Multiple Perspectives to Analyzing the Prevalence of ADHD

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Attention deficit/hyperactivity disorder (ADHD) affects an estimated 3-7% of school-age children in the U.S., with boys being three times more likely to be diagnosed than girls (American Psychiatric Association 2005). It has been recognized as the most commonly diagnosed psychiatric disorder in children and is characterized by at least 6 months of inattention and/or hyperactivity-impulsivity that is disruptive and inappropriate with normal development (American Psychiatric Association, DSM-IV-TR 2000). Although generalized simply as ADHD, there are three subtypes that specify which of the major symptoms are predominant in the child's behavior. They are the "combined type," "predominantly inattentive type," and "predominantly hyperactive-impulsive type." In addition to ADHD itself, about half of diagnosed children referred to clinics suffer from comorbidity with oppositional defiant disorder (ODD) being the most common and conduct disorder, learning disability, and anxiety and mood disorder to a lesser extent (American Psychiatric Association 2005). Many of these conditions pose potential obstacles for patients in their interpersonal relationships and activities. Aggressive behavior in children with impulsive/hyperactive symptoms have been significantly associated with peer rejection while engaging in high-risk physical activity without thinking of the consequences have led to serious injuries and accidents (American Psychiatric Association 2005). Stimulant medication has become the standard for treating ADHD with approximately 90% of patients receiving methylphenidate (Ritalin), a drug that has been credited to improving short-term cognitive and academic performance in ADHD children (Searight and McLaren 1998). Thus, the use of methylphenidate as an indicator of the prevalence of ADHD in the U.S. would not be an overstatement (LeFever et al. 1997; Wilens and Biederman 1992).

Over the past few decades, ADHD has stood at the center of heated discussions and controversy regarding its cause, classification as a mental disorder, and the effect of diagnosis and medication on patients. What differentiates ADHD from HIV/AIDS, Down's syndrome, and most cancers that have achieved unquestionable status as an illness, is the lack of scientific tests or decisive findings that specify certain cognitive, metabolic or neurological markers as its cause (Timimi and Taylor 2004; Conrad and Potter 2000). Biological, cultural, and environmental approaches have been made to analyze the nature and origin of ADHD but none have been able to withstand inconsistencies in results or decisive enough to surpass other explanations. With no concrete way to verify or refute the diagnosis, there is a growing concern over the ethical consequences of inappropriate diagnosis, such as the overprescription of methylphenidate and long term effects of labeling on children. Along with potential side effects such as insomnia, decreased appetite, stomachaches, dizziness, irritability, anxiousness, and proneness to crying, methylphenidate also acts to enhance cognitive and motor functioning of otherwise normal children compared to ADHD children or alone (Efron, Jarman, and Barker 1997; Rapport et al. 1978, 1980). This has led to a growing concern over the improper use of ADHD diagnosis to access psychoactive medication for performance enhancement.

Previously non-medical problems that are defined and treated as if they were illnesses or disorders are called "medicalized illnesses" (Conrad and Leiter 2004). Some contested illnesses that are seeking to achieve medical status without diagnostic markers include ADHD, anorexia and eating disorders, chronic fatigue syndrome (CFS), repetition strain injury, fibromyalgia, premenstrual syndrome (PMS), post traumatic stress disorder (PTSD) and multiple chemical sensitivity disorder (MCSD). These illnesses often face difficulties as their medicalization

depends on various cultural, social, and political factors such as the medical profession, self-help and advocacy groups, legal systems, the medical marketplace, academic researchers, social movements, and the patients themselves.

Regarding the nature and etiology of ADHD, there is an overall consensus among experts that a combination of genes and the environment interact to foster or inhibit its characteristics (Campbell 2000; Rutter and Sroufe 2000; Taylor 1999; Faraone and Biederman 1998). From a scientific perspective, research has found evidence of genetic and neurological origins to the disorder (Faraone 2006; Khan and Faraone 2006, Biederman 2005; Pauls 2005; Barkley 2000). Biederman and Faraone have spearheaded this area, finding evidence for a strong heritable nature to ADHD with studies showing increased risk and higher rates of ADHD in the families of patients with ADHD (Faraone and Doyle 2001; Biederman et al 1995; Faraone and Tsuang 1995; Faraone et al. 1992). Advances in molecular genetics and neuroimaging studies suggest dopamine networks and genes that regulate dopamine transmissions to be potentially associated as well (Faraone 2006). Bobb (2005) studied the genes of 192 parents to investigate possible associations between 12 previously studied genes thought to be related to ADHD. Brain resonance imaging (MRI) results showed that two of the genes, one of which was a dopamine receptor, were indeed linked to ADHD. Although the few genome-wide scans conducted by Faraone et al. (2005), Ogdie et al. (2003) and Cook et al. (1995) were not conclusive, they were able to find certain risk genes in addition to confirming an imbalance in dopamine and norepinephrine related substances. Neuroimaging studies have identified structural brain abnormalities with smaller volumes in the frontal cortex (where dopamine activity occurs), cerebellum and subcoritcal structures amongst patients with ADHD (Castellanos et al. 2002).

Pliszka et al. (2006) used an MRI to examine areas of the cortex, known to be involved in inhibitory control and found differences in its activation between children who had been on stimulant treatment and those without ADHD.

Low birth weight and prenatal exposure to alcohol and cigarettes have also been brought up as biological risk factors associated with ADHD. Children with extremely low birth weight (<1,000g), very low birth weight (<1,500g), and low birth weight (<2,500g) were shown to have higher risk of ADHD with increased ratings by teachers for inattention, delinquency, hyperactivity, school dysfunction, and increased deficits in memory compared to full-term controls (O'Callaghan and Harvey 1997; McCormick et al. 1992; Teplin et al. 1991; McCormick, Gortmaker, and Sobol 1990; Szatmari et al. 1990; Breslau, Klein, and Allen 1988). Prenatal exposure to alcohol and cigarettes is a major confounder in this relationship because substance abuse during pregnancy reduces birth weight and subsequently increases the risk of ADHD. (Mick et al. 2002). Clark et al. (2004) found children of fathers with substance use to be at greater risk for psychopathology such as ADHD, conduct disorder and major depressive and anxiety disorders. Results showed that parental substance abuse itself did not significantly contribute to childhood psychopathology but that parents with substance use disorders typically suffered from other mental disorders which were genetically passed down to their children. In this way, biological confounders also play a major role in adding to the risk of ADHD.

Consistency in methodology is a major concern in many scientific studies because the definition, behavioral categories, type, duration and number of symptoms needed to meet the threshold for ADHD diagnosis has varied across time and are rated differently across cultures (Searight and

McLaren 1998). The Diagnostic and Statistical Manual of Mental Disorders (DSM) has been used as a common reference to match observed child behaviors to a list of diagnostic criteria. However, subsequent versions of the DSM vary in definition and also show a tendency to encompass more children with behavior problems by expanding its criteria. These have serious consequences when comparing prevalence rates across time. Comorbidity with other childhood psychiatric disorders also adds to the difficulty of diagnosis as it makes the defining features of ADHD less recognizable (Searight and McLaren 1998).

Contrary to scientific explanations, researchers that have taken a cultural approach to ADHD suggest that it is a byproduct of societies that are progressively medicalized (Conrad and Leiter 2004; Timimi and Taylor 2004). Cultural norms and stigma associated with certain behaviors, degree of medicalization achieved across countries, and alternative forms of social control available to control children have been raised to explain the nature of ADHD. Various studies have shown higher rates of ADHD diagnosed in the U.S. and Canada compared to the U.K. (Malacrida 2004) while Germany recorded an 18.7% of elementary school children with ADHD (Baumgaertel, Wolraich, and Dietrick 1995). In Italy, 3.9% of children were rated by educators with an additional 6.9% as potential cases (Gallucci et al. 1993) and a 7.7% overall prevalence rate in Japan based on parent ratings (Kanbayashi et al. 1994). Variations in cultural norms have suggested a higher prevalence of ADHD in Southern Europe where there is greater tolerance for "boisterous behavior" compared to the North (Sergeant and Steinhauser 1992). Mann et al. (1992) also found differing attitudes of parents, clinicians, and society towards acceptable behavior to influence diagnosis. An examination of Chinese, Indonesian, Japanese, and U.S. mental health professionals found significant differences in their perception of hyperactivity

even when uniform rating criteria were applied. Chinese and Indonesian clinicians gave higher scores for hyperactive disruptive behaviors over others, which may be due to greater expectations in child behavior and lower tolerance for behavioral difficulties in the two cultures.

Attitudes towards pharmacotherapy and availability of alternative forms of social control across cultures also act to influence prevalence rates. Stevens, Harman, and Kelleher (2005) examined disparities in ADHD diagnosis, stimulant usage and health care visits by age, race/ethnicity, region and type of insurance using the Medical Expenditure Panel Surveys (MEPS). They found that African-American children were less likely to be diagnosed with ADHD compared to white children and that African-American families were less likely to try treatment by taking stimulants. These findings were consistent with a study by Pastor and Reuben (2005) who used data from the National Health Interview Survey. dosReis et al. (2003) attributes these differences to the fact that African-American parents have more negative attitudes towards stimulant treatment, including serious side effects and illicit drug use. In Great Britain where there is a strong culture against dismissing childhood behavioral problems on medicalization, simply sees ADHD as an excuse for bad behavior (Malacrida 2004). While drug therapy has been fully recognized in the U.S. as a form of social control, Britain uses more traditional means such as physical discipline, expulsion or suspension (Kiger 1985). Norvilitis and Fang (2005) examined perceptions of ADHD among college students and teachers in China and the U.S. and found that although Chinese samples believed in the biological etiology of ADHD, they were more likely to view it as a failure of discipline, parenting, or lack in the child's effort compared to U.S. samples. This may explain why Chinese samples differ in the nature and treatment of ADHD, endorsing increased responsibility on teachers to instill discipline in children and offering support services

after parenting has failed. They were also less inclined to resort to psychostimulants compared to American samples due to the availability of other forms of social control (Norvilitis and Fang 2005)

Environmental approaches have heavily focused on the role of parental psychopathology, marital functioning, socioeconomic status, and parenting and parent-child interactions to contribute to ADHD (Lindahl 1998). Biederman et al. (1995) found certain risk factors such as severe marital discord, low social class, large family size, paternal criminality, and maternal mental disorder alone and combined to be positively associated with ADHD and ADHD associated psychopathology, impaired cognition and psychosocial dysfunction. Cross-sectional and longitudinal studies have shown that marital distress, family dysfunction, and low social class are commonly identified risk factors for psychopathologic disorders and dysfunction in children (Mrazek and Haggerty 1994). Although evidence suggests a relationship between marital dysfunction and ADHD, the results remain inconsistent. A review by Lindahl (1998) on family variables and children's disruptive behavioral problems note that parents of children with ADHD experience no more or less marital satisfaction or conflict compared to comparison families. Other studies have supported this take, finding consistency in rates of divorce and separation in families of children with ADHD to be no more than controls (Barkley et al. 1991; Faraone et al. 1991; Brown and Pacini 1989; McGee, Williams, and Silva 1984).

Negative, critical, less approving and more demanding parents, in addition to coercive or aversive interactions and inconsistent discipline were frequently identified amongst children with ADHD compared to controls (Danforth, Barkely, and Strokes 1991; Whalen 1989; Barkley 1985;

Patterson 1982). However, Goldstein, Harvey, and Friedman-Weieneth (2007) suggested differences in the impact of parenting practices of children to differ across cultures. While several studies agree that punitive practices, coercive, over-reactive and permissive parenting are linked to disruptive behavioral problems in children, their impact across racial\ethnic groups stand to differ. Goldstein et al.'s (2007) results found that coercive, less nurturing parenting had adverse behavioral effects on African-American and Latino families, while similar parenting styles in other studies were associated with behavior problems among European Americans but not African-American families (Stormshak et al. 2000; Deater-Deckard et al. 1996). Flynn (1994) suggests that even within the same race/ethnic groups, parenting beliefs differ by region. His study revealed that after controlling for several demographic variables, one of which included race, the Northeast had significantly less favorable attitudes toward spanking compared to the West, Midwest, or South. Chen et al. (1997) examined a sample of Chinese children and found that authoritative and authoritarian parenting styles of both fathers and mothers were positively related to children's peer acceptance, social competence, and school achievement and negatively related to their social difficulties. They concluded that parental care, involvement, supervision and encouragement which is manifested in an authoritative parenting style and easily misunderstood by the West as having negative consequences, is merely a reflection of Chinese parents' affectionate attitudes towards the child.

Biological, cultural, and environmental approaches have been suggested to explain the etiology and changes in prevalence rates of ADHD across the world. However, this is further complicated by social institutions such as pharmaceutical and insurance companies that have the power to regulate what constitutes an illness from non-medical symptoms. In addition, the generosity and

eligibility of social welfare programs can work to incentivize or turn off families to identify and treat health impairments in their children.

Pharmaceutical companies are able to validate certain conditions as illnesses based on the availability of treatments. Increased specialization of medical practice and the constant development of new technologies has brought on new treatments and drugs for all kinds of diseases and discomforts, including symptoms which may otherwise have been normal conditions. The Federal Drug and Administration Modernization Act of 1997 which loosened regulatory measures for pharmaceutical companies to advertise directly to consumers and physicians via television commercials, fueled consumer interest and demand in obtaining these goods and services (Conrad and Leiter 2004; Mintzes 2002; Rosenthal et al. 2002). The availability of medication and increased awareness among consumers reinforces the notion that their symptoms, whether real or perceived, must be a legitimate illness if treatment is available.

Insurance companies are also in a position to distinguish medical illnesses from otherwise normal conditions by means of coverage. By deciding what is “medically necessary,” private and public insurers create their own definitions for what constitutes an illness and mediates between pharmaceutical companies and consumers in their access to medical solutions (Conrad and Leiter 2004). Stevens et al. (2005) has found that insurance status was most consistently associated with disparities in ADHD health care, with uninsured children having fewer physician and psychotherapy visits and stimulant prescriptions. In contrast, consumers with dispensable income can choose to obtain medical goods and services through private markets that directly link them with medical producers (Conrad and Leiter 2004). If consumers can afford treatment, they will

most definitely find providers who will provide it, inevitably excluding those who cannot pay (Conrad and Leiter 2004).

Lastly, families may be more motivated to identify and seek treatment for children with ADHD depending on the eligibility and generosity of various welfare programs such as Supplemental Security Income (SSI), welfare/TANF, and disability benefits. Various studies have associated poverty with low birth weight, increased risk for physical, mental, and emotional disorders and other disabilities including ADHD (Birenbaum 2002). Due to worse health conditions, children from low-income households miss more days of school, underachieve and drop out of high school, thus lowering their life's changes at a stable job or income (Office of Special Education 1999). The Department of Social Security in the U.K. has found that families with a disabled child face three times the costs of families with no disabled children (Steyn, Schneider, and McArdle 2002). Thus, SSI, welfare/TANF and disability benefits provide a precious source of income to support those in need. Most noteworthy is Kubik's (1999) study which found evidence that the 1990 revision of SSI eligibility, which relaxed procedures used to evaluate mental disorders, increased reported disability rates and the number of poor children receiving cash benefits. These findings indicated that SSI benefits act to encourage low-income parents to identify and treat illnesses in their children. The generosity of cash assistance and availability of perks such as Medicaid might also encourage families to seek and stay on welfare (Kubik 1999). Birenbaum (2002) also found that families of children who have a disability are more likely to remain on welfare than those of children without a disability. From the results alone it is difficult to assess whether new impairments identified in children are truly legitimate illnesses or

conditions created only to secure benefits. However, changes in regulatory measures have been shown to alter prevalence rates of medicalized illnesses.

After much discussion on factors that affect the identification of ADHD, why does it matter and what are the consequences on patients?

One of the positive outcomes resulting from ADHD being recognized as an illness is that it brings a humanitarian aspect to how deviant behavior is conceived and controlled (Conrad and Schneider 1993). Children with ADHD are no longer seen as troublemakers or as having some kind of character flaw, and their parents cease to be blamed for their child's misbehavior. Medical, therapeutic or other more "humane" types of treatment and social control are now used rather than punitive ones (Conrad and Schneider 1993). Due to the trust and prestige given to the medical profession, medicalization allows for a scientific or humane way of viewing problems, which enhances its acceptance into society. This then leads to the second outcome which involves labeling deviants with what Talcott Parsons refers to as the "sick role." This exempts individuals from normal social roles and responsibilities for their conditions (Traub and Little 1999). Children with ADHD are now seen as having a medical disorder and so long as they fulfill their obligation to acknowledge that being ill is an undesirable state and makes an effort to improve their condition, then the deviant behavior is conditionally legitimatized (Traub and Little 1999).

Medicalization also provides optimistic outcomes to patients. It gives relief to patients for providing a medical term for their undefined symptoms and also creates the possibility that their

conditions might improve if the proper treatment is discovered (Traub and Little 1999). The possible hope for a cure may even work as a self-fulfilling prophecy.

Finally, medical social control is usually more flexible and efficient than judicial or legal controls. Unlike legal and judicial controls for deviant behavior that are long, complicated and costly, medical controls are flexible, applied more informally, and adjustable to fit the needs of the individual (Traub and Little 1999). For example, controlling a hyperactive child with medication is much more efficient and less time consuming than going through various stages of parental and teacher disciplining measures.

Many of these outcomes for patients are based on the assumption that science and medicine are objective and value free. In the absence of medical tests, diagnosis for medicalized illnesses can be swayed by the moral and cultural climate of that particular society. One of the dangers of medicalization is that it may dismiss ADHD and other psychological problems in children as an illness and shifts focus away from the social situation that could have created the child's behavior. If the social system is the cause of the child's behavior, then blaming the child or the illness will not solve the true problem behind ADHD.

OBJECTIVES

The purpose of this paper is to add further dimension to the social and environmental factors that contribute to fluctuating prevalence rates of ADHD and attitudes toward medication. The following research questions will be examined.

1) Are mother's born in the U.S. more likely to have children who are diagnosed with ADHD regardless of existing racial differences? Are there any differences in the use of prescription medication between children of mothers born in the U.S. and those who are not?

2) What is the likelihood of applying for SSI (even if the claim was denied) and actually receiving it amongst families with ADHD children and those with physical disabilities?

My hypotheses for the questions are indicated below.

H_1: When the method to diagnose ADHD in children is primarily based on observations by parents and teachers, they may be looking strictly for a medical cause rather than one that concerns the child's environment. This trend is especially strong in the U.S. where the status of ADHD as a medicalized illness is very high. Therefore, I hypothesize that parents born in the U.S. who have had more exposure to American perceptions of illness have a stronger tendency to perceive their child's misbehavior as a medical one and treat it with medication.

H_2: The difficulty of evaluating mental disorder claims for SSI compared to those with physical disabilities may act as an incentive for more families to identify illnesses in their children to secure SSI benefits. However, from a state workers perspective, they may be more likely to reject them due to the difficulty in proving their case compared to children with physical disabilities. I hypothesize that children with ADHD are more likely to have applied and been rejected compared to children with physical disabilities.

DATA AND MEASURES

The data for this paper was taken from the 2000-2003 National Health Interview Survey (NHIS). The NHIS is conducted by the National Center for Health Statistics (NCHS) and is a cross sectional household survey used to monitor trends in illness and disability of the civilian non-institutionalized population of the U.S. The NHIS is divided into five parts containing data at the household, family, person, adult and child level. For each family in the NHIS, all adult members of the household age 17 years and over who were present at the time of the interview were asked to participate and respond for themselves, creating the sample person file. From each family, one sample adult and one sample child (if any) were randomly selected to answer more specific questions on health issues, thus creating the sample adult and sample child files. The sample child file of the NHIS contains a variable indicating the person number from which the child's parents could be identified. This method was used to find the parents of children who were asked whether or not their child had ADHD.

The combined sample over the four years of the survey includes children age 6-12 years and their mothers (biological, non-biological) who were asked of their child's history of identified ADD/ADHD by the following question: "Has a doctor of health professional ever told you that (sample child) had Attention Deficit Hyperactivity Disorder (ADHD) or Attention Deficit Disorder (ADD)?" Children with missing information for ADHD and mothers who could not be identified for reasons other than divorce, separation or widowed were excluded. This resulted in a sample of 18,263 children and 17,571 mothers.

In line with popular research, table 1 clearly shows that ADHD is more common amongst male, low birth weight, and white children as well as those with insurance. Furthermore, ADHD children were more frequently on some type of prescription medication for at least three months. These relationships were all significant using the chi-square test. Families of ADHD children were also more frequently identified as receiving income from SSI above all other types of welfare and were concentrated in small (>3 persons) to medium sized (3-5 persons) families.

Table 2 also shows that ADHD children were more frequently identified amongst white mothers above all other races and a significantly large proportion of them were born in the U.S. opposed to outside the U.S. Similar to results of previous studies, ADHD children were more frequently identified amongst single mothers and those with high school or less than high school education. These relationships were all statistically significant using the chi square test.

Table 1. Children 6-12 years of age included in the National Health Interview Survey, 2000-2003 by selected sociodemographic characteristics

	Children	*ADHD*	*%*
Number of respondents	18,263	1,269	7%
Sex			
Male	8,484	943	11%
Female	8,510	326	4%
		p<0.001*	
Low birthweight			
Yes (<2,500 grams)	1,115	112	10%
No (2,500+ grams)	14,793	1,051	7%
		p=0.001	
Race/ethnicity			
White only	8,597	808	9%
African-American only	2,600	177	7%
Hispanic only	4,803	223	5%
Other	994	61	6%
		p<0.001	
Health insurance coverage			
Insured	14,776	1,157	8%
Uninsured	2,165	105	5%
		p<0.001	
Prescription medication for at least three months?			
Yes	1,661	514	31%
No	15,322	753	5%
		p<0.001	
Income as a percentage of the poverty threshold			
<100%	2,127	178	8%
100-199%	3,042	232	8%
200-399%	4,365	357	8%
400%+	3,647	281	8%
Unknown	4,034	221	5%
		p=0.723	
Type of welfare			
Disability pensions	284	42	15%
Welfare/TANF	823	111	13%
Supplemental Security Income (SSI)	640	138	22%
		p<0.001	
Family size			
> 3	1,315	150	11%
3 - 5	13,600	1,011	7%
6 - 8	1,923	99	5%
> 8	156	9	6%
		p<0.001	

* p values for chi square tests

Table 2. Mothers of children 6-12 years of age included in the National Health Interview Survey, 2000-2003 by selected sociodemographic characteristics

	Mothers	*Mothers with ADHD children*	*%*
Number of respondents	17,571	1,217	7%
Race/ethnicity			
White only	8,565	813	9%
African-American only	2,438	172	7%
Hispanic only	4,524	201	4%
Other	827	31	4%
		p<0.001*	
Born in U.S.			
Yes	11,980	1,074	9%
No	4,350	143	3%
		p<0.001	
Education			
High school or less than high school degree	12,841	1,003	8%
College degree or higher	3,379	211	6%
		p=0.004	
Marital status			
Married	11,683	755	6%
Widowed, separated, or divorced	4,617	459	10%
		p<0.001	

* p values for chi square tests

RESEARCH DESIGN

A series of multinomial logistic regression models will be used to estimate the effects of key independent variables on the dependent variable.

Hypothesis 1

The model for hypothesis 1 will first examine child's recorded incidences of ADHD (*kadd*) as the dependent variable and mother's race alone as predictors. Then, whether or not she was born in the U.S. (*musborn*) will be added to examine its effect on already existing racial differences.

The second part will examine whether mother's origin of birth and having ADHD influences children's use of prescription drugs (*kpresmeds*). Since there was no information regarding ADHD specific medication in the NHIS, *kpresmeds* only describes if a child was regularly taking any prescription medication for at least three months.

The third part will focus on mother's origin of birth on prescription medication use only among ADHD children.

Control variables include child's sex (*kmale*), low birth weight (2,500g) (*klbwgt*), insurance coverage (*kinsurance*) and mother's race. Insured was defined as having Medicaid or other state-sponsored plans, government-sponsored insurance, private, or a combination of public and private insurance. Race was determined by looking at the mothers' Hispanic origin and her main race. This was recoded into "White only," "Black only," and "Hispanic only." The other races include Asian only, other, and mixed races which were grouped together due to their small individual sample sizes.

Also included were family size (*fmsize*) and presence of family members who received income from any of the three programs: disability pensions, welfare/TANF, or SSI (*fmanywelf*). Family's socioeconomic status (*fmpoverty*) was measured using the ratio of family income to poverty threshold over total combined family income because it took into consideration family size and the ages of family members. This was recoded into two categories: poverty (less than 199%) and low to middle income and higher (200%-400% or more).

Lastly, maternal psychopathological symptoms (*mfeelbad*), education (*mhsdeg*), and marital status (*msingle*) were added. Maternal psychopathological symptoms involve feeling sad, nervous, restless, or fidgety, hopeless, everything was an effort, and worthless at least "some of the time" in the past 30 days. Maternal education is a dummy variable with "high school or less than high school degree" equivalent to 1 and 0 otherwise. Mother's marital status is also a dummy variable indicating single due to divorce, separation, or widowed as 1 and 0 otherwise.

Based on the explanation above, the equation for part I of hypothesis 1 will be as follows:

logistic(*kadd*) = *kmale* + *klbwgt* + *kinsurance* + *fmsize* + *fmanywelf* + *fmpoverty* + *mfeelbad* + *mhsdeg* + *msingle* + *mwhite* + *mblack* + *mhisp* + *musborn*

Part II of hypothesis 1:

logistic(*kpresmeds*) = *kmale* + *klbwgt* + *kinsurance* + *fmsize* + *fmanywelf* + *fmpoverty* + *mfeelbad* + *mhsdeg* + *msingle* + *mwhite* + *mblack* + *mhisp* + *musborn* + *kadd*

Part III of hypothesis 1:

logistic(*kpresmeds*) = *kmale* + *klbwgt* + *kinsurance* + *fmsize* + *fmanywelf* + *fmpoverty* + *mfeelbad* + *mhsdeg* + *msingle* + *mwhite* + *mblack* + *mhisp* + *musborn* if *kadd* ==1

Table 3. Association between mother's race and origin of birth with child's identified ADHD

	Model 1: OR with controls	*Model 2: OR with musborn*
Race		
White only	2.892*	2.411**
Black only	1.635	1.381
Hispanic only	1.384	1.424
Mother born in U.S.		1.500**

* p=0.001
** p<0.05

Table 4. Association between mother's origin of birth and child's identified ADHD with use of prescription medication

	Model 1: OR with controls	*Model 2: OR when kadd==1*
ADHD	9.106*	
Mother born in U.S.	1.594*	2.005**

* p<0.001
** p=0.05

[Please see Appendix for full output]

Model 1 in table 3 shows that with race alone as predictors, the occurrence of children with ADHD is nearly 3 times more frequent among white mothers than among non-white mothers, and is significant at p=0.001. Although mother's race was examined over child's race, results for model 1 is consistent with previous literature that indicates ADHD to be more common among white children than black or Hispanic children (Pastor and Reuben 2005; Stevens, Harman, and Kelleher 2005). When *musborn* was added in model 2, the occurrence of children with ADHD was approximately 1.5 times more frequent amongst mothers born in the U.S. compared to those who were not born in the U.S., thus confirming hypothesis 1. The change in estimated logistics regression coefficients for all races in model 2 is evident of a confounding effect due to mothers being born in the U.S., although this effect was only significant for white mothers. Surprisingly, the confounding effect of *musborn* decreased the odds ratio of ADHD children amongst white mothers from 2.89 to 2.41 compared to non-white mothers.

Model 1 in table 4 shows that children with ADHD are a little over 9 times more likely to be on prescription medication compared to non-ADHD children, and that mothers born in the U.S. are approximately 1.6 times more likely to have children on prescription medication than non-U.S. born mothers. Both results were significant at p<0.001. Model 2 also shows that mothers born in

the U.S. with ADHD children are twice as likely compared to non-U.S. born mothers with ADHD children to be on prescription medication. Although whether the medication was ADHD specific or not is unknown, it does shed light on the heavy reliance on drugs amongst U.S. born mothers and more so if the child has an identified health impairment.

Hypothesis 2

The model for hypothesis 2 will first examine child's recorded incidences of ADHD (*kadd*) and those with physical disabilities (*kphysdis*) as predictors and their likelihood of applying for SSI and receiving/not receiving it relative to not applying and thus not receiving SSI (*fmssiapprsn*) as the dependent variable.

The second part will focus on the likelihood of applying and receiving SSI (*fmssiappget*) amongst children with ADHD and those with physical disabilities.

In order to determine respondents' application status for SSI, they were asked the following question: "Have you/any family members living here EVER applied for Supplemental Security Income or SSI even if the claim was denied?" To identify if families actually received income from SSI, they were asked, "Did you/any family members living here receive Supplemental Security Income (SSI)?" A crosstab was created to determine who applied and received/did not receive SSI and who did not apply and did not receive SSI.

Clarification is also needed on the definition of "physical disability." According to the U.S. Social Security Administration website, children eligible to receive SSI include individuals under 18 years of age who have "a medically determinable physical or mental impairment which results in marked and severe functional limitations and can be expected to result in death or has lasted or can be expected to last for a continuous period of not less than 12 months[1]." A total of 14 physical impairments that cause activity limitations were selected from the NHIS and those with a duration of over 12 months were filtered. Selected symptoms include activity limitations from vision/problem seeing, hearing, speech, asthma birth defect, injury, mental retardation, bone and muscular problems, epilepsy/seizures, cerebral palsy, muscular dystrophy, anemia, and diabetes. Children who reported one or more of these symptoms were coded as having a physical disability.

Control variables for hypothesis 2 are the same as those of hypothesis 1, but excluding child's sex (*kmale*) and the presence of family members receiving income from any type of welfare (*fmanywelf*).

The equation for part I of hypothesis 2:

mlogit(*fmssirsn*) = *klbwgt* + *kinsurance* + *fmsize* + *fmpoverty* + *mfeelbad* + *mhsdeg* + *msingle* + *kadd* + *kphysdis*

Part II of hypothesis 2 :

logit(*fmssiappget*) = *klbwgt* + *kinsurance* + *fmsize* + *fmpoverty* + *mfeelbad* + *mhsdeg* + *msingle* + *kadd* + *kphysdis*

[1] Social Security Online. http://www.ssa.gov/ssi/

Table 5. Association between child's identified ADHD and physical disabilities with SSI application status relative to not applying

	Model 1: OR with controls
SSI application status	
Applied, rejected	
ADHD	0.630*
Physical disability	1.884**
Applied, received	
ADHD	1.670**
Physical disability	1.965**

* p=0.001
** p<0.001

Table 6. Association between child's identified ADHD and physical disabilities with familes that applied for SSI

	Model 1: OR with controls
SSI application status	
Applied, received	
ADHD	1.075**
Physical disability	1.965

** p<0.001

[Please see Appendix for full output]

Table 5 shows that families of children with both ADHD and physical disabilities have a higher likelihood of applying for SSI regardless of whether they were rejected or not. This may indicate that parents apply for SSI with no concern for the strength of their case, such as whether their child's disability can be scientifically tested or not. Table 6 demonstrates that among families that applied for and received income from SSI, children with ADHD are more likely to receive SSI compared to those without ADHD. Therefore, having ADHD does in fact increase the likelihood of being eligible and receiving income from SSI compared to non-ADHD children, and they are just as likely to have applied and been rejected compared to children with physical disabilities, which was contrary to my hypothesis.

DISCUSSION AND CONCLUSION

Estimates using the 2000-2003 NHIS showed that U.S. born mothers were significantly more likely to have children with ADHD than non-U.S. born mothers. Although information concerning the use of prescription medication specifically for ADHD could not be obtained, the likelihood of children with or without ADHD on prescription medication was higher amongst U.S. born mothers compared to mothers born outside the U.S. Numerous studies have found racial and ethnic differences in the rates of ADHD and prescription medication use amongst children residing in the U.S. However no studies using national data have focused on how mother's origin of birth may affect rates of ADHD and prescription medication use. One of the shortcomings reported by Pastor and Reuben (2005) regarding the NHIS data is that measures of ADHD are based on parental reports of identified cases rather than on psychiatric, psychological, or educational assessments. However, this was intended in my study because the purpose was to examine differences in how mothers perceived their child's behaviors depending on their origin of birth. My findings support previous research examining sociocultural differences in how parents perceive hyperactive and disruptive behavior in children depending on their origin of birth (Malacrida 2004; Mann et al. 1992). Further investigation could expand racial and ethnic categories, especially amongst Hispanics, by adding culturally distinct subgroups. Since studies have examined large differences in parent-child relationships amongst non-Western populations, it may be interesting to add an Asian race category as well. However, consideration to sample size excluded this possibility in my current research.

The availability and generosity of welfare programs such as SSI have also been studied as affecting prevalence rates of ADHD. My findings showed that regardless of the type of disability or strength of the case, families of children with ADHD were just as likely to apply for SSI and be rejected compared to children with physical disabilities. However, compared to children without ADHD, they were more likely to apply for and receive SSI benefits. It would be interesting to examine the same question after 1996 when assessment criteria for eligibility were tightened. If the liberalization of disability standards in 1990 was followed by a significant increase in the number of disabled children identified by their parents, along with an increase in those receiving cash benefits, then opposite results may be hypothesized after 1996 (Kubik 1999). There may have been more obvious differences between children with ADHD and those with physical disabilities in their likelihood of applying and receiving SSI immediately after 1996, due to it being recently implemented. State workers making the assessments may have been more stringent in imposing the new criteria which may have relaxed over time.

One of the limitations or inaccuracies regarding this part of the study involved categorizing physical disabilities. Much caution was practiced in identifying major physical disabilities the SSI covered by referring to their criteria of eligible symptoms and duration of symptoms. However, since eligibility is determined on a case by case basis, it is highly likely that there are other confounders not mentioned in my study that may affect eligibility for both ADHD and physical disabilities, such as the number of other siblings in the family and whether or not they have any health problems.

Without conclusive scientific evidence, the etiology of ADHD continues to rest between various biological and sociocultural factors. Results from the 2000-2003 NHIS showed that mother's social and environmental characteristics play a crucial role in the identification and treatment of ADHD. Although the current study found no differences in application status and likelihood of receiving/not receiving SSI between ADHD children and those with physical disabilities, it may be worth examining changes over time succeeding drastic eligibility assessment changes.

APPENDIX

HYPOTHESIS 1:

Table 3.

Output 1. Association between mother's race with child's identified ADHD

```
xi: logistic kadd kmale klbwgt kinsurance fmsize fmanywelf fmpoverty mfeelbad mhsdeg
msingle mwhite mblack mhisp

Logistic regression                                     Number of obs   =       7163
                                                        LR chi2(12)     =     300.42
                                                        Prob > chi2     =     0.0000
Log likelihood = -1757.3356                             Pseudo R2       =     0.0787

------------------------------------------------------------------------------
        kadd | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       kmale |   2.948882   .3021134    10.56   0.000     2.412413     3.60465
      klbwgt |   1.400226   .2208912     2.13   0.033     1.027821    1.907561
  kinsurance |   1.071458   .1783114     0.41   0.678     .7732474    1.484675
      fmsize |   .8351937   .0388329    -3.87   0.000     .7624477    .9148805
   fmanywelf |   2.423456   .3154924     6.80   0.000     1.877687    3.127857
   fmpoverty |    .876777   .1005188    -1.15   0.251     .7003296     1.09768
    mfeelbad |   1.657716   .1567879     5.34   0.000     1.377219    1.995342
       mhsdeg |   1.173389   .1481217     1.27   0.205     .9162022     1.50277
     msingle |   1.134412   .1341354     1.07   0.286     .8997524    1.430273
      mwhite |   2.891542   .9160283     3.35   0.001     1.554076    5.380053
      mblack |   1.635248   .5471206     1.47   0.142     .8487679    3.150491
       mhisp |   1.384455   .4601049     0.98   0.328     .7217616    2.655609
------------------------------------------------------------------------------
```

Output 2. Association between mother's race and origin of birth with child's identified ADHD

```
xi: logistic kadd kmale klbwgt kinsurance fmsize fmanywelf fmpoverty mfeelbad mhsdeg
msingle mwhite mblack mhisp musborn

Logistic regression                                     Number of obs   =       7159
                                                        LR chi2(13)     =     306.40
                                                        Prob > chi2     =     0.0000
Log likelihood = -1754.0358                             Pseudo R2       =     0.0803

------------------------------------------------------------------------------
        kadd | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       kmale |   2.934994   .3008587    10.50   0.000     2.400782    3.588077
      klbwgt |   1.413398   .2232696     2.19   0.029     1.037058    1.926308
  kinsurance |   1.044334   .1741796     0.26   0.795     .7531327     1.44813
      fmsize |   .8331934   .0387602    -3.92   0.000     .7605852     .912733
   fmanywelf |   2.428674   .3166596     6.81   0.000      1.88099    3.135827
   fmpoverty |   .8919081   .1024981    -1.00   0.320     .7120328    1.117224
    mfeelbad |   1.637238   .1551363     5.20   0.000     1.359741    1.971366
       mhsdeg |    1.15921   .1464157     1.17   0.242     .9050031    1.484822
     msingle |   1.107213   .1315525     0.86   0.391      .877196    1.397546
      mwhite |   2.411025   .7840239     2.71   0.007     1.274693    4.560346
      mblack |   1.380508   .4712141     0.94   0.345     .7071227    2.695149
```

```
       mhisp |   1.424195   .4747947     1.06   0.289     .7409652    2.737417
     musborn |   1.500106   .2538654     2.40   0.017     1.076643    2.090124
------------------------------------------------------------------------------
```

Table 4.

Output 3. Association between mother's origin of birth and child's identified ADHD with use of prescription medication

```
logistic kpresmeds kmale klbwgt kinsurance fmsize fmanywelf fmpoverty mfeelbad mhsdeg
msingle mwhite mblack mhisp musborn kadd

Logistic regression                                     Number of obs   =       7158
                                                        LR chi2(14)     =     771.58
                                                        Prob > chi2     =     0.0000
Log likelihood = -2589.7217                             Pseudo R2       =     0.1297

------------------------------------------------------------------------------
   kpresmeds | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       kmale |   1.289231   .0954152     3.43   0.001     1.115151    1.490485
      klbwgt |   1.233808   .1605662     1.61   0.106     .9560341    1.592289
  kinsurance |   1.504802   .2143933     2.87   0.004     1.138168    1.989539
      fmsize |   .8191671   .0303304    -5.39   0.000     .7618263    .8808238
   fmanywelf |   1.752784   .1983255     4.96   0.000     1.404158    2.187968
   fmpoverty |   .9135367   .0829571    -1.00   0.319     .7645915    1.091497
    mfeelbad |   1.169553   .0891229     2.06   0.040     1.007294     1.35795
     mhsdeg |   .8856285   .0818904    -1.31   0.189     .7388299    1.061595
     msingle |    .957212   .0907789    -0.46   0.645     .7948458    1.152745
      mwhite |   1.090474   .2195234     0.43   0.667     .7349539    1.617971
      mblack |   .8173484   .1767857    -0.93   0.351      .534933    1.248864
       mhisp |   .7967208   .1650001    -1.10   0.273     .5309127    1.195609
     musborn |   1.593522   .2053399     3.62   0.000     1.237864    2.051366
        kadd |    9.10582   .9059486    22.20   0.000     7.492591    11.06639
------------------------------------------------------------------------------
```

Output 4. Association between mother's origin of birth and use of prescription medication only for children with ADHD

```
logistic kpresmeds kmale klbwgt kinsurance fmsize fmanywelf fmpoverty mfeelbad mhsdeg
msingle mwhite mblack mhisp musborn if kadd==1

Logistic regression                                     Number of obs   =        537
                                                        LR chi2(13)     =      36.73
                                                        Prob > chi2     =     0.0005
Log likelihood = -346.77637                             Pseudo R2       =     0.0503

------------------------------------------------------------------------------
   kpresmeds | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       kmale |   1.461402   .3028433     1.83   0.067     .9735917    2.193625
      klbwgt |    .978784   .3003553    -0.07   0.944      .536392    1.786041
  kinsurance |   1.901135   .6350312     1.92   0.054     .9878442    3.658791
      fmsize |   .8771332   .0803224    -1.43   0.152     .7330233    1.049575
   fmanywelf |   1.615995   .4039193     1.92   0.055     .9901051    2.637536
   fmpoverty |    .971747   .2197739    -0.13   0.899     .6237957    1.513785
    mfeelbad |   1.048855    .196037     0.26   0.799     .7271446    1.512899
```

```
      mhsdeg |   .5908691   .1552884    -2.00   0.045     .3530075    .9890052
     msingle |   .7259736    .167741    -1.39   0.166      .461578    1.141817
      mwhite |   1.126968   .7344161     0.18   0.854     .3141993      4.0422
      mblack |   .5809587   .3948217    -0.80   0.424     .1533436    2.201025
       mhisp |   .9419046   .6502313    -0.09   0.931     .2434396    3.644371
     musborn |   2.004849   .7106254     1.96   0.050     1.000853    4.015992
------------------------------------------------------------------------------
```

HYPOTHESIS 2:

Table 5.

Output 1. Association between child's identified ADHD and physical disabilities with SSI application status relative to not applying

```
fmssirsn
1 -- did not apply, did not receive SSI
2 -- applied, rejected
3 -- applied, received SSI

mlogit fmssirsn klbwgt kinsurance fmsize fmpoverty mfeelbad mhsdeg msingle kadd
kphysdis

Iteration 0:   log likelihood = -1801.1243
Iteration 1:   log likelihood = -1571.4376
Iteration 2:   log likelihood = -1509.8502
Iteration 3:   log likelihood = -1502.2253
Iteration 4:   log likelihood = -1501.6954
Iteration 5:   log likelihood = -1501.6827
Iteration 6:   log likelihood = -1501.6826

Multinomial logistic regression                 Number of obs   =       6942
                                                LR chi2(18)     =     598.88
                                                Prob > chi2     =     0.0000
Log likelihood = -1501.6826                     Pseudo R2       =     0.1663

------------------------------------------------------------------------------
    fmssirsn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
2            |
      klbwgt |   .4535203   .1826366     2.48   0.013     .0955592    .8114814
  kinsurance |    .180075   .1916288     0.94   0.347    -.1955106    .5556605
      fmsize |   .0934508   .0508085     1.84   0.066    -.0061321    .1930337
   fmpoverty |   .8813586   .1511411     5.83   0.000     .5851274     1.17759
    mfeelbad |    1.00044   .1259975     7.94   0.000     .7534891     1.24739
      mhsdeg |   .6551042   .2329415     2.81   0.005     .1985473    1.111661
     msingle |   .6789571   .1489799     4.56   0.000     .3869619    .9709522
        kadd |   .6303329   .1817353     3.47   0.001     .2741382    .9865276
    kphysdis |   1.884417   .1676916    11.24   0.000     1.555747    2.213086
       _cons |  -5.767585   .3625871   -15.91   0.000    -6.478243   -5.056927
-------------+----------------------------------------------------------------
3            |
      klbwgt |   .3591414   .3011473     1.19   0.233    -.2310965    .9493793
  kinsurance |   .8792858   .4018608     2.19   0.029     .0916531    1.666919
      fmsize |    .249898   .0742693     3.36   0.001     .1043329    .3954631
   fmpoverty |   1.791576   .3229549     5.55   0.000     1.158596    2.424556
    mfeelbad |   .6220783   .2084785     2.98   0.003     .2134679    1.030689
      mhsdeg |    1.26612   .6057318     2.09   0.037     .0789079    2.453333
     msingle |   .9295556   .2509296     3.70   0.000     .4377426    1.421369
```

```
        kadd |   1.669804   .2348822     7.11   0.000     1.209444    2.130165
    kphysdis |   1.965034   .2567455     7.65   0.000     1.461822    2.468246
       _cons |  -9.567633   .7940837   -12.05   0.000    -11.12401   -8.011257
------------------------------------------------------------------------------
(Outcome fmssirsn==1 is the comparison group)
```

Table 6.

Output 2. Association between child's identified ADHD and physical disabilities with families that applied for SSI

```
logit fmssiappget klbwgt kinsurance fmsize fmpoverty mfeelbad mhsdeg msingle kadd
kphysdis

Iteration 0:   log likelihood = -235.21705
Iteration 1:   log likelihood = -219.55068
Iteration 2:   log likelihood = -218.93457
Iteration 3:   log likelihood = -218.93007
Iteration 4:   log likelihood = -218.93007

Logit estimates                                   Number of obs   =        413
                                                  LR chi2(9)      =      32.57
                                                  Prob > chi2     =     0.0002
Log likelihood = -218.93007                       Pseudo R2       =     0.0692

------------------------------------------------------------------------------
 fmssiappget |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      klbwgt |  -.1188883   .3487809    -0.34   0.733    -.8024863    .5647097
  kinsurance |   .5678154   .4449624     1.28   0.202    -.3042949    1.439926
      fmsize |   .1778954   .0871844     2.04   0.041     .0070171    .3487737
   fmpoverty |    .961659    .352013     2.73   0.006     .2717263    1.651592
    mfeelbad |  -.3373635   .2430945    -1.39   0.165    -.8138199    .1390929
      mhsdeg |   .6979347   .6489164     1.08   0.282     -.573918    1.969787
     msingle |   .2008859    .280875     0.72   0.474    -.3496189    .7513908
        kadd |   1.074968   .2828838     3.80   0.000     .5205256     1.62941
    kphysdis |   .1063431   .2885335     0.37   0.712    -.4591722    .6718584
       _cons |  -3.889667   .8672819    -4.48   0.000    -5.589508   -2.189826
------------------------------------------------------------------------------
```

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