Effects Of Socio-Economic Characteristics On The Medication Of Children For Attention-Deficit/Hyperactivity Disorder (ADHD)

Walter O. Simmons, John Carroll University, USA
Rosemarie Emanuele, Ursuline College, USA

ABSTRACT

The diagnosis and medication of the illness known as Attention deficit/hyperactivity disorder (ADHD) has been shown to exhibit patterns unexpected from a medical condition that is randomly distributed throughout the population. This research uses new data to show statistically significant relationships between the medication of children for ADHD and several socio-economic characteristics. Most alarming is the fact that the significant relationships between medication and race and gender are robust, even when other socioeconomic characteristics are controlled for.

Keywords: Attention-Deficit/Hyperactivity Disorder; ADHD; Medication; Socio-Economic; Race; Gender

INTRODUCTION

*A*ttention-deficit/hyperactivity disorder (ADHD) is a prevalent mental disorder in children in the United States. It is the one of the most commonly studied and diagnosed psychiatric disorder in children and adolescents, affecting about 6 to 7 percent of children and is diagnosed in about 2 to 16 percent of school-aged children (Willcutt, 2012: Rader, McCauley, Callen, 2009). In the United States between 1990 and 2011 some \$143 to \$266 billion, was spent in diagnosing and medicating people with ADHD and approximately \$38 B - \$72 B of this cost was for children and adolescents (Doshi et al, 2010). More recent studies found that U.S. household income losses due to ADHD total some \$77 B each year (American Psychiatric Association (APA)).

According to the APA, ADHD is "often first identified in school-aged children when it causes disruption in the classroom or problems with schoolwork." People who are diagnosed with this condition are known to have difficulty either with attention or impulse control, or with some combination of these two symptoms. Diagnosis of ADHD is often done through a series of surveys given to the patient's teachers and parents and sometimes to the patient themselves. They contain questions that ask such things as whether "the child runs as if driven by a motor", with no explanation as to what that actually means. It is possible that teachers with different backgrounds would interpret the same behavior very differently, leading one to question the process by which children are identified as having ADHD.

Controversies about the diagnosis and treatment of ADHD are rampant and can be traced back to the 1970s (Foreman, 2006; Mayes, Bagwell and Erkulwater, 2008). The controversies involve clinicians, teachers, policymakers, parents and the media. Opinions regarding ADHD range from not believing it exists at all to stimulant medications in treatment (Cohen and Cicchetti, 2006; Mayes, Bagwell and Erkulwater, 2008). Indeed, research by social constructionist theorists (Parens and Johnston, 2009) indicate that "society members including physicians, parents, teachers and others" are the ones who determine ADHD and that it is often the younger children who are identified and medicated for this condition. Other social constructionist theorists (Szasz, 2001; Chriss, 2007) have argued that ADHD was "invented and not discovered."

Since medical conditions would not be expected to be distributed based on a child's age relative to their peers, these theories suggest that there may be very subjective elements entering into the diagnoses (and often medication) of children who may or may not need such medical intervention, and who, indeed, may need other types of intervention besides the standard medication prescribed for ADHD. The variation of diagnosis and medication of ADHD within states, among races, and gender suggest that factors other than neurological conditions play a major role in its determinants (Elder, 2010).

We expand upon the existing research by asking if there are differences in socioeconomic characteristics in the proportion of children medicated for ADHD. We examine patterns in the choice to medicate children for this condition, and are surprised to discover patterns that reflect socio-economic characteristics. For example, since there is no evidence that the neurological condition of ADHD would likely be linked to any race-based characteristics (such as is, for example, sickle cell anemia), we do not expect there to be any link between racial background and the percentage of children diagnosed and medicated for ADHD in different racial groups. We find, however, that there are, indeed, significant differences in the percentage of children medicated for ADHD among the races reported. Similarly, we find significant differences in the medication of male and female children. These results imply that the medication for ADHD may well be very arbitrary and subjective, leading to either the costly and perhaps dangerous medication of children who do not need such medication or to not diagnosing children who are indeed in need of intervention.

DATA

The data utilized in this study comes from the Data Resource Center for Child and Adolescent Health and is based on the National Survey of Children's Health (NSCH)[1]. NSCH covers multiple aspects of children's lives. The survey includes physical and mental health status, access to health care quality, and information on children's family, neighborhood and social context. The Data Resources Center makes the information available to parents, researchers, community health providers and anyone interested in children's health. The Data Resource Center for Child and Adolescent Health is a project of the Child and Adolescent Health Measurement Initiative (CAHMI) supported by the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), and the Maternal and Child Health Bureau (MCHB). With funding and direction from MCHB, these surveys were conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. The survey results are weighted to represent the population of non-institutionalized children ages 0-17 nationally and in each state. We pooled the data from three time periods 2003, 2007 and 2011. In the 2003 survey 102,353 child-level interviews were completed nationally; approximately 2000 interviews were collected per state and the number of interview per state range from 1483 to 2241 per state. In 2007, 81,642 child-level interviews were done nationally; approximately 1800 interviews per state, ranging from 1,725 to 1,932 per state. In 2011 95,677 nationally interviews were done; approximately 1,850 per state, ranging from 1,811 to 2,200 per state.

We are particularly interested in the question that asks about percentages of children who are medicated for ADHD with various socio-economic characteristics. The dependent variable is the percentage of children diagnosed with ADHD and taking medication, while the independent variables are various socio-economic characteristics that may influence whether a child is medicated, once diagnosed. Descriptive statistics for those variables are shown in Table 1.

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[1] Child and Adolescent Health Measurement Initiative (2012; 2013). "Child Health Measures: Summary of key differences in indicator measurement from 2007 to 2011/12 NSCH" Data Resource Center, supported by Cooperative Agreement 1-U59-MC06980-01 from the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau (MCHB). Data Resource Center (DRC) is a project of the Child and Adolescent Health Measurement Initiative at Oregon Health & Science University. Available at www.childhealthdata.org. Revised 01/10/13. DRC is sponsored by the Maternal and Child Health Bureau, Health Resources and Services Administration.

Table 1: Description of Variables and Descriptive Statistics

Variable	Variable Description	Mean	Standard Deviation
ADHD	ADHD and taking medication for this condition	7.3006	1.8671
WHITE	Race of child with ADHD is White	7.0771	1.9227
BLACK	Race of child with ADHD is Black	6.8660	5.9138
HISPANIC	Race of child with ADHD is Hispanic	4.3856	3.1937
OTHER-RACE	Race of child with ADHD is other ethnicity	11.696	7.3769
MALE	Child with ADHD is male	7.6738	3.2517
FEMALE	Child with ADHD is female	3.3464	1.8112
INCOME0-99	Household income of child is less than 100 (thousand)	7.3196	4.4791
INCOME100-199	Household income 100-199 (thousand)	5.8385	3.2797
INCOME 200-399	Household income 200-399 (thousand)	5.1078	2.2800
INCOME ≥400	Household income 400 & up (thousand)	4.7784	1.9121
INSURANCE PRIVATE	Child has private insurance	4.6274	1.9295
INSURANCE PUBLIC	Child has public insurance	8.1980	3.7499
NO INSURANCE	Child does not have insurance	3.3320	3.9818
TWO-PARENT	Child resides in two-parent household	13.191	6.1355
MOTHER ONLY	Child resides in mother only household	7.8856	3.9691
OTHER FAMILY	Child resides in other family structure household	8.1039	4.7657
REGION	Dummy variable for state in which child lives; 1 for East and 0 for West		

Number of Observations: 153

EMPIRICAL SPECIFICATION AND RESULTS

We use multiple regression analysis to examine the effects of socioeconomic characteristics on the percentage of children diagnosed and medicated for ADHD in recent years (2003, 2007 and 2011). These data points are derived from information from the fifty states, each of which reports the percentage of children medicated in that state in that year. The regression estimates the effects of race, gender and a set of other socio-economic control variables: income, type of insurance, family structure, and geographical location on the dependent variable - the percentage of children in each state who are diagnosed and medicated for ADHD. To account for the possibility that variables representing race and gender maybe highly correlated with the other socio-economic variables we test for multicollinearity among the variables and found no collinearity levels that were of a severe nature. The general form of the model is:

ADHD = f (race, gender, income, insurance, family structure, location).

The regression to explain variation in the percentage of children diagnosed and medicated for ADHD in each state for each of the years studied yields strong indications that most of these variables are important factors in explaining who is medicated for this condition. The model is highly significant (p-value for F-statistic is 0.000) and the explanatory variables explain 82 percent of variation in the percentage of children diagnosed and medicated for ADHD. The regressions results are depicted in Table 2.

Table 2: Regression - Determinants of ADHD

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTERCEPT	1.838836	0.275580	6.672613	0.0000*
BLACK	0.026105	0.011561	2.257934	0.0255**
HISPANIC	0.083758	0.023200	3.610279	0.0004*
OTHER RACE	0.063880	0.009810	6.511822	0.0000*
MALE	0.221322	0.074849	2.956924	0.0036*
INCOME100-199	0.120698	0.044371	2.720234	0.0074*
INCOME200-399	0.219763	0.067822	3.240274	0.0015*
INCOME400 MORE	0.097493	0.058904	1.655115	0.1001***
INSURANCE PUB	0.079748	0.042649	1.869847	0.0636***
NO INSURANCE	0.002510	0.020390	0.123087	0.9022
MOTHER ONLY	-0.070209	0.036603	-1.918097	0.0571***
OTHER FAMILY	-0.022754	0.020563	-1.106594	0.2704
EAST REGION	0.559873	0.142854	3.919210	0.0001*
R^2	0.823459			
F-STATISTIC	54.41825			

Notes: * significant at 1%, ** significant at 5%, *** significant at 10%

Race

Using the category *White* as the reference value, the three categories of *Hispanic*, *Black*, and *Other* (Asians Native Americans and other designations) are used to control for racial differences among the percentage of children diagnosed and medicated for ADHD. The results here show positive and significant effects for children classified as Hispanic, Black and Other race. These results indicate that relative to white children all other racial groups are significantly more likely to be diagnosed and medicated for ADHD. The finding here also suggest that the diagnoses and medication of ADHD is consistent across racial groups and is systematically applied to all children without racial bias. Indeed, this result is in line with other studies that show that ADHD is predominantly a genetic disorder with environmental factors contributing a minor role to the etiology of ADHD and with 76 percent of the phenotypic variance being explained by inherited genetic factors (Kiaris, 2012; and Neale et. al, 2010).

Gender

Using the category *Female* as a reference value, the category *Male* is significantly more likely to be medicated for ADHD. This is consistent with the popular perception of ADHD being a disease that is most often found in boys. Studies (CDC, 2013) find that the rate of diagnosis of ADHD differs between male and female by approximately 6 percent (10 percent for male and 4 percent for female). These results indicate that males maybe more susceptible to the disease or that females are less likely to be diagnosed (Staller and Faraone, 2006).

Income

Using the category of income ranging from zero to $100,000 as the reference value, the income levels of $100-199, 200-399, and over $400 thousand dollars are used to examine the effects on ADHD. The relationship between household income and ADHD, relative to the reference category, in all the income categories is positive and statistically insignificant at 5 percent level of significant (except the category over $400 which is marginally significant around the 10 percent level). This result indicates that diagnosis and mediation of ADHD is not bias towards a specific income category and is indeed prevalent among all income groups. We infer from this finding that families from all income levels are seeking out whatever advantages diagnosis and medication of ADHD might afford their children, such as extended time on standardized tests or accommodations in the classroom.

Insurance

We use private insurance as the reference group and find that children with public insurance have a significant effect while those with no-insurance also have a positive effect (but is not significant) on the percentage of children diagnosed and medicated with ADHD.

Family Structure

Two parent families is the reference group for the category family structure. Relative to children from two parent household, children from families with only a mother present are significantly less likely to be diagnosed and medicated for ADHD. Other family structures are also less likely to be diagnosed and medicated but in those cases, the relationship is not statistically significant.

Region

The frequency of diagnosis of ADHD varies geographically. Research (CDC, 2013) shows that mainland USA rates are higher on the east coast than on the west. To capture this pattern we categorize the ten standard federal regions as established by the Office of Management and Budget (OMB) into two groups, East and West, based on the states locations within the regions and use a dummy variable to test for geographical impact. The states within the first five regions are labeled East and those within the next five regions are labeled West. Our results indicate that relative to the western states children in the eastern states are significantly more likely to be diagnosed and medicated for ADHD.

CONCLUSIONS

The results of this study indicate that race, gender and other socio-economic variables have a significant effect on the proportion of children with ADHD who are medicated for this condition. It appears that two strong indicators of whether a child is medicated for ADHD are that child's race and gender, even when socio-economic characteristics such as income and family structure are controlled for. We suggest that this may be due to the very subjective manner in which the condition is diagnosed. This is particularly alarming when one considers that the medications used to treat this condition are very strong, and are sometimes compared to several illegal drugs, such as "speed" and cocaine.

We therefore suggest that those working with and studying ADHD might want to investigate a way to diagnose this condition that is less subjective. We suggest that they look for a more standard way to assess a child's behavior or to control for randomness in the way teachers or parents answer the surveys they are given. Only then will we be sure that all of the children diagnosed and medicated for this condition require such intervention, and that all children in need of help are identified and diagnosed in the process.

AUTHOR INFORMATION

Walter O. Simmons is Professor and Chairperson in the Department of Economics and Finance, in the Boler School of Business, John Carroll University. He received his Ph. D in Economics from Wayne State University, in Detroit Michigan and his undergraduate degree from Oakwood University in, Huntsville Alabama. His research interests include issues in international financial centers, labor market discrimination, economics of health care, and the economics of the non-profit sector. E-mail: wsimmons@jcu.edu (Corresponding author)

Rosemarie Emanuele is Professor of Mathematics and Chair of the Mathematics department at Ursuline College. She received her Ph.D. in economics from Boston College. Her research has concentrated on the economics of the nonprofit sector, including the markets for paid and volunteer labor in this sector. E-mail: remanuel@ursuline.edu

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