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The Influence of Race, Economics, Neighborhood, And School Category on the Severity of ADHD Symptoms

A thesis submitted to
The Department of Psychology
College of Arts, & Sciences

In partial fulfillment of the requirements
for a Master of Arts degree in Community Psychology

by

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The Influence of Race, Economics, Neighborhood,

And School Category on the Severity of ADHD Symptoms

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Abstract

An ordinal regression method was used to model the relationship between the ordinal outcome variable, an ADHD index created for the purpose of this research, and the predictor variables of Race, Economics, Neighborhood Rating, and School Category/Type. A secondary data analysis of the Panel Study of Income Dynamics (PSID) and Child Development Supplement (CDS) was used in this study. The final sample consisted of 1,169 elementary, middle, and high school children ages 9-18. Six analyses were conducted to determine the best fit model for the data: a combined model with all the predictor variables, one for each individual predictor variable, and one model with the combination of race and neighborhood because they were the closest in showing value. The individual model using the variable on race was the only model that showed fit at a statistically significant level. Although the model was a good fit, the R^2 was statistically small, which showed that race is likely to be a poor predictor of the outcome of ADHD severity for any student.

Keywords: ADHD, regression, PSID, CDS

Attention-Deficit Hyperactivity Disorder (ADHD) is one of the most common disorders in school-aged children. In a meta-regression analysis conducted by Polanczyk, De Lima, Horta, Biederman & Rohde (2007), over 102 studies revealed an ADHD prevalence rate of 5.3% for studies between 1978 and 2005. "A parent survey [conducted in 2009 by the Center for Disease Control and Prevention] revealed that 9.5% of those 4-17 years of age (approximately 5.4 million American children) had an ADHD diagnosis by 2007, representing a 22% increase in four years" (Wolraich, McKeown, Visser, Bard, Cuffe, Neas, Geryk et al., 2014, p. 563).

Similar to many other developmental disorders, ADHD runs in families. "First degree relatives of those with ADHD are two to eight times more likely than relatives of unaffected individuals to show ADHD" (Thapar, Cooper, Eyre, Langley, 2013, p. 4). Although genetic heritability is high, it is important to note that heritability estimates do not only include genetic influences, but also the effects of gene-environment influences. For example, these would include prenatal exposure to maternal cigarette smoking or peer rejection (gene-environment correlation) (Thapar et al., 2013).

In terms of environmental risks, there have been many different environment factors that have been reportedly associated with ADHD, but it has been difficult to identify which are causal (Thapar et al., 2013). Many of the observed associations could have been a consequence of negative mother-child relationship. A few environmental factors that have been determined to show an increased risk but have not been proven causal regarding ADHD are: maternal smoking, alcohol and substance abuse, maternal stress, low birth weight and prematurity, dietary factors, environmental toxins (e.g. lead),

and psychosocial adversity (e.g. low income and conflict between parent and child) (Thapar et al., 2013).

Some of the symptoms of ADHD include significant problems with attention span, impulse control, and motor activity level relative to similar-aged peers. The symptoms of ADHD have a strong effect on a child's academic success, which would eventually carry toward their future success; children who are left untreated with this disorder advance into adulthood with the risk of continued ADHD, antisocial behavior, and academic underachievement in comparison to the normal population of their age group (DuPaul, 1992).

In addition to the prevalence of ADHD, it is also important to note that a child either diagnosed with ADHD or displaying symptoms of ADHD will need a significant amount of support, which is usually obtained by their parents' accessibility to various supportive resources and structures. Accessibility of these resources is likely related to their socioeconomic status. Thus, three main socioeconomic variables that may have a significant influence on the accessibility of resources for children with ADHD will be considered in my research. These variables will be economics, neighborhood, and race.

<div align="center">**Socioeconomic Variables**</div>

Economics

Income plays a significant role in a family's well-being for both the parents and their children. "Financial resources can enable parents to secure access to good prenatal health care and nutrition; rich learning environment, both in the home and through child care settings and other opportunities outside the home; safe and stimulating neighborhood; and, for older children, good schools and a college education" (Duncan &

Magnuson, 2005, p. 37). Without a sufficient amount of income, parents access to

resources that would help their child thrive academically is limited, especially for a child

who is diagnosed with ADHD or is displaying symptoms of ADHD (Bradley, 2002).

It is more difficult for a family with a lower income to be able to afford or have

access to educational resources for their children. Bradley (2002) discussed the

significance of children being exposed to educational resources and the child's academic

achievement. It is important to note that, "access to [learning] material and cultural

resources mediates the relation between SES (or family income) and children's

intellectual and academic achievement from infancy through adolescence" (Bradley,

2002, p. 381). For a family who is living in poverty, it is not likely that they will be able

to afford educational resources or be able to provide a stimulating learning environment

for their child, specifically, for a child displaying symptoms of ADHD. "…The key

advantage bestowed by higher income is a stimulating learning environment. The number

of books and newspapers in the home and the access of children to learning experiences

routinely explain about a third of the poverty 'effect'" (Duncan & Magnuson, 2005, p.

37). Lee & Wong (2004) found in their study that the lower the median household

income was, the lower educational support and attainment the parents had for their

children.

Proper educational support and resources are crucial to a child's academic

development, regardless if that child is displaying symptoms of ADHD or not. A child's

academic success carries toward the child's future success and this is particularly

dependent on the parents' financial resources. "Children who lived in families with

higher income scored higher on cognitive tests and had fewer behavior problems. [It was

found that] only for the W-J letter-word score outcome did income remain a significant predictor. Every $10,000 increase in family income was associated with about half a point increase in the letter-word score" (Yeung, Linver, & Brooks–Gunn, 2002, p. 187). Klebanov et al. (1998) also found that poor children's IQ scores are more negatively affected by risks than are non-poor children's scores. "The effects of low risks on IQ scores appear mediated by the home environment. Lower risks are associated with better home environments, which in turn are associated with higher IQ scores" (Klebanov et al., 1998, p. 1429). Similarly, Duncan & Magnuson (2005) found that children whose families faced deep and persistent poverty displayed the worst academic achievement and registered the largest achievement gap, "which again suggests that these children would gain the most from added income" (Duncan & Magnuson 2005, p. 37). It is clear to see that families with a higher income are able to provide educational support and resources to help their child thrive academically.

The resources that they are able to provide to their family, especially for their children and their childrens' academic success depends on more than just their income. These resources and academic support are also influenced by the neighborhood they reside in as well.

Neighborhood

The location of a child's residence has a significant effect on a child's academic success. "The location of schools is closely related to the social and economic conditions of students" (Sirin, 2005, p. 420). The child's residence determines the school that the child would be attending as well as the quality of community educational support programs, if any. "Disadvantaged neighborhoods may have fewer institutional resources

for parents to draw upon to support their efforts to raise children, such as high-quality

child care, preschool programs, family centers, and the like" (Kohen et al., 2008, p. 164).

Data from the National Longitudinal Survey of Youth and the National Household

Education Survey indicated, "that children from poor families have less access to a wide

variety of different recreational and learning materials from infancy through adolescence"

(Bradley, 2002, p. 381). By living in a disadvantaged neighborhood, the educational

resources are limited to the child, which directly affects the child's future success. It is

important to note that disadvantaged neighborhoods tend to have fewer investments in

their educational institution, therefore; even though parents may have access to higher

quality resources, those resources won't necessarily be available. "In a nationwide study

of more than 17,000 school districts, Parish, Matsumoto, and Fowler (1995) found that

higher neighborhood SES, as measured by the value of owner-occupied housing or by

resident's educational attainment, is significantly related to greater school expenditures

per student [and differential resources were available for schools in different locations]"

(Sirin, 2005, p. 441). Similar to Sirin (2005), Catsambis & Beveridge (2001) found in

their study that with socioeconomic disadvantage, the poorest neighborhoods tended to

experience institutional disinvestment and to also have higher rates of residential

instability and financial dependence. "Data from the National Assessment of Educational

Progress indicated that the achievement of children in affluent suburban schools was

significantly and consistently higher than that of children in 'disadvantaged' urban

schools" (Sirin, 2005, p. 421).

        The quality of the neighborhood the child resides in also has a significant effect

on the child's overall development as well as their academic success. "Children benefit

from parents who are physically and emotionally healthy and live in safe neighborhoods where they trust their neighbors. These features are less typical in low-SES communities. For preschool children, in particular, the family plays a central role in children's development including the transmission of neighborhood effects" (Kohen et al., 2008, p. 164-5). These neighborhood effects would be identified as possible risks for the child. "Significant effects are found for neighborhood poverty, as well as for family poverty and family risks. Children from more affluent neighborhoods have higher IQ scores than children from less affluent neighborhoods, suggesting that the effects of neighborhood and family economic hardship are not accounted for by the number of other risk factors present" (Klebnov et al., 1998, p. 1429).

Kozyrskyj et al. (2002) found in their study that children who are living in neighborhoods with less healthy populations were more likely to have poorer school performance, as indicated by Grade 3 math standards test scores. Although these children had similar access to library books as children living in more healthy neighborhoods, they were also more likely to change schools and to have decreased access to licensed daycare, circumstances that could lead to poor school performance. This is similar to what Catsambis & Beveridge (2001) found in their study, as mentioned earlier, that the poorest neighborhoods tend to have the most families who are struggling with residential stability.

A child's surrounding in a disadvantaged neighborhood is also a risk factor for the child's academic success. In a neighborhood with higher SES neighbors, the child's immediate surroundings provide local opportunities for enrichment and learning. Most children who have contact with those in higher SES neighborhoods were also more likely

to be exposed to a variety of opportunities by experiencing direct contact with stimulating and enriching adults (Chase-Lansdale & Gordon, 1996). The risk posed by low-quality neighborhoods are the most striking in high poverty urban communities that are populated with gangs, drug activities, vacant buildings, and disinvestments in businesses and schools. In neighborhoods that are perceived as dangerous, the child's parents may be more restrictive of their child's activities. This could possibly limit learning opportunities and growth for the child (Barbarin et al., 2006).

In an experiment discussed by Duncan & Magnuson (2005), the study offered families the opportunity to move from high-poverty to low-poverty neighborhoods. The study provided a compelling test of the extent to which neighborhood matters for children's development. Although families experienced dramatic changes in neighborhood conditions (low to high-poverty neighborhoods and high to low-poverty neighborhoods), children made no improvement on test scores, school success, school engagement, or behaviors. One possible explanation is that while the neighborhoods improved a great deal, the schools attended by the children did not. The interventions implemented focused exclusively on neighborhoods rather than on influences directly related to the child, family, and school. Schools alone cannot solve the numerous problems of children growing up in high-poverty urban neighborhoods, implemented interventions would have to be focused on the child, family, and school as a whole (Duncan & Magnuson, 2005).

Sirin (2005) found that family SES variables were not as predictive of academic achievement as were neighborhood SES factors. It is clear to see that neighborhood characteristics have a substantial influence on a child's academic success. The

neighborhood that the child resides in can either limit or provide educational resources with a stimulating learning environment. However, neighborhood factors are not the only factors that can either increase or decrease a family's resources. A family's race and background can also influence the family's accessibility to resources for their child's academic success.

Race

Racial and cultural background are critical factors in a child's academic success. "On average, when Black and Hispanic children begin school, their academic skills lag behind those of whites. Accounting studies find that differences in socioeconomic status explain about half a standard deviation of the initial achievement gaps" (Duncan & Magnuson 2005, p. 47). Duncan & Magnuson (2005) found that Black and Hispanic children are much more likely to experience hardships than are white children. "The racial gaps in family socioeconomic status (SES) of the children in ECLS-K (Early Childhood Longitudinal Study) closely matched the gaps in test scores. The average socioeconomic level of black kindergartners was more than two-thirds of a standard deviation below that of whites. Hispanic children had even lower socioeconomic standing relative to whites" (Duncan & Magnuson 2005, p. 36). The prevalence of single-parent families, low birth weight, harsh parenting due to cultural norms (e.g. spanking), and maternal depressive symptoms are highest among African American children and Hispanics are known to have extremely limited children's books in their homes (Duncan & Magnuson 2005). Children's books are a learning resource for children's academic development, without access to resources such as books, it is more difficult for a Hispanic child to succeed academically.

Davis-Kean (2005) also found that for African Americans, the relations of both parents' educational attainment and family income were related directly to their children's achievement. "Other significant school-level effects indicated that African American students had lower GPAs in schools where White and Asian students had a parental educational advantage and more African Americans attended the school, and they had a lower probability of going to college when they attended schools with higher aggregate levels of parent education" (Muller et al., 2010, p. 1054). This is significant because it shows these African American's parents have been living in a neighborhood with poor access to resources before they had children. Their parents have also been living in an environment with limited stimulating education resources that might be due to family hardships. For example, an individual who is a minority and who just moved here from a different country will have more difficulty finding a job and establishing wealth than someone who was born in the United States into middle or high income family.

A family's racial and cultural background has a substantial influence on the family's accessibility to resources. Although race does have an influence on the child's academic support, all three socioeconomic variables (economics, neighborhood, and race) actually impact the family's accessibility to academic resources.

Intersectionality Between Economics, Neighborhood, and Race

It seems that the educational institutions that have a higher population of disadvantaged students also tend to be in poverty themselves. That is, "there is [a] strong relationship between school-level poverty status and percentage of minorities in school; as the percentage of minority students increases, the percentage of the student body that

is poor is highly likely to increase. In other words, poor students are extremely likely to be concentrated in schools with disproportionately large African American student bodies" (Caldas & Bankston, 1997, p. 275). This continues to put minorities at a disadvantage for academic success because they are only being exposed to those who are struggling academically as well. Students who are "attending school with classmates who come from higher SES also tend to positively raise one's own academic achievement" (Caldas & Bankston, 1997, p. 275).

There are many factors that contribute to the strong correlation between race and culture and the lower academic achievement of minority students, "but the research indicates three main factors: minorities are more likely to live in low-income households or in single parent families; their parents are likely to have less education; and they often attend under-funded schools" (Sirin, 2005, p. 420). These three main factors limit children of different ethnic and racial backgrounds to succeed academically. They have access to limited resources; these include both tangible items (children's books) and conversations with someone in a more stimulating learning environment (classmates of higher SES).

It is clear that economics, neighborhood setting, and race intersect with one another. These socioeconomic variables also have a significant influence on a family's well-being and a child's academic success. "Socioeconomic variables, most often family income, parent education, employment, or a combination thereof, are a reliable correlate of children's academic outcomes" (Janus & Duku, 2007, p. 378).

Socioeconomic Status and Public and Private Schools

Economics, neighborhood setting, and race are associated in the literature in a way that directly influences a child's development and their academic success. It is obvious that socioeconomic status of a family significantly limits educational resources for a child's academic development.

There is a significant difference in the outcome of children who are attending a public educational institution and a private educational institution. The government publically funds public schools and private schools usually receive funding on their own (from the student population). Due to this reason, public educational institutions tend to enroll more students than private educational institutions. Whereas, in private education institutions, they tend to enroll less than public educational institutions due to the fact that they are more expensive and that they receive funding based on their own fundraising or from donations from the student body itself.

Based on a family's socioeconomic status, their access to a public or private educational institution varies. As discussed in previous sections, a family coming from a disadvantaged neighborhood might only have access to a public school of lower quality education. In contrast, a family coming from a wealthy family and higher socioeconomic status might have access to a prestigious private educational institution that offers higher education quality. The accessibility to these two types of educational institutions also determines the family's accessibility to provide academic support for their child.

Academic support is significant for a family who has a child who is diagnosed and/or displaying symptoms of ADHD. The type of educational institution for the child is significant, given the fact that the quality of education is distinctive, but what is more important is the quality of support and resources offered by the educational institution.

There are numerous studies regarding the accessibility of resources for a child who is

residing in a disadvantaged neighborhood in terms of academic success, but not enough

regarding children who are diagnosed with ADHD or displaying symptoms of ADHD.

"Family SES, which will largely determine the location of the child's

neighborhood and school, not only directly provides home resources but also indirectly

provides 'social capital,' that is, supportive relationships among structural forces and

individuals (i.e., parent-school collaborations) that promote the sharing of societal norms

and values, which are necessary to succeed in school" (Sirin, 2005, p. 420). For a child

with ADHD, as mentioned earlier, the symptoms of ADHD require a significant amount

of home resources and classroom resources for the child to succeed academically. There

has not been enough attention on the prevalence of ADHD symptoms in children

attending private educational institutions and private educational institutions in regards to

family socioeconomic status.

The relationship between a family's SES and academic achievement is strong and

positive; on average, the higher a student's SES, the stronger his or her educational

outcomes tend to be. In a meta-analysis of 74 studies about SES and academic

achievement, Sirin (2005) confirmed that, "family SES at the student level is one of the

strongest correlates of academic performance. For example, higher SES students typically

have higher scores on standardized achievement tests and are more likely to complete

secondary school and university than their peers from lower SES backgrounds" (Perry &

McConney, 2010, p. 1138). The family's socioeconomic status also helps to determine

the kind of school and classroom environment the student has access to. "Past research

that compared low-SES schools with higher-SES schools found several important

differences in terms of instructional arrangements, materials, teacher experience, and

teacher-student ratio" (Sirin, 2005, p. 438). Because there has not been enough research

to distinguish between populations in public educational institutions and private

educational institutions, this is something worth exploring. There could be a significant

difference in the number of resources for children with ADHD offered at these

institutions due to population (children diagnosed and/or displaying symptoms of ADHD)

and socioeconomic differences.

Perry & McConney (2010) found that "private schools receive an equal share of

public funds, proportional to their enrollments, as public schools do, but they also charge

fees. Thus, many private schools enjoy a funding advantage compared with their public

counterparts, and this would be especially true for the high-status, high-fee schools that

enroll large numbers of high-SES students" (Perry & McConney, 2010, p. 1158). Perry &

McConney (2010) also discussed that private schools have largely used public funds to

increase the quality of their educational resources rather than increase access by reducing

school fees. Thus, the two highest mean school SES groups may be associated with

steeper increases in student achievement because they are more likely to be considerably

better resourced than the lower mean SES schools.

SES, specifically economics, neighborhood setting, and race are all connected to

the family's accessibility of resources, one key aspect being realistic access to strong

public or private schools. These resources are critical in a child's academic success.

"Children with fewer risk factors (which included single-parent family status, utilization

of social assistance, and parent's education) were more likely to arrive at kindergarten

with better cognitive and reading skills" (Janus & Duku, 2007, p. 378). Growing up in a

family with a lower socioeconomic status and residing in a disadvantaged neighborhood is undesirable to a child's academic growth, especially for a family with a child who is displaying symptoms of ADHD and is struggling academically.

Due to the significant influence that an education institution has on a child's success, along with the socio-demographic factors of race, SES, and neighborhood characteristics, an exploration between a public and private school's population of ADHD children and how the socioeconomic status of a family impacts their accessibility to resources is worth investigating. "Future educational and social programs should provide more support for these and other innovative programs that can lift the educational achievement of those who are at risk for school failure because of family SES. Without such support, the current system is likely to produce an intergenerational cycle of school failure because of family SES" (Sirin, 2005, p. 446). As for a child who is struggling academically and showing symptoms of ADHD, they deserve to be in an educational institution offering the best support possible for their academic success and future success, regardless of their socioeconomic status.

Method

Participants

A secondary data analysis of the Panel Study of Income Dynamics (PSID) and Child Development Supplement (CDS) was used in this study. The Panel Study of Income Dynamics began in 1968 with a nationally representative sample of over 18,000 individuals in 5,000 families and is still on going. The study is currently the longest running longitudinal household survey in the world and is conducted by the Institute for Social Research University of Michigan.

The CDS was added to the PSID in 1997 and included households with children ranging from age 0-12 from the originally PSID sample. This survey collected information regarding child development, school characteristics, and the child's community. The researchers were able to successfully collect data in 1997 with 2,394 families providing information on 3,563 children, in 2002, and in 2007 with the families that remained active in the PSID panel.

For this study, the sample was drawn from the 2007 data collection, CDS III (N=3563). 1,412 participants (40%) were excluded from the sample because they were over the age of 18. Twenty-eight percent, or 982 participants, were also omitted from the sample due to missing data regarding the questionnaires. The final sample consisted of 1,169 elementary, middle, and high school children ages 9-18. The secondary data analysis was approved by Concordia University – Portland at the Concordia University Institutional Review Board.

Procedure

The primary predictor variables in this study were the children's race, school category (public or private educational institution), household income (economic level), and neighborhood rating. To obtain index values of household income and neighborhood rating, both ordinal level variables in this study, multiple PSID variables were combined. For household income, responses to the questions "amount of money left over at the end of the month," "applied for government assistance," "bankruptcy," and "behind on bills," were recoded and combined. For neighborhood rating, responses to the questions "safe to walk around" and "neighborhood rating" were also recoded and combined.

The predictor variable of child's race was defined using the following PSID categories: White, Black, Hispanic, Asian or Pacific Islander, and American Indian or Alaskan Native. For the school category or type predictor variable, it was defined as Public School or Private School.

The outcome variable for this study was an ADHD index constructed from the PSID/CSD data. The ADHD symptoms were recorded and observed by the child's primary caregiver with specific attention to feedback from teachers and behavior in and out of the classroom and the child's home. To derive this index, three variables were recoded and combined, "Hyperactivity," "Inattentiveness," and "Impulsive." This category was defined on a scale from 0-5, with 0 being no symptoms of ADHD and 5 being extremely symptomatic.

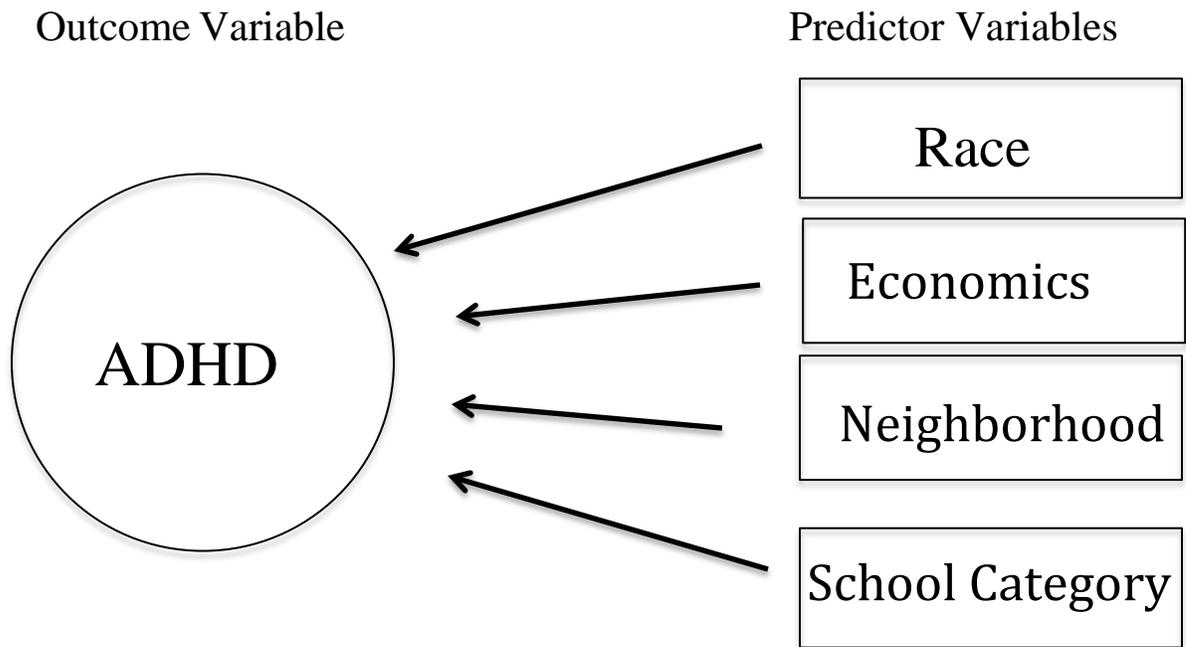The outcome and predictor variables are summarized in figure 1.

Outcome Variable   Predictor Variables

Figure 1: The model for a family's socioeconomic status toward the symptoms of ADHD.

Hypothesis

Based on the literature, it is hypothesized that a family's SES has a significant effect on a child's risk in regards to ADHD symptom severity. More importantly, neighborhood factors will have the most impact on a family's accessibility to resources, which will determine the higher risk of ADHD symptom severity in school-aged children. In terms of school type, public schools are hypothesized to have more children at risk for ADHD symptom severity than private schools, due to the diverse demographics and amount of funding.

<div align="center">

Results

</div>

The SPSS package, version 24, was used to run the data analysis. Six ordinal regression analyses were completed to assure the best attempt at seeking the best-fit model for the data. Constructing an ordinal regression model begins with identifying the ordinal outcome variable. In this case, the ordinal outcome variable is the severity of ADHD symptoms. Then, the predictors need to be identified, and these were determined to be the variables as shown in Figure 1 (race, economic, neighborhood, and school category). For the reader, example syntax is included for review in Appendix A.

In accordance with standard practice (Strand, Cadwallader & Firth, (2011), Elamir & Sadeq, (2010), Hohensee & Nies, (2012)), for each model the following was assessed in regards to how well the model fit the data. First, the model fitting information was examined. The model fitting information contains the chi-square statistic that indicates if the final model gives a significant improvement over the baseline intercept-only model. This indicates whether the model gives better predictions than if you just guessed based on the marginal probabilities for the outcome categories. Next, the

Goodness-of-Fit table is examined. This table contains Pearson's chi-square statistic for the model. These statistics are intended to test whether the observed data are consistent with the fitted model. A larger value > .05 shows that we have a good model whereas a smaller value shows that we have a poorly fit model. If the data fit well with the model, then the following will be reported: Pseudo R-Square Statistics, Parameter Estimates Table with Odds Ratio, and Test of Parallel Lines.

In linear regression, R^2 (the coefficient of determination) summarizes the proportion of variance in the outcome that can be accounted for by the explanatory variables, with larger R^2 values indicating that more of the variation is explained by the model, up to a maximum of 1. For ordinal regression models, it is not possible to compute the same R^2 statistic as in linear regression so three approximations are computed instead. These three approximations are Cox and Snell, Nagerlkerke, and McFadden. "Cox and Snell is based on the log likelihood for the model compared to the log likelihood for a baseline model. It has a theoretical maximum value of less than 1, even for a perfect model," (Elamir & Sadeq, 2010, p. 653). Nagelkerke is similar to Cox and Snell. It adjusts the scale of the statistic to cover the full range from 0 to 1. McFadden is the last version; it is "based on the log-likelihood kernels for the intercept-only model and the full estimated model," (Elamir & Sadeq, 2010, p. 654). The model with the largest R^2 value is 'best'.

The Parameter Estimates Table was used to calculate the Odds Ratios for each of the independent variables to interpret if there is a greater or lessor risk in regards to ADHD symptom severity (dependent variable) in the specific fitted model. As indicated earlier, syntax for the computation of those odds ratios was provided in Appendix A.

For ordinal models, the test of parallel lines can help evaluate the appropriateness of the proportional odds assumption. This test compares the ordinal model, which has one set of coefficients for all thresholds (labeled Null Hypothesis), to a model with a separate set of coefficients for each threshold (labeled General). If the general model gives a significantly better fit to the data (p<.05), then we are led to reject the assumption of proportional odds.

Analysis #1: Combined Model

The combined model consists of all the predictor variables into one model: Race,

Economics, Neighborhood, and School Category. Before examining further, the fit of the

model was assessed by the Model Fitting Information (Table 1).

Table 1
Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	958.035			
Final	921.815	36.220	16	.003

For the model fit, the significant chi-square statistics value that would indicate a

good fit would be a $p < .05$. This model provided a good fit according to the Model Fit

Information, with a p-value of .003. Next, as mentioned previously, the Goodness-of-Fit

table also needs to be examined before moving forward.

Table 2
Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	660.142	532	.000
Deviance	514.622	532	.698

The Goodness-of-Fit table (Table 2) represents whether or not the observed data is consistent with the fitted model. For this model to fit well, a p-value of > .05 would signify that the null hypothesis cannot be rejected, which would then conclude that the data and the model predictions are similar and the model is well fit. In this case, the combined model was not a good fit for the observed data. Although the model fitting information table provided significant values that led us to believe that the model was a good fit, the Goodness-of-Fit table determined that the observed data was not consistent with the fitted model. Hence, the combined model was rejected.

Analysis #2: Individual Model: Race

The second analysis was done as an individual model focusing on race. The

Model Fitting Information (Table 3) provided significant results.

Table 3 Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	96.768			
Final	79.646	17.122	4	.002

A significant chi-square statistic of $p < .05$ would indicate that this model would

give a significant improvement over the baseline intercept-only model. This model

resulted in a p-value of .002, which is significant and determines that the model is a good

fit so far. This also concludes that the model is able to give better predictions in regards

to how race has an affect on ADHD symptoms rather than if one were to guess based on

the marginal probabilities.

Table 4
Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	6.492	12	.889
Deviance	7.350	12	.834

For the Goodness-of-Fit table (Table 4), the values are also significant. To

conclude that the model fits well, a p-value of > .05 is needed. The Pearson's chi-square

statistic is .889 in this model, which determines that the observed data were consistent

with the model. Hence, this model will be accepted and the model could be examined in

more detail.

Table 5	
Pseudo R-Square	
Cox and Snell	.015
Nagelkerke	.016
McFadden	.006

As formerly mentioned, the Pseudo R-Square (Table 5) summarizes the

proportion of variance in the outcome that can be accounted for by explanatory variables,

with larger R^2 values indicating more variation. This table shows three versions to

estimate the coefficient of determination. With these models, the largest R^2 statistic

determines the "best" result according to this measure. In this model focusing on race, the

Nagelkerke R-square value is .016 = 1.6%. This shows that although the race model is

statistically significant, race explains a small proportion of the variance between students

and their ADHD symptom severity. This determines that in a model including race as the

only predictor variable is likely to be a poor predictor of the outcome of ADHD symptom

severity for a student.

The Parameter Estimates Table is also another component of the results that is important to interpret. With the use of the output of the Parameter Estimates Table, the odds ratios can be calculated, as shown in Table 6.

Table 6 Odds Ratio			
Item	**Exp_B**	**Lower**	**Upper**
ADHD = 0	.012	.001	.162
ADHD = 1	.033	.002	.440
ADHD = 2	.320	.024	4.302
ADHD = 3	2.646	.197	35.489
RACE = 1	.122	.009	1.647
RACE = 2	.081	.006	1.091
RACE = 3	.074	.005	1.029
RACE = 4	.112	.007	1.679
RACE = 5	1.000	-	-

By looking at table 6, we can see which races have a greater or lessor risk in the model in regards to ADHD symptoms. The odds of Whites (Race = 1) displaying ADHD symptom severity compared to other races in the model was 12% (.122), with a 95% CI, .009-1.647. The odds of Blacks (Race = 2) displaying ADHD symptom severity was 8% (.081), with a 95% CI, .006-1.091. For Hispanics (Race = 3), the odds that they are at risk for displaying ADHD symptom severity was 7% (.074), with a 95% CI, .005-1.029. For Asians or Pacific Islanders (Race = 4), the odds of them displaying ADHD symptom severity is one percent lower than Whites, 11% (.112), with a 95% CI, .007-1.679. The

odds of risk that American Indian or Alaskan Natives have in regards to ADHD symptom

severity is 100% (1.000), with a 95% CI.

The race that seemed to have the most risk compared to all other races would be

the American Indian or Alaskan Natives, according to the odds ratio. Unfortunately, this

may not be an accurate representation of American Indians or Alaskan Natives because

there were only two American Indians or Alaskan Natives in our final sample (0.2%).

Following American Indians or Alaskan Natives, Whites seem to show the greatest risk

in regards to ADHD symptom severity in this model, 12%, compared to all other races.

Table 7

Test of Parallel Lines

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	79.646			
General	72.020[b]	7.626[c]	12	.814

For this model, the test of parallel lines (Table 7) can help the researcher assess whether the assumption that parameters are the same for all categories is likely or not. This test compares the ordinal model that has one set of coefficients to a model with a separate set of coefficients. In this model, we see that the significant level is large, .814, p > .05, which would lead us to conclude that the proportional odds assumption is very reasonable.

Analysis #3: Individual Model: Economics

For the third analysis, an individual analysis was done focusing on economics.

The Model Fitting Information table (Table 8) did not provide significant results.

Table 8				
Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	97.479			
Final	93.648	3.831	4	.429

For the model fitting information table, a significant chi-square statistic, with a p-value of $< .05$ was needed for the model to provide better predictions than if one were to guessed based on marginal probabilities for the outcome categories. With this model, a p-value of .429 was the outcome, which determines that this model is not a good fit.

Table 9 Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	9.827	12	.631
Deviance	12.365	12	.417

Although the Goodness-of-Fit table (Table 9) resulted in significant results, .631 (p > .05), because the Model Fitting Information table did not show good fit with the observed data, the model must be rejected.

Analysis #4: Individual Model: Neighborhood

Similar to the individual model focusing on economics, the fourth model was done focusing on neighborhood ratings.

Table 10 Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	166.404			
Final	152.997	13.407	7	.063

Unfortunately, similar to the previous model focusing on economics, this model would also need to be rejected. The Model Fitting Information table (Table 10) shows that the data is not a good fit with the model. This tells us that we are not able to make better predictions with this model. As noted earlier, a p-value of $< .05$ is needed to determine that the model fits the data well and this model resulted in a p-value of .063.

Table 11
Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	35.250	21	.027
Deviance	29.051	21	.113

The Goodness-of-Fit table (Table 11) also shows insignificant data, that we would reject the null hypothesis, with a p-value of $< .05$. In this model, the Pearson's chi-square statistic resulted in a value of .027, which concludes that the observed data is not consistent with the model and the model would be rejected.

Analysis #5: Individual Model: School Category

For the last individual model, the focus on was on the school category or type.

Table 12				
Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	45.111			
Final	44.341	.770	1	.380

Similar to the last two models (economics and neighborhood), this model also did not show a good fit with the data. As seen in Table 12, this model resulted in a p-value of .380, which is > .05. To be able to conclude that this model is a good fit, a p-value of < .05 was needed.

This determines that this model does not give better predictions in regards to school category and ADHD symptoms.

Table 13 Goodness-of-Fit			
	Chi-Square	df	Sig.
Pearson	3.186	3	.364
Deviance	2.930	3	.403

Also similar to the previous models listed above, the Goodness-of-Fit table (Table 13) resulted in Pearson's chi-square statistic as significant, with a p-value of .364. Unfortunately, the model fitting information table did not conclude with a good fit, in which the model would be rejected.

Analysis #6: Combined Model: Race & Neighborhood

For the last model, an attempt of construct a better model with a complete fit was initiated. A model consisting of only these two variables, Race and Neighborhood, was assessed because they showed the most fit to the individual models. The individual Race model resulted in a complete fit with the data (.002) and the Neighborhood individual model was close to a model fit (.063).

Table 14 Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	388.456			
Final	357.161	31.295	11	.001

With this combined model, the Model Fitting Information table (Table 14) shows significant results. It resulted in a significant p-value of < .05, which shows that the model fits the data extremely well.

Table 15

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	145.673	109	.011
Deviance	124.249	109	.151

As for the Goodness-of-Fit (Table 15) for this model, it showed the opposite. As noted previously, for a model to be a good fit, the data must also be consistent with the model. Unfortunately with this model, the data did not seem to be consistent with the model even though the model was a good fit. A Pearson's chi-square statistic for this model would need to be $> .05$ for the observed data to show that it is consistent with the fitted model. This concludes that similar to the previous models, this model would also need to be rejected.

Discussion

Summation of Results

The hypothesis that the socioeconomic status (race, economic, neighborhood rating, and school type) of a family is associated with a child's symptom severity of ADHD was not supported in this study. The models used in this study did not show a good fit with multiple variables in this study, economic, neighborhood rating, and school type. The combined model, consisting of all the variables, also did not show an improvement in model and observed data fit. In an attempt to improve this, an additional combined model was completed with the two independent variables that resulted in the most fit with the model (Race and Neighborhood). Unfortunately, this model also did not demonstrate a good fit with the data being consistent. The only model that seemed to be a good fit and the data being consistent with the model was the individual model focusing on Race.

With the individual model focusing on Race, it was found that Whites seem to have the most risk in regards to ADHD symptom severity within the model (12%) in comparison to other races (Blacks, Hispanics, Asians, American Indians or Alaskan Natives). The overall data suggests very little variance between students and ADHD symptom severity, which shows that the model would most likely be a very poor predictor of the outcome of ADHD severity for any student.

Literature Connection

The results from this study did not align with any of the literature that was previously presented. The study certainly diverged from the literature in a few areas. First, the only model that fit the data well and was consistent was Race. It was discussed

in the literature that Race has a significant influence on a family's access to resources due to cultural backgrounds. In this study, the results showed that Whites were the ones with the most risk in regards to ADHD symptom severity in comparison to the other races. However, in the literature Blacks and minorities were mentioned as being the ones with the most risk to ADHD due to their upbringing and cultural background.

Second, it was mentioned in the literature by Sirin (2005) that neighborhood SES variables would be the most beneficial and accurate in predicting academic achievement compared to other SES variables. In this study, the neighborhood model was a good fit with the model chosen, but the data was not consistent with the model. In terms of the variables used in this study, economics, neighborhood, race and school type, it was hypothesized that neighborhood would show the most influential results based on what Sirin (2005) mentioned in their study.

In terms of environmental factors, Thapar et al. (2013) discussed in their study that environmental factors have been observed to show great risk for children with ADHD, yet, there has been no proven causal relationships between any of the factors and ADHD. With the Race model in this study, although it had significant results, there was also no clear determination if Race would be a causal effect on ADHD. It was only able to show that based on environmental factors surrounding Race, there is a slight risk for ADHD in school-aged children.

Strengths and Weaknesses

The only strength in this study would be that race did in fact show an influence on the risk of ADHD symptom severity. Again, this was the only model that fit the data well. Although the results did not align with the literature precisely, it did show that there

was a clear difference between which races were more at risk of ADHD symptom

severity compared to others.

Unfortunately, this study contained a few weaknesses. The model chosen for this

study did not fit the data very well. There were some models, for example, the

neighborhood variable, where the model fit well, but the data was not consistent with the

model. This caused inaccurate results in regards to the variable and did not provide very

much information. Another weakness in this study was that there were not enough race

representation in the data. Although race did show a clear difference in which races had

more risk than others, there were very few minorities in the data itself. This could have

misrepresented the actual impact that race has on the risk of ADHD symptom severity.

Another weakness of this study was that it was only able to cover environmental

factors regarding ADHD in a very broad manner. Information regarding the symptoms of

ADHD was pulled from the survey without much depth. A study that also had

information regarding the diagnosis of ADHD and more information regarding the

symptoms in depth for each child, would be much more beneficial. This would also help

strengthen the study to determine any possible genetic-environmental correlations as

well.

In terms of the validity of the study, internal validity could be improved to help

the study be more beneficial. The dependent variable, ADHD, consisted of combined

variables of Hyperactivity, Inattentiveness, and Impulsive, from the questionnaire. The

questionnaire could be further analyzed for variables that better represented ADHD

symptoms and/or included more specific symptoms of ADHD. This is also true for the

independent variables, Economics, Neighborhood, Race, and School Type. There were

certain variables in the questionnaire that were chosen that I, the researcher, felt fit the

criteria to represent those specific independent variables. Researcher bias could have also

been avoided if a clear criterion was set beforehand to decide which variable would be

appropriate to represent the independent variables.

Future Research

Although the models used in this study did not represent a good fit with the

observed data, it is recommended for future research that a better constructed model

should be used to determine a clear positive or negative association between ADHD

symptoms and a family's socioeconomic status. As mentioned above, it is likely that the

independent variables and dependent variable could be represented by better individual

variables from the questionnaire. Another improvement that would help construct a better

model would be to gather information on the diagnosis of ADHD in school-aged children

rather than just the symptoms accompanying ADHD. This would help give a clear

distinction between which factor is most likely associated with ADHD because children

in the sample would be diagnosed with ADHD by a professional.

Another area recommended for future research would be to have a sample with

sufficient race representation. The data consisted of generally Whites and with very few

Blacks or minorities. The literature primarily focused on the impact that minorities and

Blacks have on the risk of ADHD symptom severity, yet, the data barely consisted of

any. This did not show a good representation of race and the risk of ADHD.

Conclusion

ADHD continues to be one of the most common disorders in school-aged

children. Children with ADHD need a significant amount of support from their parents,

which are usually determined by their family's socioeconomic status. There has been a

substantial amount of research on ADHD and socioeconomic statuses within families,

separately. Yet, there has not been very much research with focus to how socioeconomic

statuses affects the risk of ADHD symptom severity. There is no clear assumption that a

family's socioeconomic status could be a predictor in the risk of ADHD symptom

severity in children but there needs to be in order to fully address this common disorder

appropriately. Future research in this area is needed to better understand the affects that a

family's socioeconomic status has on a child's overall development, academically and

mentally, in regards to ADHD.

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APPENDIX A

Syntax for Race Model:

PLUM ADHD BY RACE
  /CRITERIA=CIN(95) DELTA(0) LCONVERGE(0) MXITER(100) MXSTEP(5)
PCONVERGE(1.0E-6) SINGULAR(1.0E-8)
  /LINK=LOGIT
  /PRINT=CELLINFO FIT PARAMETER SUMMARY TPARALLEL
  /SAVE=ESTPROB.

Syntax for Odds Ratio:

GET FILE = "/Users/angelnguyen/Desktop/Thesis FINAL Lit
Review/FINAL_DATASET.sav".
COMPUTE Exp_B = EXP(Estimate).
COMPUTE Lower = EXP(LowerBound).
COMPUTE Upper = EXP(UpperBound).
FORMATS Exp_B Lower Upper (F8.3).
EXECUTE.