicity, the health burden of psychological difficulties, and fair-to-poor paternal mental health were the variables which were found to be associated with medication use (51).

Among the 2003 NSCH sample, the age group with the highest rate of medication use for ADHD was 9-12 years (6.2%, 95% CI 5.7-6.7) (50). However, among male participants of the 2007 NSCH, the prevalence of medicated ADHD was highest for the 11-14 year age group, while the rate for females increased with age (36). Children with the highest medication rates for ADHD were reported to be among the white race (5.2%) in 2007 compared to the other race category (4.4%) (53). In 2011, the rates of medicated ADHD among children with ADHD increased in white children (change from 5.2% to 7.1%) and black children (change from 5.1% to 5.7%) but decreased for the "other" race group (change from 4.4% to 3.5%) compared to the rates in 2007 (53). In the 2007 and 2011 NSCH, Non-Hispanic children had higher medication rates than Hispanic children and those with public insurance had higher rates compared to those with private insurance (53).

The study using MEPS data found that differences in the prevalence of stimulant use for ADHD existed between sexes, race/ethnicity groups, age groups, and groups by insurance type. Although the rates increased from the years 1996-2008, the demographic characteristics of children with the highest prevalence were consistent throughout the study period. In 2008 the highest prevalence (%, 95% CI) occurred in males (5.3, 4.4-6.2), non-Hispanic whites (4.4, 3.5-5.2), those among the middle age group (6-12 years) (5.1, 4.1-6.1), and those with public health insurance (4.3, 3.4-5.2) (48). A study on medication use for ADHD among subjects aged 20

years or less using Medicaid data found similar results. The authors of the publication reported that the prevalence (%, 95% CI) was highest for males (6.92, 6.84-6.99), those with non-Hispanic white race/ethnicity (6.87, 6.77-6.96), and among children in the 10-14 year age group (9.25, 9.11-9.39) during the period from 2003-2004 (54).

Statistically significant associations also existed between these demographic characteristics and stimulant medication use. The associations between stimulant medication use and gender and health insurance type were greater for males (OR=2.62, 95% CI 2.05-3.35) compared to females and those with public insurance (OR=1.88, 95% CI 1.00-3.54) compared to those with no insurance (48). Compared to non-Hispanic white children, African Americans (OR=0.64, 95% CI 0.49-0.85) and Hispanics (OR=0.70, 95% CI 0.49-1.00) had a lower risk for stimulant use (48). Although the association was not significant by age group, the direction of the association was that children aged 5-12 had a lower risk of stimulant medication use compared to those aged 13-17 (OR=0.89, 95% CI 0.71-1.12) (48).

Association between prematurity and medication use for ADHD or ECB problems

Currently there are no population based studies that assess the association between preterm birth and the use of medication for ADHD or ECB. This study evaluates the prevalence of medication use for ADHD, and separately for ECB, in a nationally-representative sample of non-institutionalized children aged 6-17 years who were participants in the 2011 NSCH. This study also assesses the association between preterm birth and medication use for ADD/ADHD or ECB. We hypothesize that the odds of using medications for 1) ADD/ADHD and 2) ECB are

significantly higher for children who were born preterm compared to children who were born full term.

Methods

We used data from the 2011-2012 NSCH, a cross-sectional telephone survey conducted in each of the fifty states and the District of Columbia from February 28, 2011 through June 25, 2012. For the NSCH, random digit dialing of cell phones and land lines was used to obtain a sample of households with children less than 18 years of age. Interviews were conducted in English, Spanish, or one of four Asian dialects with a parent or guardian of an eligible child that knew the most about the child's health status, well-being, and health care.

One child was selected from the household to be the study subject of the survey. If a household contained multiple eligible children, then a single child was randomly selected to be the study subject. The survey had a sample size of 95,677 children less than 18 years of age, including more than 1,800 per state (range 1,811-2,200). Preterm birth status is a newly added data element to the 2011 NSCH and is important in epidemiology as a determinant and an outcome of maternal and child health. Detailed survey sampling and administration processes for the 2011 NSCH are accessible at http://childhealthdata.org/learn/methods.

In accordance with HHS regulations (45 CFR 46), the NCHS ERB and the NORC Institutional Review Board (IRB) approved all study procedures and modifications for the 2011 NSCH (55). Emory University Human Subjects Review committee deemed the current analysis as a secondary analysis, and a full IRB review was waived.

Inclusion Criteria

Children were included in this analysis if they were 6-17 years old at the time of interview and the survey respondent was the mother. The study is restricted to children whose respondent is the mother to eliminate potential differences in recall bias that may exist between different parent or guardian relationships (i.e. father, step-parent, grandparent, foster parent). The study sample included 42,178 children, 44.1% of the total survey sample (Figure 1).

Exclusion Criteria

Children were excluded from this analysis for the following reasons: age < 6 years (29,997; 31.4%); the survey respondent was not the mother (20,759; 21.7%); or missing exposure/outcome data (2,743; 2.9%).

Exposure Variable

Preterm birth was measured as a categorical variable measured based on maternal response to the survey item K2Q05, "Was [CHILD'S NAME] born prematurely that is, more than 3 weeks before [his/her] due date?" Possible responses included: yes, no, don't know, and refused. "Don't know" and "refused" responses are classified as missing values. The affirmative response was classified as exposed (coded as 1), and the negative response as unexposed (coded as 0) in our analysis.

Outcome Variables

The main outcome variable of our study was maternal-reported medication use among eligible children. Henceforth, we will refer to our outcome as 'medication use'. The [survey item] and survey questions being used to measure the outcome are:

- [K4Q23] During the past 12 months, has [CHILD'S NAME] taken any medications because of difficulties with (his/her) emotions, concentration, or behavior?
- [K2Q31D] Is [CHILD'S NAME] currently taking medication for ADD/ADHD?

Each outcome is based on maternal response and is coded as a categorical variable with the following possible responses, yes, no, don't know, and refused. Again, the responses "don't know" and "refused' were classified as missing. The affirmative response was classified as having the outcome (coded as 1), and the negative response as not having the outcome (coded as 0) in our analysis.

Covariates

We have evaluated the following covariates as potential effect modifiers or confounders: child's gender (male, female), child's race (Hispanic, non-Hispanic White, non-Hispanic Black, non-Hispanic / Multiracial), child's current age (6-9, 10-13, 14-17 years), mother's age at the child's birth (≤30, >30 years), mother's education (less than high school, high school equivalent, more than high school), child's current exposure to secondhand smoke at home (none, someone smokes, but not inside, someone smokes inside), and child's current insurance type (public, private, none). The child's current age and the mother's age at the child's birth were categorized in an attempt to divide the frequencies of each age into relatively even groups. The age groups are 6-9, 10-13, and 14-17 years for the child's age, and ≤30 years

and >30 years for the mother's age. Each covariate was assigned a single reference group for the analysis as follows: female gender, non-Hispanic White race, child's age group 10-13 years, mother's age group >30 years, mother's education equivalent to high school, no one smokes in the household, and insurance type is private.

Statistical Analysis

Prevalence of medication use

The prevalence of each medication use outcome is presented as a weighted proportion with 95% CI and a weighted population estimate. Prevalence was calculated among children 6-17 years of age, with the number of children whose mother reported an affirmative response to each of the outcome questions as the numerator and all eligible children in the 2011-2012 NSCH survey as the denominator. The weighted population estimate was calculated based on the sample weights applied to each subject of the 2011-2012 NSCH. The 2011-2012 NSCH utilized a raking adjustment to match each state's weighted survey responses to selected demographic characteristics of the state's population of non-institutionalized children age 17 and younger. State population counts were obtained from the 2011 American Community Survey (ACS) (56). Prevalence estimates were multiplied by the weighted population estimates (summed across states) to estimate the total number of children with each type of medication use.

Association between preterm birth and medication use

Frequency distributions of demographic characteristics were compared between children with and without each outcome using the chi-square tests for categorical variables. Statistical significance for categorical variables was determined by assessing the p-value for the calculated Rao-Scott chi-square statistic. The Rao-Scott chi-square test was used because it applies a design correction to the Pearson test in order to account for the complex survey methods. The two-sided level of statistical significance for all tests was 0.05 and 95% confidence intervals (CI) were calculated.

We conducted logistic regression analyses to examine the associations between preterm birth and the selected medication use indicators. We assessed confounding by comparing the odds ratio for preterm birth in models with and without the specific covariates. Confounding was determined if removal of covariates individually from the full model changed the main effect estimate by more than 10%. For the ordinal covariates, child's age group, mother's age group, mother's education, and current exposure to secondhand smoke at home, we assessed the trend for the measure of effect by treating each ordinal covariate as a continuous variable in a separate logistic regression model. We assessed interaction by examining the statistical significance of coefficients for the product of the exposure and the other covariates in the model using a backward elimination process. Interaction was confirmed if the p-value was less than 0.05.

All analyses are conducted SAS 9.4 (SAS Institute Inc., Cary, NC, USA) using frequency and logistic procedures that account for the complex survey design.

Results

Table 1 compares the demographic characteristics of children reported to have or have not taken medication for ECB within the past 12 months and separately for children currently taking or not taking medication for ADHD. The distributions of several covariates, including gender, gestational age at birth, race, child's age group, child's current exposure to SHS at home, and current insurance type, were different between those taking and not taking medication for both outcomes (all p-values < 0.05). Additionally, mother's current education was differentially distributed between children who were reported to be currently using medication for ADHD and those who were not (p-value = 0.0015).

Prevalence of Medication Use

Prevalence of medication use for ECB within the 12 months prior to the interview: The estimate for the prevalence of medication use for ECB among non-institutionalized children aged 6-17 years living in the United States was 9.89% (95% CI 9.27-10.51), (approximately 3.2 million children). Specifically, the prevalence estimate for males was 12.7% (95% CI 11.7-13.7), and 7.1% (95% CI 6.3-7.8) for females. Among children using medication for EBC, an estimated 15% (95% CI 12.75-17.20) were reported to have been born prematurely, 65% were male, 69% were of non-Hispanic white race, 40% were in the oldest age category (14-17 years), 11% were exposed to SHS from someone that smokes inside, and 46% were enrolled in a public health insurance program. Additionally, 60% of the mothers of these children were in the younger age category (≤30 years) at the child's birth and 65% reported education levels greater than high school.

Prevalence of medication use for ADD/ADHD at the time of the interview: The prevalence of medication use for ADHD among non-institutionalized children aged 6-17 years living in the United States was 6.93% (95% CI 6.41-7.44) (approximately 2.2 million children). Specifically, the prevalence estimate for males was 9.5% (95% CI 8.6-10.3), and 4.4% (95% CI 3.7-5.0) for females. Approximately 15.4% (95% CI 12.70-18.13) of children using medication for ADHD were born prematurely. Also among these children, the estimated frequency distributions of the covariates are nearly the same as for children using medication for ECB with the exception that 38% of children using medications for ADHD were reported to be in the middle age category (10-13 years) and 63% of mothers were in the older category (>30 years).

Association between preterm birth and medication use for ECB within the past 12 months

Unadjusted analysis: Table 2 shows the results of the logistic regression analysis for medication use for ECB within the past 12 months. In our unadjusted analysis, all variables except the mother's age at birth were significantly associated with a child using medication for ECB within the past 12 months. Children born prematurely were at an approximately 1.4 times (OR 1.41, 95% CI 1.17-1.70) increased risk of medication use compared to term-born children (considering the odds ratio to approximate the risk ratio). The most strongly associated variable is the child's current exposure to SHS at home and the strength of this association increases as the level of smoke exposure increases. The risk of medication use for a child exposed to someone who smoked but not inside the home was 1.38 times greater (95% CI 1.17-1.62) than for children living in a household in which no one smokes. Accordingly, as smoke exposure increased to the level of the child living with someone who smoked inside the home,

the strength of the association increased significantly (trend p-value <0.05) to 2.28 times greater risk (95% CI 1.81-2.86) compared to the reference group (no one in the household smokes). Medication use among males was almost twice that among females (OR 1.92, 95% CI 1.66-2.22). The risk in Hispanic children was less than one-half times that of non-Hispanic white children (OR 0.43, 95% CI 0.33-0.55). The risk of medication use (in comparison with non-Hispanic White children) was similar for non-Hispanic black children and non-Hispanic / Multiracial children (OR 0.63 and 0.60, 95% CI 0.50-0.79 and 0.47-0.75, respectively). Children in the 6-9 years old age category had approximately one-third the risk of being reported to have this type of medication use, compared to the 10-13 year old reference group (OR 0.70, 95% CI 0.58-0.83). Lastly, compared to children with private health insurance, children with public health insurance have approximately 1.6 times higher risk of having used medication in the past 12 months for emotions, concentration, or behavior (OR 1.63, 95% CI 1.41-1.88).

Adjusted analysis: The association between preterm birth and medication use did not change meaningfully (less than 3% change) upon adjusting for all other covariates (child's age group, sex, race/ethnicity, current exposure to SHS at home, and current insurance type, and mother's age at birth and education level) compared to our unadjusted model. Prematurity was associated with an increased risk of ECB medication use within the past 12 months (OR 1.37, 95% CI 1.13-1.66) compared with term birth. The direction and magnitude of effect remained similar for all covariates in the adjusted model compared to the crude models.

Stratified analysis: According to our analyses, the best estimate of association between preterm birth and medication use for ECB is different based on the sex of the child; however, the

interaction was not statistically significant (p-value=0.17). In a fully-adjusted model stratified by sex, male children had a significant positive association between preterm birth and ECB medication use in the past 12 months compared to their counterparts born at term (OR 1.53, 95% CI 1.21-1.96). A similar association is not evident in female children (OR 1.11, 95% CI 0.81-1.52).

Association between preterm birth and current medication use for ADD/ADHD

Crude analysis: Table 3 displays the results of our logistic regression analysis for current medication use for ADHD. In unadjusted analysis, all variables except the mother's age at the child's birth were significantly associated with a child using medication for ADHD. The risk of current medication use for ADHD among children born prematurely was approximately 1.5 times higher for children born prematurely (OR 1.45, 95% CI 1.16-1.80) than for children not born prematurely. The variable with the strongest association for this type of medication use is sex. The risk of current medication use for ADHD among males was more than two times that among females (OR 2.29, 95% CI 1.92-2.74). Next, the risk of current medication use for ADHD was higher among children of non-Hispanic white race/ethnicity than among children of other races, with Hispanic children having approximately one-third the risk of non-Hispanic White children (OR 0.37, 95% CI 0.27-0.50). Children in the 6-9 years old age category had approximately one third lower risk of current medication use for ADHD compared to the 10-13 year old group (OR 0.77, 95% CI 0.64-0.94). As with medication use for ECB, the child's current exposure to SHS at home was strongly associated with medication use and the strength of this association increased with higher levels of smoke exposure. The risk of current medication use

for ADHD for a child being exposed to someone who smokes but not inside the home was 1.36 times greater (95% CI 1.14-1.62) than that for children living in a household in which no one smokes. As the level of smoke exposure increased the risk of current medication use for ADHD increased significantly (trend p-value <0.05) to 2.25 times greater risk of current medication use for ADHD for children living where someone smokes inside the home (95% CI 1.71-2.95) compared to those living where no one smokes. Lastly, among children with public health insurance, the risk of current medication use for ADHD was approximately 1.6 times greater (OR 1.60, 95% CI 1.36-1.89) compared to children with private insurance.

Adjusted analysis: The association between preterm birth and medication use for ADHD did not change appreciably (less than 5% change) after adjusting for all other covariates. The risk of current medication use for ADHD among children born prematurely was nearly 1.4 times the risk among children born at full term (OR 1.38, 95% CI 1.10-1.72).

Stratified analysis: The best estimate of association between preterm birth and medication use for ADHD, again, depended on the sex of the child (p-value of the interaction term=0.005). In a fully-adjusted model stratified on sex, the risk of current medication use for ADHD among male children born preterm was approximately 1.7 times greater than the risk for male children born at full term (OR 1.68, 95% CI 1.28-2.19). A significant association was not evident for female children (OR 0.85, 95% CI 0.59-1.22). The association of medication use and other covariates was not modified by sex; however, they are also presented in Table 3.

Manuscript Discussion

Our findings provide nationally representative estimates for the prevalence of medication use for ADHD and ECB among school-age children aged 6-17 years living in the U.S. at the time of the administration of the 2011 NSCH. Further, we present novel insights into the association between preterm birth and medication use for these mental health conditions. Our study findings highlight the role of prematurity on childhood neuropsychiatric health, and point to the need for further understanding of differences in prescription patterns and long-term effects of these medications in U.S. school-aged children who were born prematurely.

Prevalence of medication use in the past 12 months for ECB

An analysis of data from the 2011 NHIS estimated the prevalence of medication use within the past 6 months for difficulties with ECB, or being able to get along with others among children 6-17 years of age to be 7.5% (49). Our estimate of the prevalence of medication use for ECB is 9.9%. The question from the 2011 NSCH "During the past 12 months, has [CHILD'S NAME] taken any medications because of difficulties with (his/her) ECB" is worded similarly to the 2011 NHIS but includes a broader time frame (12 months compared to 6 months). Although the precision of the estimate may increase or decrease based on the time frame of recall, the external validity is strong and these findings demonstrate that medication use among children 6-17 years of age is significant enough to warrant further studies with objectives to monitor and assess the safety and efficacy of medication use in this population.

Characteristics of children using medication for these conditions are similar between our analysis and the 2011 NHIS study (49). The NHIS results are presented as the percentage of all children that used medication at each level of the covariate, and we presented the results as

the percentage of children who were in each level of the covariate among children using or not using medication. However, in both studies the highest level of medication use was observed among children of male sex, of non-Hispanic white race/ethnicity, and in the oldest age category (14-17 years in this study). In addition to the characteristics considered in the study of data from the NHIS, we also assessed the percentage of children using medication by gestational age, household smoke exposure, and maternal age at birth and education level. Among children with this type of medication use, the majority of children were born at full term (85%), unexposed to smoke inside the home (67%), born to mothers at younger maternal age (60%), and born to mothers with maternal education greater than high school (65%).

Prevalence of current medication use for ADHD

Our estimated prevalence of medication use can be compared, in magnitude and direction, with estimates from prior studies that used data from the 2003, 2007, and 2011 versions of the NSCH. Prevalence estimates for medicated ADHD among children aged 4-17 years have increased from 4.3% in 2003 to 6.1% in 2011 (51-53). The higher prevalence estimate in our study (6.9%) compared to the previous 2011 NSCH analysis (6.1%) is likely due to the narrower age range of our study subjects (52). While previous studies have included an age range of 4-17, we chose an age range of 6-17 based on the FDA labeled, minimum, recommended age of use for most ADHD medications (Appendix Table A). Although new clinical guidelines support the off-label use of ADHD medications in children 4-6 years of age, there is likely more variability in the prescribing practices of ADHD medication for children in

this age range. Inclusion of children 4-6 years old may lead to lower estimates of the prevalence of current medication use for ADHD.

Although the prevalence of medication use for ADHD has increased over the three NSCH versions (4.3% in 2003; 4.8% in 2007; 6.1% in 2011), the associations with sex and age group have remained stable; male children and those in the middle age group continue to have the highest prevalence of medication use for ADHD despite the middle age group being classified differently in the 2003 version (9-12 years) compared to the 2007 and 2011 surveys (11-14 years) (36, 51, 53). Additional demographic groups with the highest prevalence of medicated ADHD in the 2007 and 2011 NSCH versions include children of non-Hispanic ethnicity, those with public health insurance, and those from the Midwest or southern geographic regions. Our results relating to associations between medication use for ADHD and demographic characteristics cannot be directly compared to other studies based on previous NSCH versions because the results of other studies are presented as prevalence estimates for the various demographic groups. However, the demographic groups that represented the highest proportion of children using medication for ADHD in our study are similar to the demographic groups with the highest prevalence of medication use in the previous studies, such as males, children in the middle age group, and non-Hispanics (36, 51, 53). Previous NSCH-based studies did not assess some characteristics of children using medication for ADHD including: gestational age, household exposure to smoke, and mother's age at birth; therefore, there are no currently data with which we can compare our results.

Association between preterm birth and medication use

To our knowledge, we present novel findings on the association between preterm birth and medication use for ADHD or ECB from a representative sample of U.S. children 6-17 years of age. Using 2011 NSCH data, we show that preterm birth is positively associated with medication use for selected mental health conditions among our study population in crude, adjusted, and stratified logistic regression models. Sex-specific, adjusted logistic regression analysis provided the most valid estimates for association between preterm birth and medication use, and the association was only significant for male children.

There have been significant sex differences (male vs. female) in the prevalence estimates of selected mental health conditions reported from analyses of 2011 NSCH data, such as emotions/behavior problems (7.12% vs. 4.9%) and ADHD (10.73% vs. 4.91%) (42). However, the adjusted associations for a child with emotions/behavior problems or ADHD to have been born preterm were similar for male and female children after controlling for child's age, race/ethnicity, household composition, metro/non-metro residence, and household poverty and education levels. Specifically, the associations (adjusted odds ratio, aOR) for a child with an emotional/behavioral problem to have been born preterm (compared to a child without such a problem) was 1.48 (95% CI 1.20-1.82) for male children and 1.47 (95% CI 1.14-1.91) for female children (42). Additionally, among children with ADHD, the aOR for these children to have born preterm was 1.51 (95% CI 1.27-1.81) for males and 1.43 (95% CI 1.11-1.84) for females, compared with children without ADHD (42). Therefore, our results which suggest that the adjusted association between medication use for ADHD and preterm birth is modified by sex suggest that there may be differential prescribing practices for children with ADHD based on sex. However, these reported differences in the association between current medication use

for ADHD and preterm birth may be confounded by socio-demographics that were not included in our regression analyses, such as place of residence, household composition, or household poverty status. Our study does not address why differential medication use for ADHD may occur; however, this could be a future topic of investigation.

It may seem intuitive that children born prematurely would have higher risk of medication use for mental health conditions than children born at full term, due to the evidence that mental health conditions are more common among children born prematurely (19, 40-42). However, we believe we are the first to present results in a nationally representative sample of school-aged children to demonstrate this positive association. Our results suggest that the other demographic characteristics associated with medication use for ADHD or ECB are similar to those identified in other nationally representative studies supporting the validity of our study.

Based on an assumption that as mental health diagnoses increase medication use for treatment of these conditions will also increase, our results for medication use prevalence are consistent with studies of the association between prematurity and the prevalence, odds, and risk for several mental health conditions. Our results can be compared, with a generalized perspective, to the various international and community studies and meta-analyses that have reported these findings. Specifically, we report that the odds ratio for the association with preterm birth was approximately 1.4 for medication use for each of these conditions (OR= 1.37, 95% CI 1.13-1.66 for ECB, OR=1.38, 95% CI 1.10-1.72 for ADHD), while the reported odds ratios from the 2011 NSCH for the association between preterm birth and emotions/behavior,

anxiety, conduct disorders, and ADHD were similar in magnitude. The reported ORs (95% CI) for the association between preterm birth and the above conditions were: emotional/behavioral conditions (OR=1.47, 95% CI 1.25-1.73), anxiety (OR=1.58, 95% CI 1.31-1.91), conduct disorder (OR=1.50, 95% CI 1.21-1.86), and ADHD (OR=1.49, 95% CI 1.29-1.73) (42). Characteristics associated with mental health conditions in previous studies were similar to characteristics associated with medication use for those conditions in our study. For example, the risks are strongest for male children, those in the middle age group (10-13 years in our study), those of non-Hispanic white race/ethnicity, those with private insurance, and those whose parents' (mothers in our study) highest level of education is high-school equivalent (40, 42).

We acknowledge that biological differences exist between children who were born preterm and those born full term, and these differences may affect the risk / benefit ratio of medication use. Due to the increased baseline risk of cardiovascular disease and diabetes in children who were born preterm, the metabolic effects from the use psychotropic medications should be vigilantly monitored in this group (15, 16). Future studies should be conducted to observe the differences in the use and effects of these medications in school-aged children by preterm birth status.

The strengths of this study include, 1) having a large sample size, which increases the study power to detect Type 2 error and provides more precise estimates of effect via narrower 95% CI, 2) having heterogeneity in the weighted distribution of biological and socio-demographic variables, which provides strong external validity, and 3) the complex survey

design, which reduces potential confounding and provides more accurate variance estimates. However, there are also some limitations or sources of bias. Selection bias could exist due to limiting the survey to 1) families with a cell phone or landline and 2) non-institutionalized children, which may exclude children with more severe mental health conditions requiring treatment with medications. Misclassification bias may have been introduced due to 1) questionable honesty in parent-reported second hand smoke exposure in the household 2) the fact that medical diagnoses were not confirmed and it has been suggested that 3.3% of children reported to have ADHD by a parent did not meet DSM-IV criteria (35), and 3) poor recall for the 12 month medication use history. Conclusions cannot be made about causality based on our study findings. Since the outcome in this study is truly time-varying (a child's status can change at different points in time, and prevalence in the population can change over time), the survey could have different results and conclusions if it had been conducted at a different point in time.

Extended Discussion

Recommendations and Potential Next Steps

We believe it is important for parents, teachers, and physicians to understand that prematurity is associated with an increased risk of mental health diagnoses and medication use for mental health conditions. Early recognition of abnormal mental health by parents and teachers in children born preterm may allow for medical professionals to provide earlier therapy, including behavioral modification and counseling. Hopefully, this will assist the health care team to limit the use of medication to children among ages of the FDA labeling and reserve

their use for children with moderate to severe symptoms in at least two settings as the treatment guidelines suggest. Psychotropic medications should be used vigilantly in children, especially ones with stimulating or sedating properties and cardiovascular or endocrine effects.

Recommendations for future research on the mental health of children who were born preterm and medication use may include studying the significant association between medication use for mental health conditions and SHS exposure. Since this association appears strong and consistent between different geographic, race/ethnic, and socio-economic groups of children, next steps in the prevention of childhood exposure to SHS may include policy efforts to make it illegal to smoke near children, including the home environment and outdoor public areas (including parks). Additionally, future studies can examine the association between medication use and preterm birth categories (early preterm, moderate preterm, and late preterm).

Other questions that future research might examine are whether interventions among preterm children with mental health conditions at an earlier age improves long-term child-, parent-, and family-level outcomes or if there are differences in the severity of these conditions after specific medication utilization regimens. It is important to collect and analyze prospective longitudinal data to assess patterns in treatment, adverse events, financial implications, and outcomes. Also, it would be interesting to know if there are differences in the association between the prevalence of mental health conditions and medication use according to whether preterm birth is spontaneous or due to medical necessity.

References

1. Goldenberg RL, Culhane JF, Iams JD, et al. Epidemiology and causes of preterm birth. *Lancet* 2008;371(9606):75-84.
2. Morken NH. Preterm birth: new data on a global health priority. *Lancet* 2012;379(9832):2128-30.
3. March of Dimes Foundation. Our campaign to end premature birth: Annual Report 2014. 2015:14.
4. March of Dimes, PMNCH, Save the Children, et al. Born Too Soon: The global action report on preterm birth. In: Howson CP, Kinney MV, Lawn JE, eds. Geneva: World Health Organization, 2012.
5. Blencowe H, Cousens S, Oestergaard MZ, et al. National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: a systematic analysis and implications. *Lancet* 2012;379(9832):2162-72.
6. Duley L, Uhm S, Oliver S, et al. Top 15 UK research priorities for preterm birth. *Lancet* 2014;383(9934):2041-2.
7. Dole N, Savitz DA, Hertz-Picciotto I, et al. Maternal stress and preterm birth. *American Journal of Epidemiology* 2003;157(1):14-24.
8. Witt WP, Cheng ER, Wisk LE, et al. Preterm birth in the United States: the impact of stressful life events prior to conception and maternal age. *American journal of public health* 2014;104 Suppl 1:S73-80.
9. Iams JD, Romero R, Culhane JF, et al. Primary, secondary, and tertiary interventions to reduce the morbidity and mortality of preterm birth. *Lancet* 2008;371(9607):164-75.
10. Child Trends Databank. Preterm births. 2015. (http://www.childtrends.org/?indicators=preterm-births). (Accessed July 1 2015).
11. Saigal S, Doyle LW. Preterm birth 3 - An overview of mortality and sequelae of preterm birth from infancy to adulthood. *Lancet* 2008;371(9608):261-9.
12. Behrman RE, Butler AS. Preterm birth: Causes, consequences, and prevention. Washington, D.C.: The National Academies Press, 2007.
13. U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal Child Health Bureau. The health and well-being of children: a portrait of states and the nation, 2011-2012. In: U.S. Department of Health and Human Services, ed. Rockville, Maryland, 2014.
14. Allin MP. Preterm babies grown up: understanding a hidden public health problem. *Psychological medicine* 2010;40(1):5-7.
15. Lewandowski AJ, Augustine D, Lamata P, et al. Preterm heart in adult life: cardiovascular magnetic resonance reveals distinct differences in left ventricular mass, geometry, and function. *Circulation* 2013;127(2):197-206.
16. Kajantie E, Osmond C, Barker DJ, et al. Preterm birth--a risk factor for type 2 diabetes? The Helsinki birth cohort study. *Diabetes care* 2010;33(12):2623-5.
17. Treyvaud K. Parent and family outcomes following very preterm or very low birth weight birth: a review. *Seminars in fetal & neonatal medicine* 2014;19(2):131-5.
18. Indredavik MS, Vik T, Evensen KA, et al. Perinatal risk and psychiatric outcome in adolescents born preterm with very low birth weight or term small for gestational age. *Journal of developmental and behavioral pediatrics : JDBP* 2010;31(4):286-94.
19. Loe IM, Lee ES, Luna B, et al. Behavior problems of 9-16 year old preterm children: biological, sociodemographic, and intellectual contributions. *Early human development* 2011;87(4):247-52.

20. Crump C, Winkleby MA, Sundquist K, et al. Preterm birth and psychiatric medication prescription in young adulthood: a Swedish national cohort study. *International Journal of Epidemiology* 2010;39(6):1522-30.
21. Taber CW, Thomas CL. Taber's cyclopedic medical dictionary. Philadelphia: F.A. Davis Co., 1993:v.
22. Klassen AF, Miller A, Fine S. Health-related quality of life in children and adolescents who have a diagnosis of attention-deficit/hyperactivity disorder. *Pediatrics* 2004;114(5):e541-7.
23. Horsman J, Furlong W, Feeny D, et al. The health utilities index (HUI): concepts, measurement properties and applications. *Health and quality of life outcomes* 2003;1(54).
24. Saigal S, Rosenbaum P, Stoskopf B, et al. Comprehensive assessment of the health status of extremely low birth weight children at eight years of age: comparison with a reference group. *The Journal of pediatrics* 1994;125(3):411-7.
25. Saigal S, Feeny D, Rosenbaum P, et al. Self-perceived health status and health-related quality of life of extremely low-birth-weight infants at adolescence. *Jama* 1996;276(6):453-9.
26. Saigal S, Rosenbaum PL, Feeny D, et al. Parental perspectives of the health status and health-related quality of life of teen-aged children who were extremely low birth weight and term controls. *Pediatrics* 2000;105(3 Pt 1):569-74.
27. Zwicker JG, Harris SR. Quality of life of formerly preterm and very low birth weight infants from preschool age to adulthood: A systematic review. *Pediatrics* 2008;121(2):E366-E76.
28. Treyvaud K, Lee KJ, Doyle LW, et al. Very preterm birth influences parental mental health and family outcomes seven years after birth. *Journal of Pediatrics* 2014;164(3):515-21.
29. NIMH. Any disorder among children. *Statistics*, 2014.
30. Blanchard LT, Gurka MJ, Blackman JA. Emotional, developmental, and behavioral health of American children and their families: a report from the 2003 National Survey of Children's Health. *Pediatrics* 2006;117(6):e1202-12.
31. Ghandour RM, Kogan MD, Blumberg SJ, et al. Mental health conditions among school-aged children: geographic and sociodemographic patterns in prevalence and treatment. *Journal of developmental and behavioral pediatrics : JDBP* 2012;33(1):42-54.
32. Kessler RC, Berglund P, Demler O, et al. Lifetime prevalence and age-of-onset distributions' of DSM-IV disorders in the national comorbidity survey replication. *Archives of general psychiatry* 2005;62(6):593-602.
33. American Psychiatric Association. *Diagnostic and statistical manual of mental disorders: DSM-5.* Washington, D.C.: American Psychiatric Association; 2013.
34. Polanczyk G, de Lima MS, Horta BL, et al. The worldwide prevalence of ADHD: A systematic review and metaregression analysis. *American Journal of Psychiatry* 2007;164(6):942-8.
35. Froehlich TE, Lanphear BP, Epstein JN, et al. Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of US children. *Archives of pediatrics & adolescent medicine* 2007;161(9):857-64.
36. Visser SN, Bitsko RH, Danielson ML, et al. Increasing prevalence of parent-reported attention-deficit/hyperactivity disorder among children: United States, 2003 and 2007. *Morbidity and Mortality Weekly Report (MMWR)* 2010;59(44):1439-43.
37. Ramtekkar UP, Reiersen AM, Todorov AA, et al. Sex and age differences in attention-deficit/hyperactivity disorder symptoms and diagnoses: implications for DSM-V and ICD-11. *J Am Acad Child Adolesc Psychiatry* 2010;49(3):217-28.e1-3.
38. Max W, Sung HY, Shi Y. Attention deficit hyperactivity disorder among children exposed to secondhand smoke: a logistic regression analysis of secondary data. *International journal of nursing studies* 2013;50(6):797-806.

39. Kabir ZC, G.N.; Alpert, H.R.;. Secondhand smoke exposure and neurobehavioral disorders among children in the United States. *Pediatrics* 2011;128(2):263-70.
40. Farooqi A, Hagglof B, Sedin G, et al. Mental health and social competencies of 10- to 12-year-old children born at 23 to 25 weeks of gestation in the 1990s: a Swedish national prospective follow-up study. *Pediatrics* 2007;120(1):118-33.
41. Bhutta AT, Cleves MA, Casey PH, et al. Cognitive and behavioral outcomes of school-aged children who were born preterm - A meta-analysis. *Jama-Journal of the American Medical Association* 2002;288(6):728-37.
42. Singh GK, Kenney MK, Ghandour RM, et al. Mental Health Outcomes in US Children and Adolescents Born Prematurely or with Low Birthweight. *Depression research and treatment* 2013;2013:570743.
43. SAMHSA. National expenditures for mental health services and substance abuse treatment, 1986-2009. Rockville, MD, 2013.
44. Levit KR, Kaseed CA, Coffey RM, et al. Projections of national expenditures for mental health services and substance abuse treatment, 2004-2014. Rockville, MD: Substance Abuse and Mental Health Services Administration, 2008.
45. Subcommittee on Attention-Deficit/Hyperactivity D, Steering Committee on Quality I, Management, et al. ADHD: clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics* 2011;128(5):1007-22.
46. Wolraich ML, Lindgren S, Stromquist A, et al. Stimulant medication use by primary care physicians in the treatment of attention deficit hyperactivity disorder. *Pediatrics* 1990;86(1):95-101.
47. Reuters staff. Shire to test its ADHD drug in 4- to 5-year-olds in U.S. *Medscape* 2014.
48. Zuvekas SH, Vitiello B. Stimulant medication use in children: a 12-year perspective. *The American journal of psychiatry* 2012;169(2):160-6.
49. Howie LD, Pastor PN, Lukacs SL. Use of medication prescribed for emotional or behavioral difficulties among children aged 6-17 years in the United States, 2011-2012. *NCHS data brief* 2014(148):1-8.
50. Visser SN, Lesesne CA. Mental health in the United States: Prevalence of diagnosis and medication treatment for attention-deficit/hyperactivity disorder-United States, 2003. *Morbidity and Mortality Weekly Report (MMWR)* 2005;54(34):842-7.
51. Visser SN, Lesesne CA, Perou R. National estimates and factors associated with medication treatment for childhood attention-deficit/hyperactivity disorder. *Pediatrics* 2007;119 Suppl 1:S99-106.
52. Visser SN, Blumberg SJ, Danielson ML, et al. State-based and demographic variation in parent-reported medication rates for attention-deficit/hyperactivity disorder, 2007-2008. *Preventing chronic disease* 2013;10:E09.
53. Visser SN, Danielson ML, Bitsko RH, et al. Trends in the parent-report of health care provider-diagnosed and medicated attention-deficit/hyperactivity disorder: United States, 2003-2011. *J Am Acad Child Adolesc Psychiatry* 2014;53(1):34-46 e2.
54. Winterstein AG, Gerhard T, Shuster J, et al. Utilization of pharmacologic treatment in youths with attention deficit/hyperactivity disorder in Medicaid database. *The Annals of pharmacotherapy* 2008;42(1):24-31.
55. Blumberg SJ, Foster EB, Frasier AM, et al. Design and Operation of the National Survey of Children's Health, 2007. Washington, DC: Department of Health and Human Services, 2012, (Vital Health Statistics)(Office GP publication no. 2012-1331)

56. CDC, NCHS, SLAITS. 2011-2012 National Survey of Children's Health Frequently Asked Questions. 2013.

Figure 1. Study Flowchart

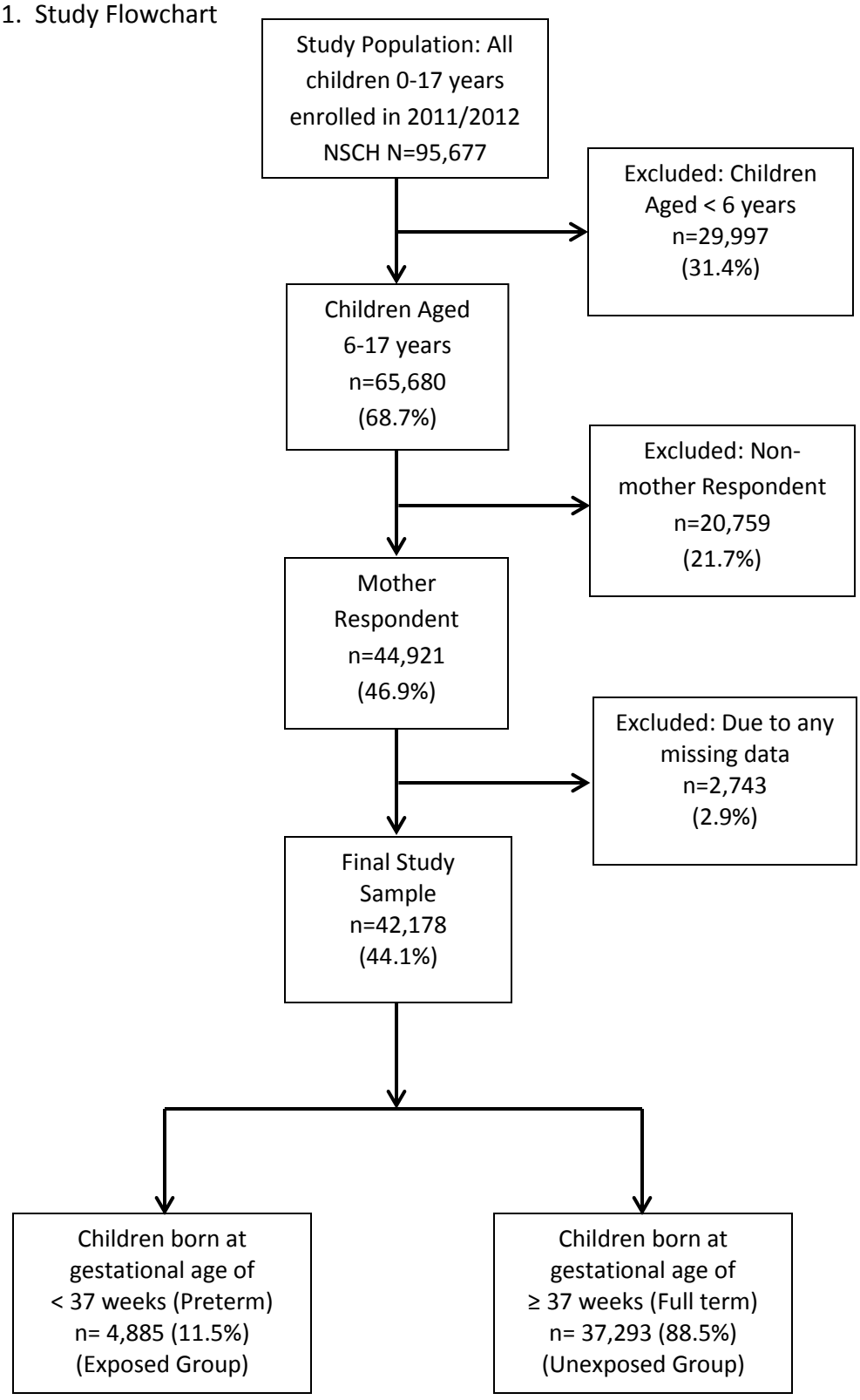


Table 1. Demographic characteristics of children aged 6-17 years as reported by their mother and stratified on medication use status, NSCH 2011-2012 (n=42,178)

Characteristic		Medication use in the past 12 months for difficulties with the child's emotions, concentration, or behavior					Current medication use for ADHD				
		Yes		No		p-value	Yes		No		p-value
Child		n	%*	n	%*		n	%*	n	%*	
Gestational Age	Preterm (<37 weeks)	656	15.0	4229	11.1	0.0003	468	15.4	4417	11.2	0.0009
	Full Term (37+ weeks)	3603	85.0	33690	88.9		2446	84.6	34847	88.8	
Age group (years)	6-9	951	24.7	11880	33.0	<0.0001	755	28.6	12076	32.5	0.0302
	10-13	1513	35.6	12250	33.2		1125	37.9	12638	33.0	
	14-17	1795	39.7	13789	33.8		1034	33.5	14550	34.5	
Sex	Male	2743	64.7	18953	48.9	<0.0001	2035	68.8	19661	49.1	<0.0001
	Female	1516	35.3	18966	51.1		879	31.2	19603	50.9	
Race & Ethnicity	Hispanic	356	12.8	4840	23.4	<0.0001	231	10.9	4965	23.2	<0.0001
	Non-Hispanic White	3227	69.0	26176	53.6		2207	69.1	27196	54.1	
	Non-Hispanic Black	324	11.6	3549	14.4		235	13.3	3638	14.2	
	Non-Hispanic/Multiracial	352	6.6	33354	8.6		241	6.7	3465	8.5	
Exposure to secondhand smoke at home	No one smokes in household	2895	67.3	29633	76.5	<0.0001	1966	67.2	30562	76.2	<0.0001
	Someone smokes, but not inside	958	21.9	6355	18.1		670	21.8	6643	18.2	
	Someone smokes inside	406	10.8	1931	5.4		278	11.0	2059	5.6	
Current insurance type	Public	1552	45.6	8814	33.2	<0.0001	1070	45.6	9296	33.6	<0.0001
	Private	2623	51.4	27327	61.0		1786	51.4	28164	60.7	
	None	84	3.0	1778	5.8		58	3.0	1804	5.7	
Mother											
Age at delivery (years)	≤30	2135	59.8	19656	40.2	0.4565	1405	36.9	20386	40.3	0.0849
	>30	2124	40.2	18263	59.8		1509	63.1	18878	59.7	
Education level	<High school	301	11.8	2722	14.3	0.0988	209	10.8	2814	14.3	0.0015
	High School	827	23.0	6629	20.9		605	26.1	6851	20.7	
	>High school	3131	65.2	28568	64.8		2100	63.1	29599	65.0	

*Weighted percent

P-value from the Rao-Scott chi-square test

ADHD=attention deficit hyperactivity disorder

Table 2. Association between preterm birth and maternal report of medication use in the past 12 months for difficulties with ECB among children aged 6-17 years, NSCH 2011-2012

Characteristic		Unadjusted		Adjusted		Male Adjusted		Female Adjusted	
Child		**cOR**	**95% CI**	**aOR***	**95% CI**	**aOR^**	**95% CI**	**aOR^**	**95% CI**
Gestational Age	Preterm (<37 weeks)	1.41	1.17-1.71	1.37	1.13-1.66	1.53	1.21-1.96	1.11	0.81-1.52
	Full Term (37+ weeks)	Ref		Ref		Ref		Ref	
Age group (years)	6-9	0.70	0.58-0.83	0.70	0.59-0.84	0.74	0.59-0.93	0.61	0.46-0.81
	10-13 (REF)	Ref		Ref		Ref		Ref	
	14-17	1.10	0.93-1.29	1.14	0.96-1.34	0.90	0.73-1.11	1.62	1.24-2.10
Sex	Male	1.92	1.66-2.22	1.96	1.70-2.26				
	Female (REF)	Ref		Ref					
Race & Ethnicity	Hispanic	0.43	0.33-0.55	0.36	0.27-0.49	0.40	0.28-0.57	0.30	0.20-0.45
	Non-Hispanic White (REF)	Ref		Ref		Ref		Ref	
	Non-Hispanic Black	0.63	0.50-0.79	0.48	0.38-0.60	0.59	0.44-0.78	0.33	0.22-0.50
	Non-Hispanic/Multiracial	0.60	0.47-0.75	0.53	0.41-0.67	0.54	0.40-0.73	0.51	0.35-0.75
Exposure to secondhand smoke at home	No one smokes in household (REF)	Ref		Ref		Ref		Ref	
	Someone smokes, but not inside	1.38	1.17-1.62	1.15	0.98-1.36	1.08	0.87-1.34	1.28	0.98-1.65
	Someone smokes inside	2.28	1.81-2.86	1.69	1.32-2.17	1.80	1.29-2.50	1.54	1.07-2.21
Current insurance type	Public	1.63	1.41-1.88	2.30	1.93-2.74	2.41	1.97-2.96	2.13	1.64-2.77
	Private (REF)	Ref		Ref		Ref		Ref	
	None	0.61	0.37-0.98	0.77	0.47-1.27	0.73	0.39-1.39	0.85	0.40-1.81
Mother									
Age at delivery (years)	≤30	0.95	0.82-1.09	1.02	0.88-1.19	0.94	0.78-1.13	1.18	0.93-1.50
	>30 (REF)	Ref		Ref		Ref		Ref	
Education level	<High school	0.75	0.57-0.99	0.90	0.67-1.20	1.00	0.69-1.46	0.69	0.45-1.05
	High School (REF)	Ref		Ref		Ref		Ref	
	>High school	0.91	0.77-1.08	1.13	0.94-1.35	1.05	0.83-1.31	1.27	0.96-1.68

cOR=Crude/unadjusted Odds Ratio; aOR=Adjusted Odds Ratio; CI=Confidence Interval

*Each variable is adjusted for all other variables in the table

^Adjusted for all other variables in the table except gender

Table 3. Association between preterm birth and maternal report of current medication use for ADD/ADHD among children aged 6-17 years, NSCH 2011-2012

Characteristic		Unadjusted		Adjusted		Male Adjusted		Female Adjusted	
Child		**cOR**	**95% CI**	**aOR***	**95% CI**	**aOR^**	**95% CI**	**aOR^**	**95% CI**
Gestational Age	Preterm (<37 weeks)	1.45	1.16-1.80	1.38	1.10-1.72	1.68	1.28-2.19	0.85	0.59-1.22
	Full Term (37+ weeks)	Ref		Ref		Ref		Ref	
Age group (years)	6-9	0.77	0.64-0.94	0.78	0.64-0.95	0.85	0.67-1.09	0.64	0.46-0.88
	10-13 (REF)	Ref		Ref		Ref		Ref	
	14-17	0.85	0.70-1.03	0.87	0.71-1.06	0.82	0.65-1.03	0.96	0.67-1.37
Sex	Male	2.29	1.92-2.74	2.32	1.95-2.77				
	Female (REF)	Ref		Ref					
Race & Ethnicity	Hispanic	0.37	0.27-0.50	0.31	0.22-0.43	0.37	0.25-0.55	0.18	0.11-0.29
	Non-Hispanic White (REF)	Ref		Ref		Ref		Ref	
	Non-Hispanic Black	0.74	0.57-0.95	0.56	0.43-0.74	0.67	0.49-0.92	0.39	0.23-0.66
	Non-Hispanic/Multiracial	0.62	0.47-0.81	0.55	0.42-0.72	0.57	0.41-0.79	0.51	0.31-0.83
Exposure to secondhand smoke at home	No one smokes in household (REF)	Ref		Ref		Ref		Ref	
	Someone smokes, but not inside	1.36	1.14-1.62	1.09	0.90-1.32	1.09	0.87-1.37	1.10	0.79-1.51
	Someone smokes inside	2.25	1.71-2.95	1.61	1.20-2.16	1.64	1.13-2.37	1.57	1.00-2.47
Current insurance type	Public	1.60	1.36-1.89	2.05	1.67-2.51	2.23	1.79-2.79	1.72	1.22-2.44
	Private (REF)	Ref		Ref		Ref		Ref	
	None	0.62	0.35-1.10	0.77	0.43-1.37	0.75	0.33-1.58	0.86	0.39-1.90
Mother									
Age at delivery (years)	≤30	0.87	0.73-1.02	0.93	0.78-1.12	0.89	0.72-1.10	1.03	0.75-1.40
	>30 (REF)	Ref		Ref		Ref		Ref	
Education level	<High school	0.60	0.45-0.81	0.76	0.55-1.05	0.86	0.58-1.27	0.54	0.31-0.93
	High School (REF)	Ref		Ref		Ref		Ref	
	>High school	0.77	0.64-0.93	0.91	0.74-1.12	0.90	0.70-1.15	0.94	0.66-1.32

cOR=Crude/unadjusted Odds Ratio; aOR=Adjusted Odds Ratio; CI=Confidence Interval

*Each variable is adjusted for all other variables in the table

^Adjusted for all other variables in the table except gender

ADHD=attention deficit hyperactivity disorder

Appendix Table A. Pharmacological agents labeled to treat ADHD with associated brand and generic names and minimum recommended age for use.*

Pharmacological agent		**Minimum Recommended Age (years)**
Brand name	Generic name	
Evekeo	Amphetamine	3
Adderall, Adderall XR	Amphetamine/Dextroamphetamine	6
Strattera	Atomoxetine	6
Kapvay, Catapres, Duraclon,	Clonidine	
Focalin, Focalin XR	Dexmethylphenidate	6
Zenzedi, Dextrostat, Dexedrine, ProCentra,	Dextroamphetamine	6
Tenex, Intuniv	Guanfacine	6
Haldol	Haloperidol	3
Vyvanse	Lisdexamfetamine	6
Desoxyn	Methamphetamine	6
Ritalin, Methylin, Ritalin SR, Metadate ER, Methylin ER, Concerta, Metadate CR, Ritalin LA, Aptensio XR, Quillivant XR, Daytrana	Methylphenidate	3

*Source: Clinical Pharmacology. 2015. Drugs indicated for attention-deficit hyperactivity disorder (ADHD). Tampa, FL: Gold Standard, Inc.
Available at: http://www.clinicalpharmacology-ip.com Accessed 06/23/2015.

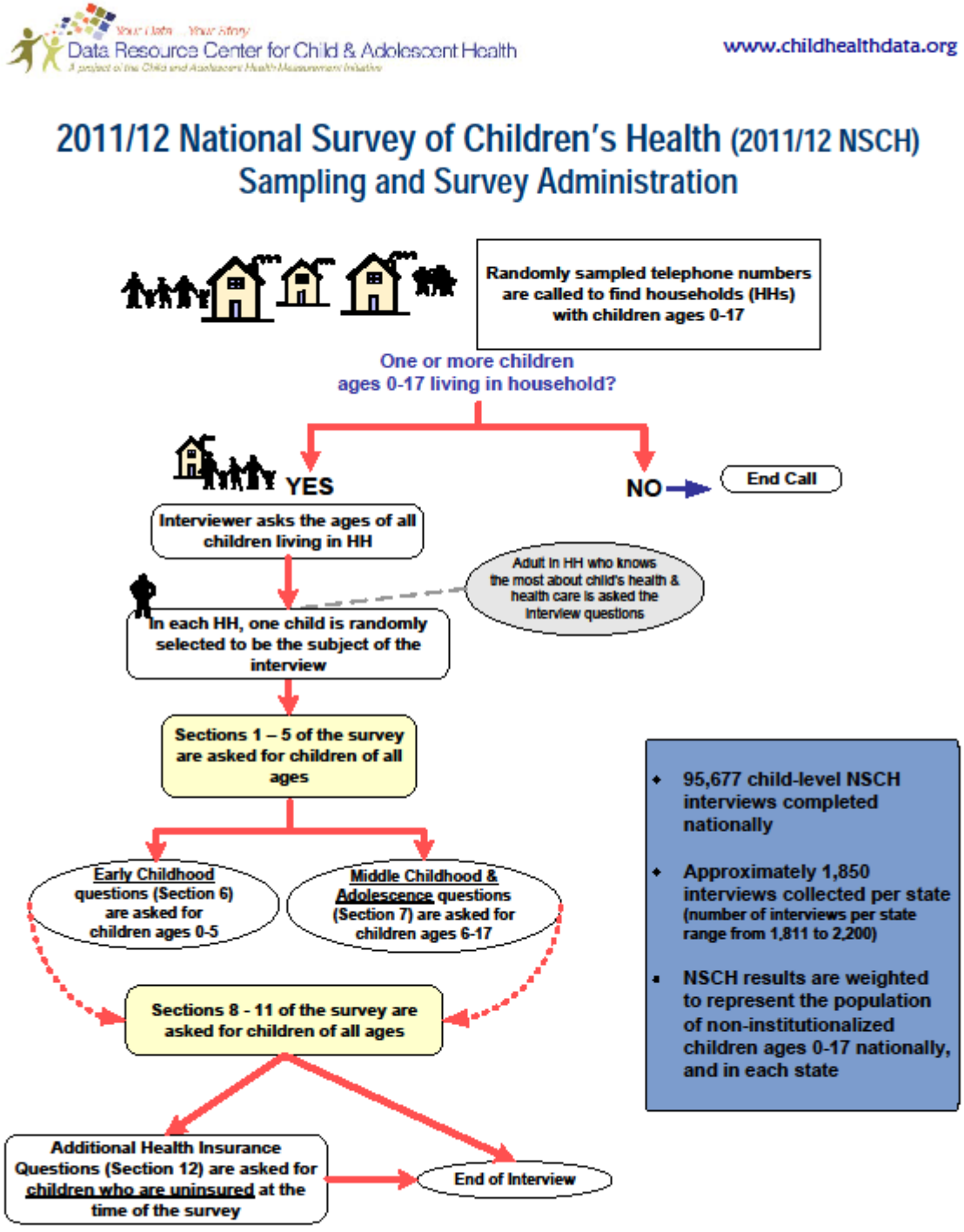
Appendix Figure A. Updated Black Box warning for the increased risk of suicidality with the use of antidepressants in children, adolescents, and adults.

Suicidality and Antidepressant Drugs

Antidepressants increased the risk compared to placebo of suicidal thinking and behavior (suicidality) in children, adolescents, and young adults in short-term studies of major depressive disorder (MDD) and other psychiatric disorders. Anyone considering the use of [Insert established name] or any other antidepressant in a child, adolescent, or young adult must balance this risk with the clinical need. Short-term studies did not show an increase in the risk of suicidality with antidepressants compared to placebo in adults beyond age 24; there was a reduction in risk with antidepressants compared to placebo in adults aged 65 and older. Depression and certain other psychiatric disorders are themselves associated with increases in the risk of suicide. Patients of all ages who are started on antidepressant therapy should be monitored appropriately and observed closely for clinical worsening, suicidality, or unusual changes in behavior. Families and caregivers should be advised of the need for close observation and communication with the prescriber. [Insert Drug Name] is not approved for use in pediatric patients. [The previous sentence would be replaced with the sentence, below, for the following drugs: Prozac: Prozac is approved for use in pediatric patients with MDD and obsessive compulsive disorder (OCD). Zoloft: Zoloft is not approved for use in pediatric patients except for patients with obsessive compulsive disorder (OCD). Fluvoxamine: Fluvoxamine is not approved for use in pediatric patients except for patients with obsessive compulsive disorder (OCD).] (See Warnings: Clinical Worsening and Suicide Risk, Precautions: Information for Patients, and Precautions: Pediatric Use)

*Source: Food and Drug Administration. 2014. Antidepressant use in children, adolescents, and adults: revisions to product labeling. Available at: http://www.fda.gov/downloads/Drugs/DrugSafety/InformationbyDrugClass/UCM173233.pdf Accessed 07/03/2015

Appendix Figure B – NSCH sampling methods and procedures



Appendix I NSCH Weighting and Variance Estimation

Weighting

Each record in the 2011-2012 NSCH public release dataset is assigned a single sampling weight (NSCHWT). Case weighting begins with a base weight which accounts for the probability of selection of each telephone number from among others in its bank of numbers. The base weights are then adjusted for non-resolution of telephone lines, non-residential lines, non-response, sub-sampling by age eligibility, multiple telephone lines, and non-coverage of children in households with no land line.

Finally, a raking adjustment is used to match each state's weighted survey responses to selected demographic characteristics of the state's population of non-institutionalized children age 17 and younger. State population counts were obtained from the 2011 American Community Survey (ACS). Counts of children by Metropolitan Statistical Area or non-MSA, age, gender, race, and ethnicity were used in the raking adjustment. Additional information can be found in an FAQ document released by the National Center for Health Statistics
ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/slaits/nsch_2011_2012/01_Frequently_asked_questions/NSCH_2011_2012_FAQs.pdf

Variance Estimation

Use of statistical software with the capacity to take into account the complex sampling design of the survey is necessary to appropriately calculate the variances and associated standard errors and confidence intervals required for accurate statistical hypothesis testing. Computer programs capable of variance estimation for complex sample designs include SUDAAN, SAS V 9.0+, STATA, WesVar, and SAS Complex Samples. A 1-stage sampling plan should be set up using STATE and SAMPLE variables as strata, IDNUMR as the cluster and NSCHWT as the weight.

The NSCH is designed to provide independent data results for each of the 50 states and the District of Columbia. Subsetting the survey data to a particular state does not compromise the design structure of the survey. However, subsetting to any other population subgroup (e.g., age group, race/ethnicity, or income) within or across states will lead to incorrect standard error estimation, even if complex samples statistical software is used. To avoid this problem, use a subpopulation procedure that allows for the targeting of specific subpopulations for analysis while retaining the full sample design information, such as SUDAAN's SUBPOPN option.

The only substate geographic information included in the NSCH public use data set is a variable for Metropolitan Statistical Area (MSA) status. The MSA status information is available for the 35 states in which the population is at least 500,000 in both categories (MSA and non-MSA). Zip code data is collected with the NSCH; however, this information is not released in the public use data set due to confidentiality restrictions. Confidential data from the survey are managed by the Research Data Center of the NSCH; information on how to access these data may be found on the RDC web page, http://www.cdc.gov/rdc/ .

*Source: 2011/12 National Survey of Children's Health. Child and Adolescent Health Measurement Initiative (CAHMI), "2011-2012 NSCH: Child Health Indicator and Subgroups SAS Codebook, Version 1.0" 2013, Data Resource Center for Child and Adolescent Health, sponsored by the Maternal and Child Health Bureau. www.childhealthdata.org .

```
libname nsch 'h://';
libname library 'h://';
run;

*START CLEANING*;
data nsch.variables_formatted;
set nsch.nsch2011_12_drc_formatted;
*medication use*;
adhdmed = .;
if K2Q31D = 1 then adhdmed =1;
if K2Q31D = 0 then adhdmed =0;
if K2Q31B = 0 then adhdmed =0;
if K2Q31A = 0 then adhdmed =0;
if K2Q31A in (6,7,.M)or K2Q31B in (6,7,.M) or K2Q31D in (6,7,.M) then adhdmed
= .M;
if AGEYR_CHILD < 6 then adhdmed = .L;
label adhdmed = " Indicator 2.7: How many children currently have ADD/ADHD
and take medication for this
condition?, age 6-17";

adhdbehavmed = .;
if K4Q23 in (6,7,.M) then adhdbehavmed = .M;
if K4Q23 = 0 then adhdbehavmed = 0;
if K4Q23 = 1 then adhdbehavmed = 1;
if K2Q31D = 1 then adhdbehavmed = 1;
if AGEYR_CHILD < 6 then adhdbehavmed = .L;
label adhdbehavmed = "Indicator 2.9: Is child currently taking any meds for
problems with emotions, concentration
or behavior?, age 6-17";

*smoking*;
insmoke = .;
if K9Q40 = 0 then insmoke = 1;
if K9q40 = 1 and K9Q41 = 0 then insmoke = 2;
if K9Q40 = 1 and K9Q41 = 1 then insmoke = 3;
if K9Q40 = 1 and K9Q41 in (6,7) then insmoke = .M;
if K9Q40 in (6,7,.M,.P) or K9Q41 in (6,.M,.P) then insmoke = .M;
label insmoke = "Indicator 6.4a: Whether tobacco smoker lives in household
and, if so, exposure to
secondhand smoke inside home";

premat = K2Q05;
if K2Q05 in (6,7,.M) then premat = .M;
if k2q05 = . then premat = .M;
label premat = "Indicator 1.7: Child was born premature, more than 3 weeks
before due date";

lowweight = .;
if 0 < = K2Q04R < = 53 then lowweight = 1;
if 54 < = K2Q04R < = 88 then lowweight = 2;
if 89 < = K2Q04R < = 163 then lowweight = 3;
if K2Q04R = .M then lowweight = .M;
label lowweight = "Indicator 1.8a: Child's birth weight, converted into
pounds";
```

```
instype = .;
if K3Q01 in (1,6,7) and K3Q02 = 1 then instype = 1;
if K3Q01 = 1 and K3Q02 = 0 then instype = 2;
if K3Q01 = 0 then instype = 3;
else if instype not in (1,2,3) then instype = .M;
label instype = "Indicator 3.3: Type of insurance coverage";
run;

*flowchart numbers*;
data flowchart;
set nsch.variables_formatted;
if ageyr_child in (6,7,8,9,10,11,12,13,14,15,16,17);
run;

data flowchart1;
set flowchart;
if relation=1;
run;
*end flowchart numbers*;

*restrict to study subjects only*;
data nsch.sample_formatted;
set nsch.variables_formatted;
if relation=1 and ageyr_child in (6,7,8,9,10,11,12,13,14,15,16,17);
run;

*categorize child and mom age, change race to include hispanic*;
data nsch.sample;
set nsch.sample_formatted;
gender=.;
if sex = 1 then gender = 1;
else if sex = 2 then gender = 0;
momeduc=.;
if educ_momr = 1 then momeduc = 1;
else if educ_momr = 2 then momeduc = 2;
else if educ_momr = 3 then momeduc = 3;
race = .;
if HISPANIC = 0 and RACER = 1 then race = 2;
if HISPANIC = 0 and RACER = 2 then race = 3;
if HISPANIC = 0 and RACER = 3 then race = 4;
if HISPANIC = 1 then race = 1;
if race = . then race = .M;
label race = "Race and ethnicity of child";
childage_cat = .;
if  (6<=ageyr_child<10) then childage_cat = 1;
else if (10<=ageyr_child<14) then childage_cat = 2;
else if ageyr_child > 13 then childage_cat = 3;
if childage_cat = . then childage_cat = .M;
momage_birth = k9q16r-ageyr_child;
if momage_birth<=30 then momage_cat = 0;
else if momage_birth>30 then momage_cat = 1;
if momage_cat = . then momage_cat = .M;
run;

*change 6, 7, DK, RF, etc. responses to missing*;
data sample_changemiss;
```

```
set nsch.sample;
array amiss(*) premat childage_cat momage_cat race gender momeduc insmoke
lowweight instype adhdmed adhdbehavmed;
do i = 1 to dim(amiss);
if amiss(i) in (6 96 996 9996 7 97 997 9997 .L .M .N .P .A) then amiss(i) =
.;
end;
run;

*delete missing values*;
data nsch.sample_nomiss;
set sample_changemiss;
if premat =. then delete;
if childage_cat =. then delete;
if momage_cat =. then delete;
if race =. then delete;
if gender =. then delete;
if momeduc =. then delete;
if lowweight =. then delete;
if insmoke =. then delete;
if instype = . then delete;
if adhdmed = . then delete;
if adhdbehavmed = . then delete;
run;
*END CLEANING*;

*////////////////////////////*;

*START SURVEYFREQ*;
*table 1*;
*prevalence of outcome and exposure*;
proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
tables premat adhdbehavmed adhdmed/ cl chisq row;
run;

*prevalence of preterm birth by medication use status*;
proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
tables premat*(adhdbehavmed adhdmed)/ cl chisq col;
run;

*prevalence of medication use by gender*;
proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
tables gender*(adhdbehavmed adhdmed)/ cl chisq row;
run;

proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
```

```
weight nschwt;
tables adhdbehavmed*(premat gender race childage_cat momage_cat momeduc
insmoke instype)/cl chisq row;
run;

proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
tables adhdmed*(premat gender race childage_cat momage_cat momeduc insmoke
instype)/cl chisq row;
run;
*END SURVEYFREQ*;

*/////////////////////////////////////////*;
*START SURVEYLOGISTIC*;
*test for correlation*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype/corrb expb;
run;

*assess interaction with single variable*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat gender premat*gender/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat race premat*race/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat childage_cat premat*childage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat momage_cat premat*momage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
```

```
class momeduc (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat momeduc premat*momeduc/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class insmoke (ref='1')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat insmoke premat*insmoke/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat instype premat*instype/expb;
run;

*test interaction - backward elimination*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype premat*gender premat*race
premat*childage_cat premat*momage_cat premat*momeduc premat*insmoke
premat*instype;
run;
*remove momeduc*;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender premat*race
premat*childage_cat premat*momage_cat  premat*insmoke premat*instype;
run;
*remove race*;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')
 insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender childage_cat
momage_cat momeduc insmoke instype premat*gender
```

```
premat*childage_cat premat*momage_cat  premat*insmoke premat*instype;
run;
*remove insmoke*;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')
 instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender
premat*childage_cat premat*momage_cat  premat*instype;
run;
*remove childage_cat*;

proc surveylogistic data=nsch.sample_nomiss;
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender
 premat*momage_cat  premat*instype;
run;
*remove momage_cat*;

proc surveylogistic data=nsch.sample_nomiss;
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race  childage_cat
momeduc insmoke instype premat*gender premat*instype;
run;
*remove gender*;

proc surveylogistic data=nsch.sample_nomiss;
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat  race childage_cat
momage_cat momeduc insmoke instype premat*instype;
run;
*remove instype*;

*///////*;

*Table 2 Crude*;
*adhdbehavmed*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=premat/expb;
run;
```

```
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=gender/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=race/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=childage_cat/expb;
run;

*for trend*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=childage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=momage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class momeduc (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=momeduc/expb;
run;

*test trend*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=momeduc/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class insmoke (ref='1')/param=ref;
```

```
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=insmoke/expb;
run;

*terst trend*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=insmoke/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1')=instype/expb;
run;

*Table 2-fully adjusted*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype/expb;
run;

*test trend*;
*Table 2-fully adjusted*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype/expb;
run;

*Table 2-fully adjusted with gender interaction term*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype premat*gender;
contrast 'premat 1 vs 0 at male' premat 1 gender 0 premat*gender 1/est=exp;
contrast 'premat 1 vs 0 at female' premat 1 gender 0 premat*gender 0/est=exp;
run;
```

```
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype race*gender;
contrast 'hispanic vs white at male' race 1 0 0 gender 0 race*gender 1 0
0/est=exp;
contrast 'black vs white at male' race 0 1 0 gender 0 race*gender 0 1
0/est=exp;
contrast 'multiracial vs white at male' race 0 0 1 gender 0 race*gender 0 0
1/est=exp;
contrast 'hispanic vs white at female' race 1 0 0 gender 0 race*gender 0 0
0/est=exp;
contrast 'black vs white at female' race 0 1 0 gender 0 race*gender 0 0
0/est=exp;
contrast 'multiracial vs white at female' race 0 0 1 gender 0 race*gender 0 0
0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype childage_cat*gender;
contrast '6-9 years vs 10-13 at male' childage_cat 1 0 gender 0
childage_cat*gender 1 0/est=exp;
contrast '14-17 years vs 10-13 at male' childage_cat 0 1 gender 0
childage_cat*gender 0 1/est=exp;
contrast '6-9 years vs 10-13 at female' childage_cat 1 0 gender 0
childage_cat*gender 0 0/est=exp;
contrast '14-17 years vs 10-13 at female' childage_cat 0 1 gender 0
childage_cat*gender 0 0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype momage_cat*gender;
contrast '<=30 years vs >30 at male' momage_cat 1 gender 0 momage_cat*gender
1/est=exp;
contrast '<=30 years vs >30 at female' momage_cat 1 gender 0
momage_cat*gender 0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
```

```
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype momeduc*gender;
contrast '<HS vs HS at male' momeduc 1 0  gender 0 momeduc*gender 1
0/est=exp;
contrast '>HS vs HS at male' momeduc 0 1  gender 0 momeduc*gender 0
1/est=exp;
contrast '<HS vs HS at female' momeduc 1 0 gender 0 momeduc*gender 0
0/est=exp;
contrast '>HS vs HS at female' momeduc 0 1 gender 0 momeduc*gender 0
0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype insmoke*gender;
contrast 'some vs none at male' insmoke 1 0 gender 0 insmoke*gender 1
0/est=exp;
contrast 'inside vs none at male' insmoke 0 1 gender 0 insmoke*gender 0
1/est=exp;
contrast 'some vs none at female' insmoke 1 0 gender 0 insmoke*gender 0
0/est=exp;
contrast 'inside vs none at female' insmoke 0 1 gender 0 insmoke*gender 0
0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdbehavmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype instype*gender;
contrast 'public vs private at male' instype 1 0 gender 0 instype*gender 1
0/est=exp;
contrast 'none vs private at male' instype 0 1 gender 0 instype*gender 0
1/est=exp;
contrast 'public vs private at female' instype 1 0 gender 0 instype*gender 0
0/est=exp;
contrast 'none vs private at female' instype 0 1 gender 0 instype*gender 0
0/est=exp;
run;

*look at cell sizes*;
proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
tables adhdbehavmed*premat*gender
```

```
adhdbehavmed*race*gender
adhdbehavmed*childage_cat*gender
adhdbehavmed*momage_cat*gender
adhdbehavmed*momeduc*gender
adhdbehavmed*insmoke*gender
adhdbehavmed*instype*gender/expected;
run;

*////////ADHDMED///////////*
*test for interaction*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat gender premat*gender/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat race premat*race/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat childage_cat premat*childage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat momage_cat premat*momage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class momeduc (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat momeduc premat*momeduc/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class insmoke (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat insmoke premat*insmoke/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
```

```
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat instype premat*instype/expb;
run;

*test for interaction using backward elimination*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype premat*gender premat*race
premat*childage_cat premat*momage_cat premat*momeduc premat*insmoke
premat*instype;
run;
*remove momeduc*;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender premat*race
premat*childage_cat premat*momage_cat premat*insmoke premat*instype;
run;
*remove race*;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')
insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype premat*gender
premat*childage_cat premat*momage_cat premat*insmoke premat*instype;
run;
*remove insmoke*;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')
 instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender
premat*childage_cat premat*momage_cat  premat*instype;
run;
*remove instype*;
```

```
proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender
premat*childage_cat premat*momage_cat;
run;
*remove childage_cat*;

proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race  childage_cat
momage_cat momeduc insmoke instype premat*gender premat*momage_cat;
run;


*//////////////////*
*test correlation of variables*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype/corrb expb;
run;
*////////*;

*Table 3-crude*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=premat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=gender/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=race/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class childage_cat (ref='2')/param=ref;
stratum state sample;
```

```
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=childage_cat/expb;
run;

*for trend*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=childage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=momage_cat/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class momeduc (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=momeduc/expb;
run;

*for trend*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=momeduc/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class insmoke (ref='1')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=insmoke/expb;
run;

*for trend*;
proc surveylogistic data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1')=insmoke/expb;
run;

proc surveylogistic data=nsch.sample_nomiss;
class instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
```

```
model adhdmed (event='1')=instype/expb;
run;

*Table-3*fully adjusted*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype/expb;
run;

*Table-3 trend*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype/expb;
run;

*Table-3 fully adjusted with gender interaction term*;
proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype premat*gender;
contrast 'premat 1 vs 0 at male' premat 1 gender 0 premat*gender 1/est=exp;
contrast 'premat 1 vs 0 at female' premat 1 gender 0 premat*gender 0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype race*gender;
contrast 'hispanic vs white at male' race 1 0 0 gender 0 race*gender 1 0
0/est=exp;
contrast 'black vs white at male' race 0 1 0 gender 0 race*gender 0 1
0/est=exp;
contrast 'multiracial vs white at male' race 0 0 1 gender 0 race*gender 0 0
1/est=exp;
contrast 'hispanic vs white at female' race 1 0 0 gender 0 race*gender 0 0
0/est=exp;
contrast 'black vs white at female' race 0 1 0 gender 0 race*gender 0 0
0/est=exp;
contrast 'multiracial vs white at female' race 0 0 1 gender 0 race*gender 0 0
0/est=exp;
```

```
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype childage_cat*gender;
contrast '6-9 years vs 10-13 at male' childage_cat 1 0 gender 0
childage_cat*gender 1 0/est=exp;
contrast '14-17 years vs 10-13 at male' childage_cat 0 1 gender 0
childage_cat*gender 0 1/est=exp;
contrast '6-9 years vs 10-13 at female' childage_cat 1 0 gender 0
childage_cat*gender 0 0/est=exp;
contrast '14-17 years vs 10-13 at female' childage_cat 0 1 gender 0
childage_cat*gender 0 0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype momage_cat*gender;
contrast '<=30 years vs >30 at male' momage_cat 1 gender 0 momage_cat*gender
1/est=exp;
contrast '<=30 years vs >30 at female' momage_cat 1 gender 0
momage_cat*gender 0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype momeduc*gender;
contrast '<HS vs HS at male' momeduc 1 0  gender 0 momeduc*gender 1
0/est=exp;
contrast '>HS vs HS at male' momeduc 0 1  gender 0 momeduc*gender 0
1/est=exp;
contrast '<HS vs HS at female' momeduc 1 0 gender 0 momeduc*gender 0
0/est=exp;
contrast '>HS vs HS at female' momeduc 0 1 gender 0 momeduc*gender 0
0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
```

```
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype insmoke*gender;
contrast 'some vs none at male' insmoke 1 0 gender 0 insmoke*gender 1
0/est=exp;
contrast 'inside vs none at male' insmoke 0 1 gender 0 insmoke*gender 0
1/est=exp;
contrast 'some vs none at female' insmoke 1 0 gender 0 insmoke*gender 0
0/est=exp;
contrast 'inside vs none at female' insmoke 0 1 gender 0 insmoke*gender 0
0/est=exp;
run;

proc surveylogistic data=nsch.sample_nomiss;
class race (ref='2') childage_cat (ref='2')
momeduc (ref='2') insmoke (ref='1') instype (ref='2')/param=ref;
stratum state sample;
cluster idnumr;
weight nschwt;
model adhdmed (event='1') = premat gender race childage_cat
momage_cat momeduc insmoke instype instype*gender;
contrast 'public vs private at male' instype 1 0 gender 0 instype*gender 1
0/est=exp;
contrast 'none vs private at male' instype 0 1 gender 0 instype*gender 0
1/est=exp;
contrast 'public vs private at female' instype 1 0 gender 0 instype*gender 0
0/est=exp;
contrast 'none vs private at female' instype 0 1 gender 0 instype*gender 0
0/est=exp;
run;

*look at cell sizes*;
proc surveyfreq data=nsch.sample_nomiss;
stratum state sample;
cluster idnumr;
weight nschwt;
tables adhdmed*premat*gender
adhdmed*race*gender
adhdmed*childage_cat*gender
adhdmed*momage_cat*gender
adhdmed*momeduc*gender
adhdmed*insmoke*gender
adhdmed*instype*gender/expected;
run;
```

Appendix III 2011/2012 NSCH Topics and Survey Questions

Data Resource Center for Child & Adolescent Health

Guide to Topics & Questions Asked

National Survey of Children Health 2011/12

Telephone numbers are dialed at random to identify households with one or more children under 18 years old. If more than one child is identified, one is chosen at random and the interviewer asks to speak to the parent or guardian who knows the most about the child's health and health care. If he or she is not available, multiple call back attempts are made to reach them.

**Denotes that original version of the variable is not released publicly. Variable may be recoded or omitted in public use data files.

CLICK on the question numbers in blue text below to view the full text of the question and its response options.

SECTION 1: Initial Demographics

Child's sex (K1Q01)

- Respondent's relationship to the child (K1Q02)**
- What is the primary language spoken in your home? (K1Q03)**

SECTION 2: Child's Health and Functional Status Information

- In general, how would you describe [CHILD'S NAME]'s health? (K2Q01)
- How would you describe the condition of [CHILD'S NAME] teeth? (K2Q01_D)
- How tall is [CHILD'S NAME] now? (K2Q02)
- How much does [CHILD'S NAME] weigh now? (K2Q03)
- What was [CHILD'S NAME]'s birth weight? (K2Q04) *(children ages 0-5 years only)*
- Was [CHILD'S NAME] born premature? (K2Q05) *(children ages 0-5 years only)*
- Does [CHILD'S NAME] currently need or use medicine prescribed by a doctor, other than vitamins? (K2Q10, K2Q11, K2Q12)
- Does [CHILD'S NAME] need or use more medical care, mental health or educational services than is usual for most children of the same age? (K2Q13, K2Q14, K2Q15)
- Is [CHILD'S NAME] limited or prevented in any way in [his/her] ability to do the things most children of the same age can do? (K2Q16, K2Q17, K2Q18)
- Does [CHILD'S NAME] need or get special therapy, such as physical, occupational, or speech therapy? (K2Q19, K2Q20, K2Q21)
- Does [CHILD'S NAME] have any kind of emotional, developmental, or behavioral problem for which he/she needs treatment or counseling? (K2Q22, K2Q23)

<u>If YES to any of the items (K2Q10-K2Q23) above, two follow up questions are asked:</u>

  - Is this because of a medical, behavioral, or other health condition?
  - Has this condition lasted or expected to last for 12 months or longer?

For each condition, please tell me if a doctor or other health care provider ever told you that [CHILD'S NAME] had the condition, even if [he/she] does not have the condition now. Has a doctor or health professional ever told you that [CHILD'S NAME] has any of the following conditions?

**The following list is applicable for ages 3-17 years only*

- Learning disability (K2Q30A,K2Q30B,K2Q30C)

**The following list is applicable for ages 2-17 years only*

- Attention Deficit Disorder or Attention Deficit Hyperactive Disorder, that is ADD or ADHD* (K2Q31A-C)
- Depression (K2Q32A-C)
- Anxiety problems (K2Q33A-C)
- Behavior or conduct problems (K2Q34A-C)
- Autism, Asperger's Disorder, pervasive developmental disorder, or other autism spectrum disorder (K2Q35A-C)
- Any developmental delay that affects [his/her] ability to learn (K2Q36A-C)
- Intellectual disability or mental retardation (K2Q60A-C)
- Cerebral Palsy (K2Q61A-C)
    - How would you describe (his/her) ability to walk? (K2Q61C
- Stuttering, stammering, or other speech problems (K2Q37A-C)
- Tourette Syndrome (K2Q38A-C)

**The following list is applicable for all children (ages 0-17)*

- Asthma (K2Q40A-C)
- Diabetes (K2Q41A-C)
- Epilepsy or seizure disorder (K2Q42A-C)
- Hearing problems (K2Q43A-C)
- Vision problems that cannot be corrected with glasses or contact lenses (K2Q44A-C)
- Bone, joint, or muscle problems (K2Q45A-C)
- A brain injury or concussion (K2Q46A-C)

<u>If YES to any of the items (K2Q31A-K2Q46A) above, two follow up questions are asked:</u>

- Does [CHILD'S NAME] currently have the condition? (K2Q31B-K2Q46B)

- Would you describe [his/her] condition as mild, moderate, or severe? (K2Q31C-K2Q46C)

<u>If YES to any of the following conditions (ADD/ADHD, Depression, Anxiety Problems, Behavior/Conduct Problems, Autism or ASD, Developmental Delay, Intellectual Disability or Mental Retardation, Cerebral Palsy, Speech Problems, or Tourette Syndrome [K2Q31A, K2Q34A-K2Q43A, K2Q45A-K2Q61A], one follow up question is asked:</u>

- How old was [CHILD'S NAME] when you were first told by a doctor or other health care provider that[he/she] had [CONDITION]?

<u>If child has ever been diagnosed with Autism or ASD (K2Q35A) follow-up questions were asked:</u>

- What type of doctor or other health care provider first told you that [child's name] had Autism or ASD? (K2Q35D)
- To the best of your knowledge, did [CHILD'S NAME] ever have Autism or ASD? (K2Q35E)
    - If YES, Reasons why [CHILD'S NAME] may no longer have Autism or ASD? (K2Q35F)
        - Treatment helped condition go away
        - Condition seemed to go away on its own
        - Behaviors or symptoms changed
        - A doctor or health care provider changed the diagnosis
        - Other reason(s) (K2Q35G)**
    - If NO, Reasons why a doctor, health care provider, or school professional may have told you that [CHILD'S NAME] had a condition that [he/she] never had (K2Q35H)
        - With more information, the diagnosis changed
        - The diagnosis was given so [CHILD'S NAME] could receive needed services
        - You disagree with the doctor or other helath provider about their opinion that [CHILD'S NAME] has Autism or ASD
        - Other reason(s) (K2Q35J)**

SECTION 3: Health Insurance Coverage

- Does [CHILD'S NAME] have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid? (K3Q01)
    - If YES, [Is that coverage/ Is [he/she] insured by] Medicaid or the State Children's Health Insurance Program, S-CHIP? (K3Q02)
    - If YES, during the past 12 months, was there any time when [he/she] was not covered by ANY health insurance? (K3Q03)
    - If NO, during the past 12 months, was there any time when [he/she] had health care coverage? (K3Q04)
- The next four questions are asked for insured children only.
    - Does [CHILD'S NAME]'s health insurance offer benefits or cover services that meet [his/her] needs? (K3Q20)
    - Does [CHILD'S NAME]'s health insurance allow [him/her] to see the health care providers [he/she] needs? (K3Q22)
    - Not including health insurance premiums or costs that are covered by insurance, do you pay any money for [CHILD'S NAME]'s health care? (K3Q21A)
        - How often are these costs reasonable? (K3Q21B)
- In the past 12 months, did your family have problems paying or were unable to pay any of [CHILD'S NAME]'s medical bills? (K3Q25)
- In the past 12 months, how often have you been frustrated in your efforts to obtain health care services for [CHILD'S NAME]? (C4Q04)

SECTION 4: Health Care Access and Utilization

- Is there a place [CHILD'S NAME] usually goes when [he/she] is sick or you need advice about [his/her] health? (K4Q01)
    - Is it a doctor's office, emergency room, hospital outpatient department, clinic, or some other place? (K4Q02)
- A personal doctor or nurse is a health professional who knows your child well and is familiar with your child's health history. This can be a general doctor, a pediatrician, a

specialist doctor, a nurse practitioner, or a physician's assistant. Do you have one or more persons you think of as [CHILD'S NAME]'s personal doctor or nurse? (K4Q04)

- During the past 12 months, did [CHILD'S NAME] see a doctor, nurse, or other health care professional for any kind of medical care including sick-child care, well-child checkups, physical exams, and hospitalizations? (S4Q01)
- During the past 12 months, how many times did [CHILD's NAME] see a doctor, nurse, or other health care provider for preventive medical care such as a physical exam or well-child check-up? (K4Q20)
- During the past 12 months, did [CHILD'S NAME] see a dentist for any kind of dental care, including check-ups, dental cleanings, x-rays, or filling cavities?(K4Q30)
- During the past 12 months, how many times did [CHILD'S NAME] see a dentist for preventive dental care, such as check-ups and dental cleanings? (K4Q21)
- Mental health professionals include psychiatrists, psychologists, psychiatric nurses, and clinical social workers. During the past 12 months, has [CHILD'S NAME] received any treatment or counseling from a mental health professional? (K4Q22) *(children ages 2-17 years only)*
- During the past 12 months, has [CHILD'S NAME] taken any medication because of difficulties with [his/her] emotions, concentration, or behavior? (K4Q23) **asked only for children who are not taking medication for ADD/ADHD*
- Specialists are doctors like surgeons, heart doctors, allergy doctors, skin doctors, and others who specialize in one area of health care. During the past 12 months, did [CHILD'S NAME] see a specialist (other than a mental health professional)? (K4Q24)
    - If NO, during the past 12 months, did you or a doctor think that [he/she] needed to see a specialist? (K4Q25)
    - If YES, during the past 12 months, how much of a problem, if any, was it to get the care from the specialists that [CHILD'S NAME] needed? (K4Q26)
- Has [CHILD'S NAME] [ever (0-5 years)/in the past two years (6-17 years)] had (his/her) vision tested with pictures, shapes, or letters? (K4Q31)
    - If YES, What kind of place did [CHILD'S NAME] have (his/her) vision tested?(K4Q32)

- Sometimes people have difficulty getting health care when they need it. By health care, I mean medical care as well as other kinds of care like dental care and mental health services. During the past 12 months, was there any time when [CHILD's NAME] needed health care but it was delayed or not received? (K4Q27)
    - If YES, what type of care was delayed or not received? (K4Q28)
- Some new parents are helped by programs that send nurses, healthcare workers, social workers, or other professionals to their home to help prepare for the new baby or take care of the baby or mother. Between the time [you were (his/her) mother was] pregnant with [CHILD'S NAME] and up until the present day, did someone from such a program visit your home?(K4Q35)
    - If YES, How many different professionals came to your home? (K4Q35A)
    - If YES, Please tell me if the [the professional / any of the professionals] who visited your home talked about parental concerns about their children and families (K4Q35B)
- 14. Earlier you told me that you had been told by a doctor or other health care provider that [CHILD'S NAME] had (a condition / conditions) that affected (his/her) learning or development. Has [CHILD'S NAME] ever received therapy services to meet (his/her) developmental needs, such as Early Intervention, occupational therapy, or behavioral therapy?(K4Q36)*(children who have been diagnosed with autism/ASD or Developmental Delay only)*
    - If YES, How old was [CHILD'S NAME] when (he/she) began receiving services? (K4Q35A)
    - If YES, Is [CHILD'S NAME] currently receiving therapy services?(K4Q35B)

SECTION 5: Medical Home

- During the past 12 months, did [CHILD'S NAME] need a referral to see any doctors or receive any services? (K5Q10)
    - Was getting referrals a big problem, a small problem, or not a problem? (K5Q11)
- Does anyone help you arrange or coordinate [CHILD'S NAME]'s care among the different doctors or services that [he/she] uses? (K5Q20)**asked for children who used more than two services*

- During the past 12 months, have you felt that you could have used extra help arranging or coordinating [CHILD'S NAME]'s care among these different health care providers or services? (K5Q21) **asked for children who used more than two services*
    - If YES, during the past 12 months, how often did you get as much help as you wanted with arranging or coordinating [CHILD'S NAME]'s care? (K5Q22)**asked for children who used more than two services*
- Overall, are you very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied with the communication among [CHILD'S NAME]'s doctors and other health care providers? (K5Q30)**asked for children who used more than two services*
- Do [CHILD'S NAME]'s doctors or other health care providers need to communicate with [his/her] child care providers, school, or other programs? (K5Q31)
    - Overall, are you very satisfied, somewhat satisfied, somewhat dissatisfied, or very dissatisfied with that communication? (K5Q32)
- During the past 12 months, how often did [CHILD'S NAME]'s doctors and other health care providers spend enough time with [him/her]? (K5Q40)
- During the past 12 months, how often did [CHILD'S NAME]'s doctors and other health care providers listen carefully to you? (K5Q41)
- When [CHILD'S NAME] is seen by doctors and other health care providers, how often are they sensitive to your family's values and customs? (K5Q42)
- Information about a child's health or health care can include things such as the causes of any health problems, how to care for a child now, and what to expect in the future. During the past 12 months, how often did you get the specific information you needed from [CHILD'S NAME]'s doctors and other health care providers? (K5Q43)
- During the past 12 months, how often did [CHILD'S NAME]'s doctors or other health care providers help you feel like a partner in [his/her] care? (K5Q44)

SECTION 6: Early Childhood (0-5 years) *questions asked for children ages 0-5 years only

- Do you have any concerns about [CHILD'S NAME]'s learning, development, or behavior? (K6Q01)
- Are you concerned about how [he/she]:
    - Talks and makes speech sounds? (K6Q02) *(ages 4 months- 5 years)*

- Understands what you say? (K6Q03) *(ages 4 months- 5 years)*
- Uses [his/her] hands and fingers to do things? (K6Q04) *(ages 4 months- 5 years)*
- Uses [his/her] arms and legs? (K6Q05) *(ages 4 months- 5 years)*
- Behaves? (K6Q06) *(ages 4 months- 5 years)*
- Gets along with others? (K6Q07) *(ages 4 months- 5 years)*
- Is learning to do things for [himself/herself]? (K6Q08) *(ages 10 months- 5 years)*
- Is learning pre-school or school skills? (K6Q09) *(ages 18 months- 5 years)*

- During the past 12 months did [CHILD'S NAME]'s doctors or other health care providers ask you if you have concerns about [his/her] learning, development, or behavior? (K6Q10)
- Sometimes a child's doctor or other health care providers will ask parent to fill out a questionnaire at home or during their child's visit. During the past 12 months, did a doctor or other health care provider have you fill out a questionnaire about specific concerns or observations you may have about [CHILD'S NAME]'s development, communication, or social behaviors? (K6Q12) *(ages 10 months to 5 years only*)
    - Did this questionnaire ask about your concern or observations about how [CHILD'S NAME] talks or makes speech sounds? (K6Q13A) *(ages 10-23 months only)*
    - Did this questionnaire ask you about how [CHILD'S NAME] interacts with you or others? (K6Q13B) *(ages 10-23 months only)*
    - Did this questionnaire ask about your concern or observations about words and phrases [CHILD'S NAME] uses and understands? (K6Q14A) *(ages 24-71 months only)*
    - Did this questionnaire ask about your concern or observations about how [CHILD'S NAME] behaves and gets along with you and others? (K6Q14B) *(ages 24-71 months only)*
- Does [CHILD'S NAME] have any developmental problems for which [he/she] has a written intervention plan called an Individual Family Services Plan (IFSP) or Individualized Education Program (IEP)? (K6Q15)

- Does [CHILD'S NAME] receive care for at least 10 hours per week from someone not related to [him/her]? This could be a day care center, preschool, Head Start program, nanny, au pair, or any other non-relative. (K6Q20)
- During the past month, did you or anyone in the family have to quit job, not take a job, or greatly change your job because of problems with child care for [CHILD'S NAME]? (K6Q27)
- Was [CHILD'S NAME] ever breastfed or fed breast milk? (K6Q40)
    - If YES, how old was [CHILD'S NAME] when [he/she] completely stopped breastfeeding or being fed breast milk? (K6Q41)
    - If YES, how old was [CHILD'S NAME] when [he/she] was first fed formula? (K6Q42)
    - This next question is about the first thing [CHILD'S NAME] was given other than breast milk or formula. Please include juice, cow's milk, sugar water, baby food, or anything else that [CHILD'S NAME]'s might have been given, even water. How old was [CHILD's NAME] when [he/she] was first fed anything other than breast milk or formula? (K6Q43)

I am going to read a list of items that sometimes describe children. For each item, please tell me how often this was true for [CHILD'S NAME] during the past month. Would you say never, rarely, sometimes, usually, or always?*(ages 6 months- 5 years)*

- [He/She] is affectionate and tender with you.(K6Q70)
- [He/She] bounces back quickly when things don't go his/her way. (K6Q73)
- [He/She] shows interest and curiosity in learning new things. (K6Q71)
- [He/She] smiles and laughs a lot. (K6Q72)

- On an average weekday, about how much time does [CHILD'S NAME] usually spend in front of a TV watching TV programs, videos or playing video games? (K6Q65A)
- On an average weekday, about how much time does [CHILD'S NAME] usually spend with computers, cell phones, handheld video games, and other electronic devices? (K6Q65B)
- During the past week, how many days did you or other family members read to [CHILD'S NAME] ? (K6Q60)

- During the past week, how many days did you or other family members tell stories or sing songs to [CHILD'S NAME]? (K6Q61)
- During the past week, how many days did [CHILD'S NAME] play with other children [his/her] age? (K6Q63)
- During the past week, how many days did you or any family member take [CHILD'S NAME] on any kind of outing, such as to the park, library, zoo, shopping, church, restaurants, or family gatherings? (K6Q64)

SECTION 7: Middle Childhood and Adolescence (6-17 years) *questions asked for children ages 6-17 years only

- What kind of school is [CHILD'S NAME] currently enrolled in? (K7Q01)
    - If NOT ENROLLED, at any time during the past 12 months, was [CHILD'S NAME] enrolled in a public school, a private school, or home school? (K7Q01F)
- During the past 12 months, about how many days did [CHILD'S NAME] miss school because of illness or injury? (K7Q02)
- During the past 12 months, how many days has [CHILD'S NAME]'s school contacted you or another adult in your household about any problem [he/she] is having with school? (K7Q04)
- Since starting kindergarten, has [he/she] repeated any grades? (K7Q05)
    - If YES, Which grade or grades did he/she repeat? (K7Q05_A)
- Does [CHILD'S NAME] have a health problem, condition, or disability for which [he/she] has a written intervention plan called an Individualized Education Program or IEP? (K7Q11)
- During the past 12 months, was [CHILD'S NAME] on a sport team or did [he/she] take sports lessons after school or on weekends? (K7Q30)
- During the past 12 months, did [CHILD'S NAME] participate in any clubs or organizations after school or on weekends? (K7Q31)
    - If NO, during the past 12 months, did [he/she] participate in any other organized events or activities? (K7Q32)
- During the past 12 months, how often did you attend events or activities that [CHILD'S NAME] participated in? Would you say never, sometimes, usually or always? (K7Q33)

**asked for children who participated in one or more extracurricular activities (K7Q30-K7Q32)*

- Regarding [CHILD'S NAME]'s friends, would you say that you have met all, most, some, or none of [his/her] friends? (K7Q34)
- During the past 12 months, how often has [CHILD'S NAME] been involved in any type of community service or volunteer work at school, church, or in the community? Would you say once a week or more, a few times a month, a few times a year, or never? (K7Q37) **chidlren age 12-17 years only*
- During the past week, did [CHILD'S NAME] earn money from any work, including regular jobs as well as babysitting, cutting grass or other occasional work? (K7Q38) **chidlren age 12-17 years only*
    - If YES, during the past week, how many hours did [CHILD'S NAME] work for pay? (K7Q39)
- During the past week, on how many nights did [CHILD'S NAME] get enough sleep for a child [his/her] age? (K7Q40)
- During the past week, on how many days did [CHILD'S NAME] exercise, play a sport, or participate in physical activity for at least 20 minutes that made [him/her] sweat and breathe hard? (K7Q41)
- On an average weekday, about how much time does [CHILD'S NAME] usually spend reading for pleasure? (K7Q50)
- On an average weekday, about how much time does [CHILD'S NAME] usually spend in front of a TV watching TV programs, videos or playing video games? (K7Q60A)
- On an average weekday, about how much time does [CHILD'S NAME] usually spend with computers, cell phones, handheld video games, and other electronic devices, doing things other than schoolwork? (K7Q60B)
- Do you monitor the content of what [CHILD'S NAME] watches on TV, plays on the computer, or does on electronic devices? (K7Q61A)
- Do you limit the amount of time [CHILD'S NAME] spends watching TV, playing on the computer, or using electronic devices? (K7Q62)

<u>I am going to read a list of items that sometimes describe children. For each item, please tell me how often this is true for [CHILD'S NAME] during the past month:</u>

- [He/She] argues too much. (K7Q70)
- [He/She] bullies or is cruel or mean to others. (K7Q71)
- [He/She] is unhappy, sad, or depressed. (K7Q79)
- [He/She] cares about doing well in school. (K7Q82)
- [He/She] does all required homework. (K7Q83)
- [He/She] finishes the tasks he/she starts and follows through with what he/she says he'll/she'll do. (K7Q84)
- [He/She] stays calm and in control when faced with a challenge. (K7Q85)
- [He/She] shows interest and curiosity in learning new things. (K7Q86)

SECTION 8: Family Functioning

- About how often does [CHILD'S NAME] attend a religious service? (K8Q12)
- During the past week, how many days did all the family members who live in the household eat a meal together? (K8Q11)
- How well can you and [CHILD'S NAME] share ideas or talk about things that really matter? (K8Q21) *(ages 6-17 years only)*
- In general, how well do you feel you are coping with the demands of (parenthood/raising children)? (K8Q30)
- During the past month, how often have you felt [CHILD'S NAME] is much harder to care for than most other children [his/her] age? (K8Q31)
- During the past month, how often have you felt [he/she] does things that really bother you a lot? (K8Q32)
- During the past month, how often have you felt angry with [him/her]? (K8Q34)
- Is there someone that you can turn to for day-to-day emotional help with (parenthood/raising children)? (K8Q35)

SECTION 9: Parental Health

- Including the adults and all the children, how many people live in this household? (K9Q00)**

- How old are you [MOTHER TYPE]? (K9Q16)**
- What is the age of the oldest adult living in the household? (C10Q14)**
- Would you say that your relationship is completely happy, very happy, fairly happy, or not too happy? (K9Q18)
- Would you say that, in general,([CHILD'S NAME]'s [MOTHER TYPE]/your) health is excellent, very good, good, fair, or poor? (K9Q20)
- Would you say that, in general,([CHILD'S NAME]'s [FATHER TYPE]/your) health is excellent, very good, good, fair, or poor? (K9Q21)
- Would you say that, in general,([CHILD'S NAME]'s [MOTHER TYPE]/your) mental and emotional health is excellent, very good, good, fair, or poor? (K9Q23)
- Would you say that, in general,([CHILD'S NAME]'s [FATHER TYPE]/your) mental and emotional health is excellent, very good, good, fair, or poor? (K9Q24)
- Does anyone living in your household use cigarettes, cigars, or pipe tobacco? (K9Q40)
    - Does anyone smoke inside the [CHILD'S NAME]'s home? (K9Q41)
- Since [CHILD'S NAME] was born, how often has it been very hard to get by on your family's income – hard to cover the basics like food or housing? Would you say very often, somewhat often, often, rarely, or never? (ACE1)
- Did [CHILD'S NAME] ever live with a parent or guardian who got divorced or separated after [CHILD'S NAME] was born? (ACE3)
- Did [CHILD'S NAME] ever live with a parent or guardian who died? (ACE4)
- Did [CHILD'S NAME] ever live with a parent or guardian who served time in jail or prison after [CHILD'S NAME] was born? (ACE5)
- Did [CHILD'S NAME] ever see or hear any parents or adults in (his/her) home slap, hit, kick, punch, or beat each other up? (ACE6)
- Was [CHILD'S NAME] ever the victim of violence or witness any violence in (his/her) neighborhood? (ACE7)
- Did [CHILD'S NAME] ever live with anyone who was mentally ill or suicidal, or severely depressed for more than a couple of weeks? (ACE8)

- Did [CHILD'S NAME] ever live with anyone who had a problem with alcohol or drugs? (ACE9)
- Was [CHILD'S NAME] ever treated or judged unfairly because of (his/her) race or ethnic group? (ACE10)
    - If YES, During the past year, how often was [CHILD'S NAME] treated or judged unfairly? Would you say very often, somewhat often, rarely, or never? (ACE11)
- Other than adults in your home or [CHILD'S NAME]'s parents, is there at least one other adult in [CHILD'S NAME]'s school, neighborhood, or community who knows [CHILD'S NAME] well and who (he/she) can rely on for advice or guidance? (K9Q96)*(ages 0-6 years only)*

SECTION 10: Neighborhood and Community Characteristics

- Please tell me if the following places and things are available to children in your neighborhood, even if [CHILD'S NAME] does not actually use them:
    - Sidewalks or walking paths? (K10Q11)
    - A park or playground area? (K10Q12)
    - A recreation center, community center, or boys' or girls' club? (K10Q13)
    - A library or bookmobile? (K10Q14)
- In your neighborhood, is there litter or garbage on the street or sidewalk? (K10Q20)
- How about poorly kept or dilapidated housing? (K10Q22)
- How about vandalism such as broken windows or graffiti? (K10Q23)
- Now, for the next four questions, I am going to ask you how much you agree or disagree with each of these statements about your neighborhood or community:
    - "People in my neighborhood help each other out." (K10Q30)
    - "We watch out for each other's children in this neighborhood." (K10Q31)
    - "There are people I can count on in this neighborhood." (K10Q32)
    - "If my child were outside playing and got hurt or scared, there are adults nearby who I trust to help my child."? (K10Q34)

- How often do you feel [CHILD'S NAME] is safe in your community or neighborhood? (K10Q40)
- How often do you feel [he/she] is safe at school? (K10Q41)

SECTION 11: Additional Demographics

- Is [CHILD'S NAME] of Hispanic or Latino origin? (K11Q01)
- Is [CHILD'S NAME] White, Black or African American, American Indian, Alaska Native, Asian, or Native Hawaiian, or other Pacific Islander? (K11Q02)**
    - At any time during the past 12 months, did [CHILD'S NAME] receive services from any Indian Health Service hospital or clinic? (K11Q03) **asked only for American Indian or Alaska Native children*
- What is the highest grade or year of school (you have/[CHILD'S NAME]'s [MOTHER TYPE] has) completed? (K11Q20)
- Thinking back to who you lived with when you were about 13 years old, what was the highest grade or year of school completed by your mother, father, or main guardian? If you lived with more than one parent or guardian, please tell me about the one who had the most education? (K11Q22A)**
- Was [CHILD/ CHILD'S MOTHER/ CHILD'S FATHER] born in the United States? (K11Q30)
    - How long has [CHILD/ CHILD'S MOTHER/ CHILD'S FATHER] been in the United States? (K11Q34A-K11Q37A)
- How many times has [CHILD'S NAME] ever moved to a new address? (K11Q43)
- Was anyone in the household employed at least 50 weeks out of the 52 weeks? (K11Q50)
- At any time during the past 12 months, even for one month, did anyone in this household receive any cash assistance from a state or a county welfare program? (K11Q60)
- During the past 12 months, did ([CHILD'S NAME]/any child in the household) receive Food Stamps or Supplemental Nutrition Assistance Program benefits? (K11Q61)
- During the past 12 months, did ([CHILD'S NAME]/any child in the household) receive free or reduced-cost breakfasts or lunches at school? (K11Q62)

- Does anyone who lives in the household currently receive benefits from the Women, Infants, and Children (WIC) Program? (S9Q34)