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Epidemiology of Children with ADHD in Rural Versus Metropolitan Settings

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Table of Contents

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Abstract

Attention deficient disorder with hyperactivity (ADHD) is an increasing psychiatric disorder affecting children across the world. With significant debate on diagnosis, ADHD is commonly underdiagnosed in children, even today. Approximately 4.6 million children are diagnosed with ADHD, but more than two thirds of these children are untreated. Primary care providers remain the responsible stakeholders for assessing, diagnosing, and treating children with ADHD appropriately. This literature review is aimed to investigate the correlation between the assessment and early diagnosing of ADHD among children in rural settings compared to that of the metropolitan/urban communities. Providing children with ADHD symptoms an early diagnosis, improves day to day development and minimizes the risks of comorbidities presenting later in life. Timely diagnosing and adequate treatment allow medical providers to change lives of those who suffer from long-term effects related to ADHD. A comprehensive literature review was performed using electronic search databases including PubMed, Embase, Access Medicine, and Clinical Key. A variety of key terms were used when researching. Articles were limited to the past 28 years when ADHD became a studied topic. Randomized controlled trials, prospective studies, cross-sectional studies, peer-reviewed journal articles, and systematic reviews were closely reviewed. These articles expanded the research used to access the primary outcomes of early diagnosis and treatment of children faced with ADHD, comparing rural to metropolitan/urban communities and access to specialized care. Exclusion criteria consisted of editorials, abstracts, on-going trials, and studies performed outside the United States.

Key Words: attention deficient hyperactive disorder, rural, urban, primary care providers

Introduction

Attention-deficit with hyperactivity disorder (ADHD) is a concerning psychiatric medical condition across the world affecting approximately 4.6 million children aged 6-17 years old, accounting for 8.4% of children of this age group (Basch, 2011). As the prevalence continues to cloak the world's youth over the past 30 years, more interest and research has been conducted. ADHD is a chronic, psychiatric medical disorder which causes individuals difficulty with sustaining attention, being hyperactive, and demonstrating impulsive behavior. When diagnosed later in life, this may come with added consequences, such as a delay in higher education. Therefore, diagnosing and treating this disorder early in life significantly decreases the likelihood of adverse outcomes proceeding into adulthood. This literature review will attempt to establish an association between rural and metropolitan/urban children diagnosed with ADHD and their outcomes due to availability of care.

Statement of the Problem

Research shows that approximately 4.6 million children across the country are struggling with underdiagnosed ADHD due to a lack of specialized care (Basch, 2011). Children who suffer from inadequate specialized psychiatric care tend to have lower self-esteem, troubled relationships, and are found to have poorer educational performance. Providing children with access to specialized psychiatric care in all parts of the country allows for appropriate, time sensitive treatment for this disorder while preventing delay in personal development. Diagnosis of ADHD is done clinically, without evaluation through laboratory or diagnostic testing, centered on patient history. Unfortunately, ADHD is highly stigmatized today, which may further delay treatment. However, through timely diagnosing and adequate treatment, medical providers can improve the lives of those who suffer from symptoms related to ADHD.

Research Question

In children, is there a benefit to early diagnosis and specialized care of ADHD which occurs in metropolitan areas compared to those in rural settings?

Methods

A comprehensive literature review was performed using electronic search databases including PubMed, Embase, Access Medicine, and Clinical Key. Keywords used for this research include attention deficient disorder with hyperactivity, ADHD, epidemiology, rural population, rural community, metropolitan population, metropolitan communities, urban population, urban community, telemedicine, primary care, statistical, and pediatric. Articles found after searching were limited to the past 28 years when ADHD truly became studied. Randomized controlled trials, prospective studies, cross-sectional studies, peer-reviewed journal articles, and systematic reviews were all included expanding on primary outcomes of early diagnosis and treatment of children faced with ADHD, comparing rural to urban communities and access to specialized care. Exclusion criteria consisted of editorials, abstracts, on-going trials, and studies performed outside the United States or of a different language. After removing research articles that met the exclusion criteria, 13 studies met all inclusion criteria and are utilized in this literature review. Journal articles were reviewed and determined to be relevant based on topic, research methods, and bias.

Literature Review

A review of literature shows that the ever-increasing prevalence of ADHD among children continues to be underdiagnosed. There is significant debate on the most practical way to diagnose and treat ADHD. Research continues to study the long-term effects of those who remain untreated and the level of impairment that contributes to these individuals. Current

studies review the quality of life an individual has when dealing symptoms associated with undiagnosed ADHD, how diagnosing and appropriate treatment is achieved, and the outcomes related to ADHD. In the current literature review, the aim is to identify the current research of those who are left untreated in rural to metropolitan/urban communities and the associated long-term outcomes compared to those who were treated effectively and timely.

ADHD and quality of life

In the 1930s, "minimal brain dysfunction" was defined as what now has evolved to the psychiatric disorder known as attention deficient disorder with hyperactivity (ADHD). At that time, children were labeled "troublemakers" as they would have a difficult time with social interactions, become easily frustrated, and have impulsive behavior. Over the course of many years, there was profound research identifying the potential causes of this psychiatric disorder. ADHD was discovered to be predominantly a frontal lobe dysfunction. More specifically, located within the small anterior cingulate gyrus and dorsolateral prefrontal cortex, resulting in inattentiveness, difficultly focusing, emotional regulation, and disability in decision making (Magnus et al., 2020). Due to this frontal lobe dysfunction, ADHD is associated with fewer dopaminergic receptors released from the brain, in turn accounting for a decrease in goal-directed behavior, decision making, and emotion regulation (Magnus et al., 2020).

ADHD is one of the most heritable psychiatric disorders, with factors including both genetic and environmental components. These components include fetal exposure during pregnancy through viral infections, smoking or alcohol use, and/or nutritional deficiency making ADHD the most prevalent disorder observed in children (Magnus et al., 2020). Educating expecting mothers of these long-term risk factors is critical to prevent unfortunate long-term outcomes. Alas, delaying diagnosis can lead to comorbidities throughout life, therefore carrying

this psychiatric disorder into adulthood. It has been found that adults who had a delay in ADHD diagnosis are at an increased risk to have comorbidities varying from thyroid complications to mood instability, low self-esteem, and tend to have issues with increased procrastination (Magnus et al., 2020).

Unfortunately, there is not a simple diagnostic test that can definitively diagnosis ADHD, therefore the American Academy of Pediatrics (AAP) set guidelines to aid in making the diagnosis. When it comes to diagnosing ADHD, the physical exam, alone, is not sensitive enough to formally diagnose individuals with ADHD. Given there is no definitive laboratory test or radiology exam that can be utilized to diagnosis ADHD, the AAP set guidelines in place to help aid the process of diagnosing ADHD and evaluating for comorbid conditions. The AAP set these guidelines as recommendations for primary care professionals as beneficial evidence-based practices, formulated to assist in the diagnosing process. To do so, the AAP strongly recommends three different primary methods to be gathered as part of the clinical decision-making process. These include rating scales, teacher and parent interview, and a detailed physical examination. Rating scales are to be performed for further assessment by utilizing the Diagnostic and Statistical Manual of Mental Disorder (DSM-IV) criteria, specifically the Vanderbilt ADHD Rating Scale. The DSM-IV criteria use three subtypes in which it bases the presences of inattention and hyperactivity/impulsivity symptoms. These three subtypes include: predominately inattentive types, predominantly hyperactive/impulsive type, or combination (Langberg et al., 2008). Furthermore, rating scales are cost-effective and time-efficient for primary care providers (PCPs) to collect from clinical and daily settings, like home and school. This documentation assesses social, academic, and occupational impairment from the perspective of the parents and teachers, who accompany the child most during waking hours. Having this

vantage point is crucial as these populations accompany the child more than the PCP. The most common DSM-IV questionnaire form utilized is the Vanderbilt ADHD Rating Scale. Popularity has increased due to its straightforward format which allows medical professionals to follow specific questions in which guardians and teachers can assess daily and collect relevant history related to inattentive and hyperactivity symptoms of the child. Once completed, medical professionals will utilize these forms to aid in the clinical evaluation for adequate diagnosing of ADHD.

Medical professionals are frequently approached by guardians and teachers to assess children for ADHD, given early recognition and management aids in direction of the education and psychosocial development process (Herrerias et al., 2001). Medical professionals should initiate an evaluation for ADHD in children ages six to twelve years old who present with concerns of inattentiveness and hyperactivity. Herrerias et al. (2001) conveyed a strong recommendation which initiates simple questions used to monitor early signs of ADHD. These simple questions include asking about how the child is doing in school, if the teacher has expressed concerns or problems with learning, or if there are concerns with behavior in school, at home, or when interacting with others of their age. Furthermore, questionnaires and rating scales are highly recommended by the AAP. These techniques help determine the clinical diagnosis of distinguishing children with ADHD to those without ADHD. These questionnaires, which are completed by those closely associated with the child including their guardian and teachers, should be reviewed by the PCP. Among these questionnaires and rating scales, core symptoms are assessed including the duration of symptoms, degree of functional impairment, and coexisting conditions (Herrerias et al., 2001). Guardians and teachers spend a vast majority of their time with these children compared to the medical provider. Essentially, the eyes and ears of

this diagnosing process is aided by those who spend a substantial portion of their day with the child.

According to Magnus et al. (2020), it is crucial to take an appropriate, detailed history during the physical exam and utilize the DSM-IV assessment to diagnosis a child with ADHD. Based upon their history and inattentive or hyperactivity symptoms which are present in multiple settings, PCPs can confidently diagnosis ADHD. Inattentive symptoms to screen for during the DSM-IV assessment include not paying close attention to tasks, rushing through assigned tasks, not finishing work, missing small details, not listening when spoken to, difficultly organizing things, avoiding tasks that take sustained mental effort, losing things, or demonstrating forgetfulness. On the other hand, hyperactivity symptoms include fidgeting, leaving their seat, climbing on things, being loud, blurting out answers, difficulty waiting their turn, talking out of turn, or interrupting others. Children who present with at least six of the nine symptoms as mentioned in DSM-IV possess the characteristics of ADHD (Magnus et al., 2020). Therefore, diagnosing is a team approach involving not only the medical professional but also the individual's guardian(s) and teacher to properly assess children in multiple, daily settings.

The processes of diagnosing ADHD may be complicated due to a few factors, including the subjectivity involved during the clinical evaluation and comorbidity conditions that are commonly associated in these children. The US national epidemiological study estimates that between 44-80% of children diagnosed with ADHD will have at least one comorbidity condition (Langberg et al., 2008). The diagnosis of ADHD is done by a thorough evaluation by a medical provider who is well-versed in ADHD diagnostic criteria and recognizing or treating other comorbidity conditions. Like some other mental health conditions, the diagnosis of ADHD is a subjective, clinical judgement based on the presence of mental symptoms, or lack thereof.

Unfortunately, as the prevalence of ADHD rises across the nation there is still a limited number of specialized PCPs. This poses a challenge to an efficient diagnosis and assessment for other conditions which may present in ADHD individuals. Therefore, the PCPs must have specialized knowledge to know when the child would benefit from a referral to a subspecialist, particularly that of psychiatric medicine. Despite improvements in ADHD algorithms and tools, such as the DSM-IV, ADHD will continue to be a subjective diagnosis set by a subjective criterion. Therefore, primary care providers continue to be utilized to address ADHD-related concerns. Due to the latest improvements and using evidence-based methods of practice, new and experienced practicing physicians can be prepared to make a reliable diagnosis (Langberg et al., 2008). PCPs will continue to be the face of diagnosing and treating children with ADHD, therefore it is essential that adequate physical evaluations, along with the AAP guidelines, be utilized when considering the diagnosis of ADHD in children.

Outcomes of undiagnosed ADHD

Schneider et al. (2019) conducted a study comparing adverse childhood experiences (ACE) among children with ADHD and autism. This 2016 randomized study used data from the National Survey of Children's Health (NSCH). The NSCH, which is nationally represented, uses a cross-sectional, telephone, and mail survey targeting children aged 0 to 17 across the United States (US). This randomized trial requested the parents/guardian who are familiar with the child's health and health care to participate in filling out a questionnaire form. Questions in this survey included the child's physical and mental health, access to and the use of health care services, health insurance coverage, experiences within the child's health care and sociodemographic.

A total of 50,212 responded to the randomized survey conducted by Schneider et al. (2019). Within this sample, there was a mean age of 12.23 years, standard deviation (SD) of 3.359 years with majority being aged 6 to 17 years old. This heterogenous sample indicated 69.7% of the participants of the male sex and 79.6% of the white ethnicity. Of those that responded, 8.2% indicated having a child with diagnosed ADHD (*n*=4,141), 1.3% having autism (*n*=654), 1.2% having both ADHD/autism (*n*=600) and 82.9% of the children without any neurodevelopmental concerns (*n*=41,644) (Schneider et al., 2019). Based on the adjust means and standard errors, those with ADHD with two or more ACEs have an adjusted mean of 12.50 and a standard error of 0.15. Approximately half of these children with ADHD were utilizing behavior treatment and two-thirds medication treatment. As predicted, children with ADHD have significantly more ACEs compared to those with autism or those without any neurodevelopmental concerns. Unfortunately, the conclusion of the study indicated that those with ACEs are at in increased likelihood of long-term effects being carried into adulthood.

According to Harpin et al. (2016), ADHD is the most common childhood psychiatric disorder with long-term outcomes. This childhood-onset disorder has significant impact on many different health related qualities of life including decreased self-esteem and social function. Due to the decrease in self-esteem and social function, Harpin et al. (2016) conducted a systematic review to assess the outcomes of those with ADHD who are treated and those left untreated, comparing long-term effects. The analysis done from January 1980 to December 2011 included 127 studies that reported decreased self-esteem and/or social function as long-term outcomes. Over the course time, the publication rate had risen steadily from 1980 to 2011 “with a total of 127 studies reporting 150 outcomes (the total number of outcomes is greater than the total number of studies because some studies reported self-esteem and social function outcomes)”

(Harpin et al., 2016, p. 297). The sample size ranges from 12 to 8,158 individuals and longitudinal study duration ranged from 2 to 25 years with a mean duration of 7.4 years. Therefore, this systemic review found that there is connection between ADHD and long-term outcomes of decreased self-esteem and social function.

It is understood that ADHD tends to have a negative impact on overall success with academic achievement and educational outcomes, as well as decreased social function and/or self-esteem when not treated appropriately. Basch (2011) writes a literature review with concerns about both the underdiagnosed and adequate treatment of ADHD. As we already know, there are approximately 4.6 million children with ADHD between the ages of 6-17 years old with nearly two thirds of these children who are undertreated with proper medication. Furthermore, urban minority children in a low-income family are less likely to receive adequate treatment with proper medication (Basch, 2011). To emphasize his findings, he conducted three different cohort studies of children of school entry age rather than grouping those with ADHD and those without. He noted that in 2001 through a National Health Interview Survey Sample Child Component with 10,367 children aged 4-17 living in a household income less than $20,000 are more likely to meet ADHD diagnosis threshold compared to others in the sample (Basch, 2011). Additionally, these children were less likely to receive consistent medication therapy in this sample study. A second survey done by the 2003 National Survey of Children's Health had studied 79,264 children aged 4-17 years old. Of these sampled, 7.8% were diagnosed with ADHD. Again, more commonly reported in boys (11%) than girls (4.4%). Finally, 9.6% of those in this sample were living in a home of poverty (Basch, 2011). Based on these two sample surveys, it is found that poverty plays a significant role in ADHD among children, as children of a low-income family are less likely to receive consistent treatment and maintain pharmacological therapy.

Lastly, a nationwide survey was conducted in 2008 on the prevalence of ADHD within the US by the Summary Health Statistics for Children: National Health Interview Survey (Basch, 2011). This study estimated that of children aged 3-17, 8% were diagnosed with ADHD. Conclusion of this study indicated that there was a greater prevalence in boys (11%) than girls (5%), White (10%) than Black (9%) children than Hispanic children (4%), children in single-mother families (10%) than in 2-parent families (7%), in families with less income than $35,000 (12%) than over $100,000 (6%), and in children aged 5-11 (7.3) and aged 12-17 (11.1%) than in children aged 3-4 (1.9%) (Basch, 2011). With these three different studies, Basch (2011) concluded that there is a disproportional prevalence of school-aged urban minority children which are faced with a negative impact on their academic achievement and educational outcomes.

Underdiagnosed ADHD can lead to long term effects such as adult functional impairments, personality disorders, and increased risk of comorbid disorders. Therefore, appropriate diagnosis can predict clinically, meaningful outcomes. ADHD has been stated to be associated with functional impairments including school dysfunction, peer problems, increased family conflict, poor occupational performance, antisocial behavior, and traffic violations or accidents. If not treated appropriately, and efficiently, these impairments can carry into adulthood (Biederman and Faraone, 2005).

For decades, the idea of ADHD carrying into adulthood was skeptical. However, follow-up studies for those with ADHD, both inadequately treated and untreated, has shown that this mental health disorder carries into adulthood. These individuals who are not appropriately treated will continue to show impairing symptoms consistent with the DSM-IV criteria yet will no longer meet the full threshold criteria by the age of 30-40 years. Despite this, they continue to

be at a high risk for additional comorbidities (Biederman and Faraone, 2005). Early diagnosing and effective treatment will help prevent functional impairments that may be carried into adulthood.

Attention deficient hyperactivity disorder, when left untreated, may increase in severity over the course of time and lead to comorbid conditions. Due to its increasing risk of comorbidities, making an early diagnosis and providing timely treatment is critical. With high prevalence of ADHD, PCPs must take an active role in caring and treating children with this psychiatric disorder due to the shortage of specialized mental health providers (Langberg et al., 2009). Furthermore, in 2000 and 2001, the pediatricians of the AAP were surveyed and revealed that approximately 80% were evaluating and treating children with ADHD. Pediatricians of the AAP state that this is a core responsibility, assessing approximately one to two new ADHD children a month based on clinical evaluations. Of these pediatricians, 87% were also collecting information from both parents and teachers, as part of the AAP guidelines, as part of the ADHD assessment. Likewise, 57% reported they used formal criteria in the diagnosis process and 27% reported this formal criterion adhered to the DSM-IV criteria (Langberg et al., 2009). Based on the statistics, physicians are managing treatment modalities of children routinely, yet are not completely compliant to the AAP guidelines that are in place for efficient, timely diagnosis of ADHD.

A protocol was placed to provide guidance for PCPs of rural communities to implement and assess children based on the AAP guidelines (Langberg et al., 2009). Upon a thorough, specialized training of 202 physicians from 55 practices, physicians were making significant improvements. Prior to the training, physicians used standardized teacher ratings as part of ADHD evaluations 52% of the time. At three months post-intervention, ratings significantly

improved as physicians were collecting teacher ratings 94% of the time for appropriate ADHD diagnosis (Langberg et al., 2009). Specialized training has been proven to make a positive impact when it comes to diagnosing children with ADHD, across the nation. It's been known that specialized training for PCPs is needed in all communities, more specifically those in rural settings.

Collaborative care and evidence-based medicine

According to Imboden and Fehr (2018), one in every five children within the US have a mental health condition, most of which are diagnosed with ADHD. As in other studies, boys were twice as likely to be diagnosed than girls. It is unfortunate, however, that there has been a seemingly increasing rate of children diagnosed with ADHD due to inadequate medical professional education. Furthermore, Imboden and Fehr (2018) found that children with ADHD have a higher mortality and suicide rates, as well as comorbidities carrying into their adulthood. This reiterates the significance for medical health professionals to be proficient in utilizing evidence-based diagnosis. The National Survey of Children's Health found that within the US, approximately 11% of children have received an ADHD diagnosis and the prevalence of the same diagnosis had increased by 42% between 2003 and 2011 (Imboden and Fehr, 2018). Overall, diagnosing ADHD is nationally on the rise and continues to be a common psychiatric disorder.

As the prevalence of children diagnosed with ADHD continues to rise, there are still great concerns in provider-system barriers of those in rural settings compared to that of the urban setting. Rural primary care providers have reported an increase in medical and behavioral health needs of their patients yet voice low levels of confidence to provide adequate care to these individuals. PCPs continue to work towards adhering to the AAP guidelines that support the

diagnosis and treatment of ADHD. However, barriers like the lack of adequate specialized training, lack of time for prolonged sessions, and insufficient insurance reimbursements keep PCPs uncomfortable in this realm. Additionally, unlike urban areas, rural areas which are medically underserved find it challenging to provide specialized, behavioral medical professionals causing a great provider to patient discrepancy.

Rural areas, unlike urban areas, are medically underserved and find it challenging to provide specialized, behavioral medical professionals, causing a great provider to patient discrepancy. To obtain this specialized care located within urban areas, many rural patients end up traveling, on average, two hours. Furthermore, these individuals are faced with insurance plans that also require out-of-pocket deductibles be met, exceeding affordability to those of a low-income status. This makes for great inconvenience to these patients and in turn, causes a lack of follow-up care leading to poor long-term outcomes. Thus, there is a great need for specialized care in rural medical settings for children who are living with ADHD (Palmer et al., 2010).

The prevalence of ADHD is distributed greatly geographically. Nationally, services are spared with limited access to specialized evaluation and treatments for children living with ADHD in rural areas (Palmer et al., 2010). Palmer et al. (2010) reviews the status of children which are living with ADHD by paying particular focus on potential ways to improve care and the outcomes faced by the underserved populations in the rural communities in comparison to those living in the metropolitan communities. The introduction of telepsychiatry has opened the opportunity of convenience for psychiatrists and other specialists to collaborate with primary care physicians through videoconferencing to provide evidence-based care, allowing for improved health care and outcomes for underserved children diagnosed with ADHD (Palmer et.

al, 2010). PCPs assume majority of the cases in which they diagnosis and treat children with ADHD, however this has been shown to be suboptimal therefore the implementation of telepsychiatry has become more widespread over time. Telepsychiatry adheres to the American Academy of Child and Adolescent Psychiatry in that care is provided to reach youth remotely and develop collaborative care models with local PCPs (Palmer et al., 2010). The purpose of telepsychiatry is to improve mental health by providing collaborative care to rural areas, allowing for early diagnosis and treatment to those who struggling with ADHD symptoms and comorbid conditions.

According to Palmer et al. (2010), there has only been one randomized, controlled study to determine the efficiency of telepsychiatry in children. This study examined 28 children who have been diagnosed with ADHD in which were randomly assigned to treatment, either in person or through videoconferencing. These children all showed comparable improvements and enhanced outcomes, indicating efficiency in cognitive- behavioral health through advancing telehealth. Furthermore, these children along with the providers and families felt satisfied with care via telepsychiatry and would continue to seek medical care through this advancement of telehealth.

Given the success of psychiatric health through the advancement of telemedicine, these services are being offered in many primary care settings including medical centers, community health centers, rural schools, urban day care centers, correctional facilities, and private practices across the nation. Thankfully, these successful programs have the capability to bring services to large population of youth faced with ADHD and have been found to be feasible, acceptable, and sustainable for all who are involved.

Rural verse urban outcomes

Epstein et al. (2014) completed a study of 1594 randomized patient charts seen by 188 pediatricians in 50 different practices including those of an urban, suburban, and rural settings. This study was conducted from August 2010 through December 2012. The main goal of this research was to assess and improve the quality of community-based ADHD care for children. Of these 50 different practice settings, 53 pediatricians reported being in urban settings, 103 as suburban, and 17 of a rural location. Moreover, suburban practices stated that 26.5% were Medicaid patients, whereas 47.9%, and 78.1% were Medicaid patients in rural and urban settings respectively. There were unfortunate limitations to this chart review methodology, however. Personal patient data such age listed age, gender, and comorbid conditions were lacking for patient charts. Therefore, the relationship between the quality of ADHD care and patient-level data could not be assessed in this study (Epstein et al., 2014).

Within this study, Epstein et al. (2014) utilized a Cox regression model to demonstrate ADHD care variable using the location of practice to predict pediatrician-delivered care. A Cox Model uses statistical medical research to investigate the association between time-to-event data. The results indicated that those in urban settings were diagnosed with ADHD first diagnosed and received treatment earlier on than those in the suburban or rural setting. Additionally, medication treatment was best utilized in urban areas than suburban and rural (urban vs suburban -0.288 and urban vs rural -0.123). Psychosocial therapy was best utilized in urban, as well, compared to those of suburban and rural settings (urban vs suburban -0.431 and urban vs rural -0.227) (Epstein et al., 2014). Evidence stated throughout this study shows that urban facilities have a timelier and more effective manner in diagnosing and treating ADHD with either medication or psychotherapeutic management, in comparison to rural settings. According to this 2014 study,

rural settings overall had poor quality of care to that of the urban, however there is much room for improvement in all settings.

In 2000 and 2001, a three-month training course was conducted that included 19 practices in a 50-mile radius of the Cincinnati area, in which 84 primary care providers voluntarily participated to gain specialized guidance in quality-improvement methods to diagnosis children with ADHD (Epstein et al., 2008). During this three-month trial and training process, the goal was to implement and test quality-improvement interventions aimed at improving community-based primary care in adherence to the AAP. Additional training was provided to aid in early diagnosis and treatment of ADHD via evidence-based medicine. Throughout this training process there was pre-intervention and post-intervention analysis based on the workup, diagnosis, and follow up care of children with ADHD (Epstein et al., 2008). Before intervention, 311 elementary aged children were reviewed. Of these children presenting with ADHD, the mean age was 7.88 years; SD of 1.6 years, and 75% were male. Approximately half of the patients had documentation indicating that either the parent (55%) or teacher (52%) had indicated using the Vanderbilt ADHD Rating scale for apparent concerns of ADHD. Of those 311 children, only 38% of these children had ADHD documented in their charts. Furthermore, treatment was deemed deficient based on the guidelines of the American Academy of Pediatrics as only 27% had follow up telephone calls, 1% with written care-management plans, and 52% had a follow up office visit to reassess medications and overall improvement. Finally, only 9% of parents and 9% of teachers were involved in follow-up rating scale results, as a means of documenting systematical response to treatment (Epstein et al., 2008).

After completion of ADHD training, the same 84 pediatricians' post-intervention charts were reviewed. A total of 235 new children were seen presenting with ADHD. Of these new

cases, the mean age was 8.14 years; SD 1.76 years, and of those, 74% were male. These newly trained PCPs, post-intervention, were now implementing a written care/management plans and entirely involving the parents of these ADHD children. This includes contacting them within 14 days of starting medication treatment and conducting follow-up visits within a six-week time frame. Based on statistics, there was a 45% improvement in treatment plans and follow-up visits, allowing for enhanced, evidence-based quality care for those struggling with ADHD (Epstein et al., 2008).

Compared to pre-intervention, these pediatricians demonstrated a significant improvement in meeting the AAP recommendations of adequate ADHD practice. As a result of post-intervention, 77% of children met DSM-IV diagnostic criteria for ADHD after a three-month assessment. As time passed, results continued to show a much larger portion of children meeting DSM-IV diagnostic criteria. In six months, results were 96%, nine months 83%, and at a year 77%. This demonstrated a substantial increase from the pre-intervention baseline of 38%, respectively (Epstein et al., 2008). This study indicated that educating PCPs is essential to the diagnosis and treatment of ADHD among children.

In rural Nebraska, a study was conducted to evaluate the ADHD assessment protocol in collaboration with primary care physicians, based on AAP guidelines. This study was done in midsize communities with a population approximately 20,000. Two pediatric primary care practices participated, which were the only pediatric clinics in a 50-mile radius. Clinic one, was composed of an independent, private, clinic practice that employed three full time physicians, two part-time physicians, a nurse practitioner, a physician assistant, and approximately twenty nursing staff. Clinic two, however, was a hospital-based practice employing three full time physicians and approximately fifteen nursing staff (Polaha et al., 2005). Neither of which had

specialized behavioral health training, specifically in ADHD, indicating the lack of specialized care in this rural setting. Throughout the study, these physicians were trained to interpret rating scales and utilize them to appropriately assess for ADHD among children, enhancing their specialized care.

Prior to rating scale training, clinic one saw 76 children who were diagnosed with ADHD between the dates of December 1998 through April 2000. For clinic two, 25 medical records were identified with ADHD in 2001. Ultimately, these two clinics were using their own methods of diagnosing ADHD, as a result of the lack of specialized training. Polaha et al., found that although PCPs have great training and experience with interpretation of medical records and reports from specialist, they have limited training for psychiatric behavior, specifically ADHD and empirically supported rating scales (2005). In the end, this study was used to examine and determine the methods in which were being used to assess ADHD in these pediatric clinics. Research has proven that PCPs struggle to provide appropriate care accurately and effectively for children with ADHD (Basch, 2011; Epstein et al., 2008; Palmer et al., 2010; Polaha et al., 2005).

Following PCPs specialized training in ADHD and the implementation of the AAP guidelines and protocols, these same two clinics were reassessed in the same manner as prior to training. For clinic 1, a total of 54 children were evaluated for ADHD from September 2000 to December 2000 as well as the year 2002. Clinic 2 identified 34 for the entire year of 2002 and 2003. Across both clinics, 101 charts were reviewed for ADHD from pre-intervention of the AAP guidelines and protocol placement and found that 86 contained an assessment for ADHD post-intervention (Polaha et al., 2005). Conclusion of this study indicated that rural pediatric PCPs could implement the AAP guidelines and protocol for assessment of ADHD appropriately and longitudinally. Although these providers were utilizing their own methods of diagnosing

ADHD, most of these methods were not in line with the AAP guidelines. Once these guidelines were incorporated, both clinics drastically increased their ADHD diagnosis accuracy. Polaha et al., (2005), stated that the introduction and implementation of the AAP guidelines as well as the development of an efficient, primary care setting allow PCPs to collect relevant data and patient history upon a short, specialized ADHD training. Therefore, the physicians in both clinics successfully increased appropriate diagnosis among children; 88-100% rating scales were being collected from the child's home or school. Furthermore, these pediatric physicians felt they were able to confidently diagnose children with ADHD using the supporting protocol and guidelines that have been established by the American Academy of Pediatrics (Polaha et al., 2005). Diagnostic and Statistical Manual of Mental Disorder criteria, including the Vanderbilt ADHD Rating Scale, have also enhanced primary care provider's knowledge to adequately diagnosis ADHD in rural settings today.

Discussion

Attention Deficient Hyperactive Disorder remains a chronic, psychiatric disorder affecting 4.6 million, to date, of children aged 6-17 across the United States. Based on the multiple studies discussed above, it has been recognized that providing children with adequate care through early diagnosis and treatment helps prevent long-term comorbidities (Biederman and Faraone, 2005; Langberg et al., 2008; Magnus et al., 2020). Primary care providers are still faced with the determining this clinical diagnosis via physical exam, despite specialized training. Furthermore, the studies discussed express how equipping providers with access to specialized training, including utilizing the DMS-IV Vanderbilt assessment, allows them to increase competency when making an ADHD diagnosis. Additionally, primary care providers can confidently diagnose a child with ADHD by aiding in the assistance of family members and

teachers who are with the child for most of their waking hours. These important members of a child's community become the eyes and ears for the physician who is faced with aiding in an important diagnosis for such a child.

A delay in diagnosing a child with ADHD can lead to long-term comorbidities that carry into adulthood, including mood instability, decreased self-esteem and social function, tendencies to procrastinate, and lacking skills academically. The US National Epidemiological Study estimates that between 44-80% of children diagnosed with ADHD will have at least one comorbidity condition (Langberg et al., 2008). These individuals who are not appropriately treated will continue to show impairing symptoms consistent with the DSM-IV criteria yet will no longer meet the full threshold criteria by the age of 30-40 years. Despite this, they continue to be at a high risk for additional comorbidities (Biederman and Faraone, 2005). Furthermore, Imboden and Fehr (2018) found that children with ADHD have a higher mortality and suicide rate as well as comorbidities carrying into their adulthood. Early diagnosis and effective treatment will help prevent functional impairments to be carried into adulthood.

To date, of the approximately 4.6 million children with ADHD, nearly two thirds of these children are undertreated with proper medication. Basch (2011) writes a literature review with concerns about both the underdiagnosed and inadequate treatment of ADHD. Although the prevalence of ADHD is dispersed geographically, services are spared with limited access to specialized evaluation and treatments for children living with ADHD in rural areas (Basch, 2011; Palmer et. al, 2010). Children in rural settings are inadequately treated because of limited access to the specialized care needed, so many are utilizing telepsychiatry medicine technology (Palmer et al., 2010). Furthermore, poverty plays a significant role in ADHD among children, as children

of a low-income family are less likely to receive consistent treatment and maintain pharmacological therapy, including both rural and urban settings (Basch, 2011).

Based on most recent research, ADHD is underdiagnosed and treated in all types of settings but for different various reasons. Providing primary care providers and pediatricians with the proper tools and specialized training has revamped the way ADHD is assessed clinically. Today, pediatric physicians felt they were able to confidently diagnose children with ADHD with the supporting protocol and guidelines that have been set from the American Academy of Pediatrics (Polaha et al., 2005). With the proper AAP protocol and guidelines in place, children across the nation are better served, especially those of rural settings without specialized care readily available. With the use of the Vanderbilt ADHD Rating Scales, primary care providers have enhanced the ability to adequately diagnosis ADHD in rural setting.

Applicability to Clinical Practice

With the information provided in the literature review, it will be evident whether children are offered the same access to specialized care for symptoms of ADHD in the rural settings compared to those of the metropolitan settings. Nonetheless, understanding how children faced with ADHD symptoms are benefited from early diagnosis to prevent a delay in personal development and functional impairments that can persist into their adulthood. As a medical provider, understanding the importance of early diagnosis and utilizing specialized training and the DSM-IV Vanderbilt Rating scale with family and teachers can significantly improve symptoms and personal development in individuals with ADHD.

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