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Beyond the ADHD Diagnosis: Does the insurance rate, mental health status in parents, and food availability in the United States impact or predict the prevalence of diagnosis of ADHD in children?

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Population and Public Health

Scholarship in Medicine Final Report

By checking this box, I indicate that my mentor has read and reviewed my draft proposal prior to submission

Abstract

More than 6 million children in the US have been diagnosed with ADHD in 2016 and many studies such as those performed through the National Survey of Children's Health have seen those numbers climbing through 2017.¹ Prevalence of ADHD itself has increased by 42% over the past 8 years.² This study analyzed, through the use of public data available through County Health Ranking and data through the Data Resource Center for Child and Adolescent Health if the insurance status, mental health standing of parents, and food availability in the United States could impact or predict the diagnostic prevalence of ADHD in children. Through preliminary correlation and regression analysis, this study showed that only mental health distress in parents had a statistically significant on ADHD prevalence. Though insurance rate and free and reduced-price lunches did not have a significant effect their impact on ADHD prevalence needs further evaluation. This analysis will allow for future change in how we think

about and analyze the diagnosis of ADHD and how treatment can be further than just pharmaceuticals and can address more of the social determinants of health.

Key Words: ADHD, mental health, food availability, insurance rate

Introduction

According to the CDC, more than 6.1 million children in the US have been diagnosed with attention deficit hyperactivity disorder (ADHD) in 2016 and many studies such as those performed through the National Survey of Children's Health have seen those numbers climbing through 2017.¹ Furthermore, prevalence of ADHD itself has increased by 42% over the past 8 years according to studies done by the National Institute of Health.² As the incidence of ADHD climbs within the United State as a whole, we are beginning to realize that this is a major public health condition and the need to understand the many factors influence, and can eventually predict, the prevalent diagnosis.

ADHD has commonly been described as a "familial disorder" and has often been associated with a set of hereditary and environmental risk factors, including, but not limited to socioeconomic status, family size, placement in foster care, race and gender.³ Anecdotally parents can often trace the behavior and thus the disease process from person to person. As the increasing prevalence of ADHD begins to unfold, researchers have placed more of an importance in understanding the genetic and hereditary features of the disease, questioning if there is a relationship between the diagnosis in children and the prevalence of mental health conditions in parents of that child. Many twin studies conducted on the ADHD population reinforce the strong genetic correlation within the diagnosis of ADHD. However, as the rates of ADHD rise nationwide more and more emphasis is being placed on whether a familial relationship is noted in mental health disorders and specifically in ADHD.⁴ One meta-analysis looked at published and unpublished studies to evaluate the association between parental psychopathology and childhood ADHD.⁵ Prior to its publication there had been conflicting statements about the validity of the correlation between parental mental health and diagnosis of mental health

conditions, namely ADHD in children. Through this meta-analysis, researchers were able to confirm a statistically significant relationship between childhood ADHD and parental psychopathology. Approximately 16.9% of parents of children with ADHD disorder themselves were diagnosed with mental disorder and parents of children with ADHD had 2.85 times the odds of parents of children without ADHD of having a mental disorder.⁵ Mental disorders in parents were not limited to ADHD but were noted to have had prior association with ADHD such as depressive disorders, anxiety disorders, personality disorders, and bipolar related disorders. Parental psychopathology in families of children with ADHD have also been shown to further exacerbate problems within the family, further increasing the likelihood of poor treatment outcomes, but also of more vital consequences such as poor healthcare follow up, poor insurance, and even struggles with food security.⁶

Just like ADHD, food insecurity is a major public health concern and has been associated with predisposing or even exacerbating mental health conditions in both children and adults. Evidence exists to show that early childhood exposure to environmental stressors, most notably food insecurity has been associated with exacerbating ADHD symptoms like inattentiveness, hyperactivity, and impulsivity.⁷ Furthermore, when periods of compromised nutrition occur during critical periods of early childhood development the likelihood that these disruptive symptoms not only continue into adolescence and adulthood but can even worsen throughout this time frame.⁷ Other large scale epidemiologic and observational studies support this relationship between the presence of early childhood food insecurity and symptoms of ADHD but research is lacking on whether early childhood food insecurity can truly impact and predict the diagnosis of ADHD.⁸ By contributing to this research stage, we can not only tackle the increasing rates of ADHD but also help combat food security by asking questions about food security at pediatric

ADHD appointments and pointing families to resources that they may not know about or be too afraid to ask.

Food insecurity isn't the only social determinant of health that has been linked to ADHD. Studies have linked socioeconomic status, paternal delinquency, race, gender, and household size to rising rates of ADHD.³ Few studies have remarked on how prevalence of health insurance impact children diagnosed with ADHD. Not only is ADHD testing, medication and treatment expensive, but interruption in treatment and delay in diagnosis have been linked to poor outcomes. Without insurance patients are not able to receive the care and treatment that they require further perpetuating this alarming rise in diagnosis. These factors all come together to give just a preview into the importance of understanding not only the condition of ADHD but the key factors that are behind the diagnosis.

In summary, research describing the symptoms and diagnosis of ADHD is robust and growing rapidly as the number of children diagnosed with ADHD expeditiously climbs. However, the literature is lacking in its detailed description of the diagnosis. More specifically, in how the signs and indicators of ADHD are related to social factors and determinants. This study will look to integrate, examine, and further investigate how parental psychopathology and mental health, food insecurity and insurance rates all impact the incidence and rising rate of ADHD in the United States as a whole. It will further begin to understand how these crucial health outcomes and communal factors may contribute to the diagnosis of ADHD, but most importantly determine if there is a predictable relationship between these factors and ADHD.

Hypothesis/Specific Aims/Research Questions

RQ 1: How did ADHD diagnosis prevalence change in the United States from 2016, to 2017, to 2018?

RQ2: How does the percentage of uninsured children correlate with the prevalence of ADHD in 2017?

RQ3: What is the correlation between frequent mental distress in adults with children diagnosed with ADHD in 2017 in the United States?

RQ4: How does rate of children who receive free or reduced-price lunch correlate with ADHD diagnosis in 2017?

RQ5: How can insurance rate, mental health status in parents, and food availability account for the variance in diagnosis of ADHD in children in 2017?

Methods

Data Collection

Data will be collected and utilized from publicly available domains. The prevalence of ADHD will be gathered from childhealthdata.org through their database for the United States for the years 2016, 2017, and 2018 in each of the 50 states and the District of Columbia. Rate of uninsured children, frequent mental distress in adults (as a factor of mental health status in parents), and percentage of children who receive free or reduced-price lunch (as a factor of food insecurity) will be collected from County Health Rankings for each of the 50 states. Children between the ages of 0-19 at the time of the various surveys living in the United States will be

included in data analysis, however prevalence of ADHD will include children age 3-17 as this is the time period of diagnosis.

The prevalence of ADHD status of children in the United States in 2016, 2017, and 2018 gathered from childhealthdata.org was collected also in the NSCH in 2017 by answering the question of “Has a doctor or other health care provider ever told you that this child has Attention Deficit Disorder or Attention-Deficit/Hyperactivity Disorder, that is ADD or ADHD?”. The question was then broken down into children who ADD or ADHD do not currently have, children who ever had ADD or ADHD, but not currently, and children who currently have ADD or ADHD.

Parental psychopathology and mental health status will be assessed as a frequent mental distress collected from County Health Rankings. This data was collected by looking at the percentage of adults in each state reporting 14 or more days of poor mental health per month in the year 2017 through the Behavioral Risk Factor Surveillance System (BRFSS). This is a state based random telephone survey that is conducted annually in each of the 50 states. Data obtained from the BRFSS are representative of each state’s total non-institutionalized population over 18. The responses have totaled more than 400,000 each year with landline telephones or cellphones since 2011. Data was weighted using ranking methods to reflect population distributions. One limitation of the BRFSS is that all measures are based on self-reported information which cannot be validated with medical records.

Food instability or insecurity will be analyzed through the factor of percentage of children eligible for free or reduced-price lunch through data collected from County Health Rankings in each state within the year 2017. This data was collected from the National Center for Education Statistics through a congressional mandate to collect statistics on the condition of American

education. The numerator in this data set is the number of public-school students grades PK-12 eligible for free or reduced price lunch while the denominator is the total number of students enrolled in public schools grade PK-12 in each state.

The percentage of uninsured children age 19 or under in each state in the United States for the year 2017 was accessed from County Health Rankings. This data was collected from the US Census Bureau's Small Area Health Insurance Estimates program through a complex statistical modeling. The numerator is the number of people under the age 19 who currently have no health insurance and the denominator being the general population under 19. A child is classified as uninsured if they are not currently insurance through a current/former employer or union from their parent or legal guardian, Medicare, Medicaid, Medical Assistance or any kind of government-assistance plan.

Data Analysis

Data was analyzed using both correlation and regression analysis and ANOVA with posthoc tests. RQ1 was analyzed with ANOVA with posthoc testing. Research questions 2-4 used Pearson correlation analysis. RQ5 was analyzed with stepwise linear regression.

Results

An ANOVA indicated that prevalence rates of ADHD in the United States in the years 2016, 2017, and 2018 (RQ1) were not significant different ($F_{2,150}=.249$, $p=.780$, Table 1).

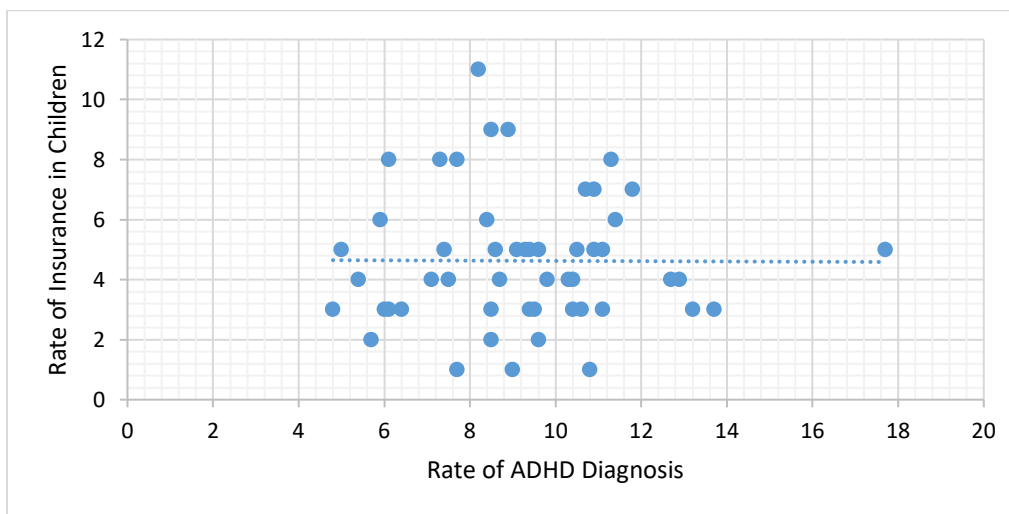
Table 1: Prevalence Rates of ADHD in the United States in 2016,2017, and 2018

Year	n	Mean	SD
2016	51	9.471%	2.37
2017	51	9.245%	2.49
2018	51	9.141%	2.35

Abbreviation: SD, Standard Deviation

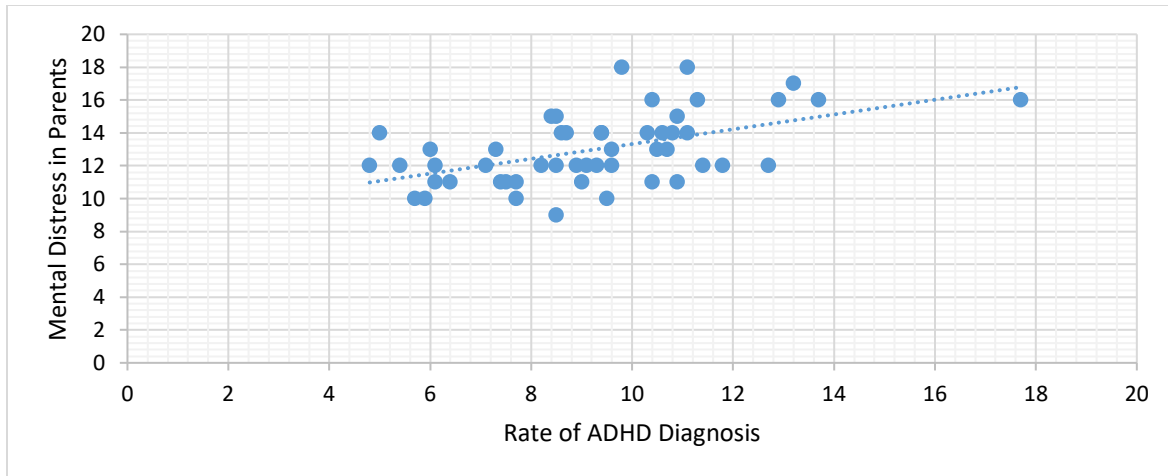
Looking at how the percentage of uninsured children correlates with the prevalence of ADHD diagnosis in the year 2017 (RQ2), a Pearson correlation analysis indicated a non-significant correlation ($r=-.005$, $p=.971$), indicating no relationship between ADHD prevalence and rate of uninsured children in the United States.(Figure 1).

Figure 1: Correlation Between ADHD Diagnosis Rate and Insurance Rate in Children in the United States



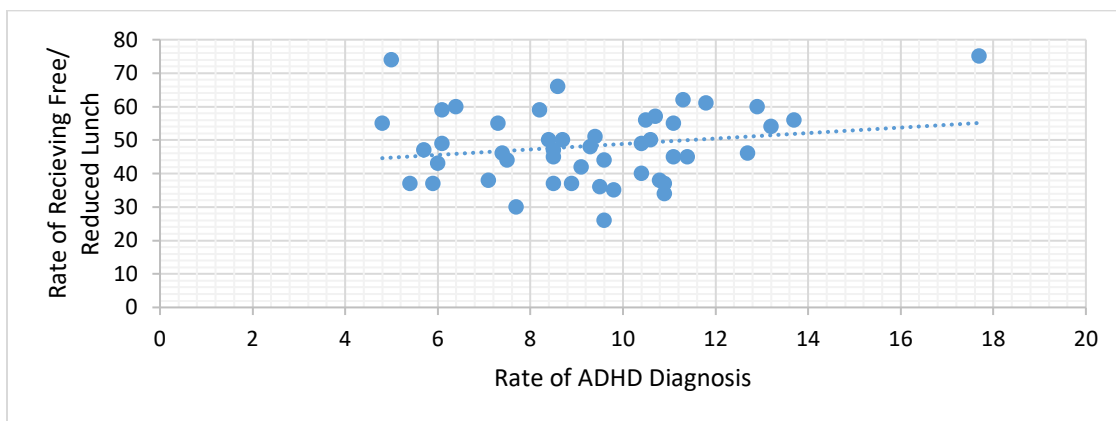
The third research question (RQ3) looked at the correlation between frequent mental distress in adults with children diagnosed with ADHD in 2017 in the United States. A Pearson correlation indicated a moderately significant correlation ($r=.524$, $p<.001$), whereas mental health distress in adults increases, so does the prevalence of ADHD diagnosis in children (Figure 2).

Figure 2: Correlation Between ADHD Diagnosis Rate and Mental Health Distress in Adults in Children in the United States



Similarly, our fourth research question (RQ4) looked at the correlation between the rate of children who receive free or reduced-price lunch with ADHD diagnosis prevalence in 2017. A Pearson correlation indicated no significance between the two variables ($r = .196$, $p = .188$, Figure 3).

Figure 3: Correlation Between ADHD Diagnosis Rate and Rate of Children who receive Free or Reduced Price Lunch in the United States



Finally, our last and final research question (RQ5) examined how insurance rates, mental health status in parents, and food availability can account for the variance in diagnosis of ADHD in children in 2017. A stepwise linear regression showed that the best fitting model was not

significant. The only variable that significantly contributed to the model was mental distress in parents ($F_{1,45}$, $p < .001$), accounting for 27.1% of the variance in ADHD diagnosis prevalence ($B = .617$, $t = 4.092$, $p < .001$). Rate of uninsured children and use of free or reduced lunch did not contribute significantly to the model.

Discussion

While many aspects of this study did not produce statistically significant data, the study did produce further understanding regarding the intricacies of the ADHD diagnosis. Literature regarding incidence of ADHD has stated that incidence and rate of diagnosis of ADHD is on the rise in the United States, and the first research question of this study looked to examine this phenomena.¹ While there was no statistically significant rise in prevalence of ADHD in the United States over 2016, 2017, and 2018 when looking at state-level diagnosis prevalence, there is little doubt that ADHD is a prevalent diagnosis, though potentially no longer significantly increasing. This could very likely be due to increased awareness and understanding regarding the diagnosis of ADHD and better knowledge of how to recognize the disease. Though the disease seems to have plateaued in frequency over the past couple of years, it can be suggested that there could be another rise in prevalence in the years to come as the boom of children diagnosed in the early 2000s start to have their own children, further adding to the description of familial disorder.³

The second question of this study looked to examine the relationship regarding insurance rate in children and the diagnosis of ADHD. While research has frequently linked socioeconomic status and household size to rates of ADHD, our data did not establish a statistically significant relationship between rate of uninsured children and diagnosis of ADHD.³ This could be due to a variety of reasons including lack of ability to seek healthcare in this population to establish a

diagnosis of ADHD or just a lack of a relationship regarding this social determinant of health. Regardless of the underlying reason, working to ensure that children have adequate access to healthcare and mental health services in particular is still crucial so that diagnosis of ADHD and other mental health disorders can be firmly established for initiation of treatment.

Contributing to the literature regarding ADHD and its possible inheritance, our third research question did shed light on the notion of ADHD having familial connections. We found that as parents experienced mental health distress, the rate of ADHD prevalence in the United States increased in a statistically significant way. This supports the notion that many children who are diagnosed with ADHD have parents with some form of mental health disorder.⁴ More work needs to be determined regarding the direct, potentially genetic relationship between the diagnosis of ADHD in the parent and the likelihood of the child having the same diagnosis, but, regardless of genetics, children with parents suffering from mental health disorders are more likely to themselves have a mental health diagnosis.⁵ With this further knowledge we can help parents and children alike better understand the warning signs and other additional risk factors for these mental health disorders so that treatment and diagnosis can be established early in the disease process, helping to mitigate complications later in life.

Similarly, the fourth research question in this study compared the rate of ADHD diagnosis and presence of children receiving free or reduced lunch. Though we thought this data might give us an idea of the relationship between socioeconomic status and ADHD diagnosis, this data ultimately proved to not be statistically significant. As with insurance rates and its relationship with ADHD diagnosis, this can be due to a variety of similar reasons. Research is still clear on the relationship between socioeconomic status and prevalence of ADHD and this variable needs

to be further examined, perhaps regarding the guidelines for receiving a free or reduced price lunch to further understand how the diagnosis of ADHD may relate to this factor.³

The final research question in this study took all of the previous factors and examined how they can account for the variance in the diagnosis of ADHD in children. While unfortunately, the best fitting model only contained mental distress in parents, this was not completely unexpected due to the other variables not having significant correlations with ADHD diagnosis (RQ2 and 4).

Our data did help to further establish the intricacies and complexities of the ADHD diagnosis. ADHD is much more than hyperactivity and inattentiveness in two settings. It affects family units and social determinants of health that are often not thought of. One of the major limitations of this study was in the presence of data publicly available. The study was restricted in questions that could be answered and analyzed based on already conducted surveys in the United States and thus questions and conditions could not be expanded or elaborated on. Additionally, the study was also limited in the surveys it had access to along with incomplete information about treatment modalities and efficacy of children diagnosed with ADHD. This study and in particular this data, though not always statistically significant, can pave the way for further understanding and research into the diagnosis of ADHD and help affected families and populations further understand the diagnosis not only for their individual treatment and care but for the diagnosis as a whole.

Conclusion

This study was designed to begin to unravel the diagnosis of ADHD and its relationship to many different facets of mental health and healthcare. Further work can be done regarding the genetics and familial disposition of the diagnosis along with further understanding into a variety

of other social determinants of health and their substantial impact into the diagnosis of ADHD. Healthcare and health in general are about much more than the pathophysiology of a condition. It is about the social, familial, and societal impacts that a condition has and can have. ADHD is no different. This study scratches the surface of this understanding and with further research and potentially patient centered research and analysis, more can be learned about ADHD and treatments can be structured to advise on many of these social, familial and societal relationships.

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